CNEA NT - 11/86

Progress Report

1984 - 1985

Department of Physics

Comisión Nacional
de Energía Atómica

Dirección de
Investigación y Desarrollo

Gerencia de
Investigaciones

Buenos Aires - Argentina
1986

CNEA NT - 11/86

Progress Report
1984 - 1985
Department of Physics

Comisión Nacional
de Energía Atómica

Dirección de
Investigación y Desarrollo

Gerencia de
Investigaciones

Buenos Aires - Argentina
1986

INTRODUCTION

The present Report covers a period in which we began the harvest of what many seeded and ripened over the years. But these were also times for completion and consolidation and moreover for the beginning of many quests we only could envisage years ago.

In fact, this Report tells us about highlights of the period such as when on November 14, 1984, the first beam was run through the tandem accelerator TANDAR or when on September 1985 the programme of experiments in Physics using the beams of the accelerator could be started and years of preparation and training finally gave way to the work for which this important facility was intended.

The pages of this Report also tell about the continuing work in experimental and theoretical Nuclear Physics as well as in Solid State Physics. Here is displayed, for consideration of the scientific community, what has been accomplished in these two years.

The achievement of some of our previous goals as well as the possibilities opened by the installation of the democratic regime, encouraged the launching of some projects we had been studying for quite some time. These were mainly oriented to insert our Laboratories in the local and international scientific community as well as to the transfer towards the rest of the society.

In that sense a milestone of this period was the opening, on April 1984, of a systematic programme of graduate studies. The seventeen Physics graduates already studying and working for their doctoral degree are an indication of the firm intent of our Department to participate in the very much needed educational effort of the country, in particular in the field of science and technology.

The international insertion was promoted by various means. We continued with the Workshops by the seventh and eighth consecutive years with the participation of physicists of Brazil, Chile and Italy. The "Fourth International Conference on Electrostatic Accelerator Technology and Associated Boosters" was held in Buenos Aires and somehow represented the succesful "coming in society" for the TANDAR Accelerator. Among many distinguished scientists that came to our Laboratories during these two years, we had the privilege of the visit of Professor Abdus Salam, Nobel Laureate. He stimulated our ideas of making of the TANDAR Laboratory a centre for international cooperation, he promoted these ideas in his visit to the President of Argentina and he gave us some generous support of the

International Centre at Trieste to start a scheme of Associated Members so that physicists of the Latin American region could participate of the activities at our Laboratory. His encouragement and advice inspired a serie of efforts that, with the support of international agencies, will certainly render some results in the following years.

After more than thirty years working at our Department and more than twenty of succesful participation in its direction as its Chairperson or as the Head of the TANDAR Project, Dr. Emma Pérez Ferreira was called to occupy an important advisory position at the Atomic Energy Commission first and as Member of a Presidential Council later. She had then to be replaced as Chairperson of the Physics Department, but she is still present among us and continues helping in many of our activities.

What is shown in the next pages is the result of the coherent effort of scientists, engineers, technicians, administrative and maintenance workers. We would like to give special thanks to Lic. Martha Pérez who for the third time is the Editor of our Progress Report and to Mrs. María Teresa Carmuega for the efficient typing.

Ernesto E. Maqueda
March 1986

I. Tandar

I.1 Accelerator

I.2 Laboratories

I.3 Nuclear Facilities

I.1 ACCELERATOR

1.1.1 Numerical analysis of terminal charge selector designs for electrostatic accelerators*

A.M.J.Ferrero

The performance of two terminal charge selector designs is analyzed by numerical integration of particle trajectories. It is shown that the attempt to offset the electrical quadrupole field by displacement of the two poles in the bending plane of each quadrupole results in large beam aberration and poor charge selection efficiency. A numerical analysis performed by offsetting the quadrupole field displacing the entire quadrupole off the beam axis yielded satistactory charge resolution.

---

*Nucl.Inst.& Meth, in press.

I.1.2 Heavy Ion Accelerator assembly and start up

N.Fazzini and H.González

To reach the appropriate vacuum level inside of the accelerating tubes was the first major work in the beginning of this period.

A big effort was made looking for leaks or "virtual leaks", but after that a reliable leak tight system was atteined, with a leak rate of 10^{-10} mbar l/sec at 5 Kg/cm^2 of SF_6 pressure. It is good enough for a vacuum level of $10^{-7}/10^{-8}$ mbar.

Beam transmission measured in the inyector was better than 85%.

A $^{12}C^{+3}$ beam was passed through the accelerator in novembre 14, 1984. The terminal voltage then was 12 MV and the beam current was 50 nA. For GVM test purposes, a carbon beam was put on target in february 1985. This test showed that GVM readings were 1.8% below the real value. Conditioning of accelerating tubes was carried out gradually. The whole column was conditioned up to 13 MV, then 15 MV were reached by conditioning groups of units, and finally unit by unit conditioning went up to the equivalent of 18 MV. Three units had to be changed by new ones because of their poor performance. The entire column reached then at 16 MV.

One of the acceptance tests was carried out with 3 μA of protons at 10 MeV. Likewise, 600 nA of protons at 17 MV were passed through the accelerator. Solid strippers were used for this beams.

Four experimental beam lines were assembled and ready for use. They were:

1) On line isotope separator
2) All purpose 30" scattering chamber
3) Conversion electron beam line
4) Gamma ray spectroscopy beam line

Two other beam lines are still being assembled:

1) General purpouse heavy ion beam line
2) Atomic physics beam line

Some of this facilities were designed in the laboratory and all supplies for the lines (power, water, air, etc.) were installed.

An agreement of not spent too much time pushing up to voltage in the terminal was settled with NEC. So, conditioning was suspended by a period of at least six months in september 1, 1985.

Different beams for experiments have been running since that date. Those experiments also will test the radiation safety levels, and after this period, conditioning at 20 MV will restart.

The first experiment in TANDAR was carried out in September 12, 1985. A $^{16}O^{+6}$ 72 MeV beam was put on target in all purpose scattering chamber. Up to present, beams of ^{2}H, ^{7}Li, ^{12}C, ^{16}O, ^{19}F and ^{40}Ca were accelerated at terminal voltages ranging from 10 to 15 MV

I.3.3 Electromechanical general services

J.Nicolai, C.Giménez and S.Nigro

The main jobs of the preventive maintenance were the electrical and mechanical service of several different equipments related to the accelerator, experimental areas and buildings (refrigeration systems, air conditioning [300 tn of refrig.], computer room, etc.).

About of new extension of TANDAR laboratory, the technical especifications for bit was completed, including laboratories, offices; stores rooms and circulations, with a total area of 8.400 m^2 and 1.5 MWatt of installed power.

I.2 LABORATORIES

I.2.1 Target Laboratory

H.Grahmann and A.Filevich

In the period covered in this report work continued in the set up of the different pieces of equipment. The following facilities are already operative in the laboratory:

- water demineralizer
- fume hood
- high and low power optical microscopes
- two turbopumped vacuum evaporators
- one oil difussion pumped evaporator
- electron gun and deposition thickness monitor
- polishing machine
- ovens, vacuum dessicator, controlled atmosphere quartz oven.
- high and low range scales
- diamond disk cutter
- press
- electrodeposition
- small metal roller
- electroerosion

The production of thin carbon foils for ion stripping at the accelerator terminal is being routinely done in the target shop. The existent glow discharge chamber for cracking ethylene gas was improved and some problems related with the electric field distribution were fixed. The gas is a mixture of 90% ethylene and 10% argon. The glow discharge is produced at a pressure of 100μTorr, with 2.5 kV and about 50 μA. The area of the active surface is 80 cm^2.

Carbon is deposited onto glass plates covered with ClNa used as a release agent. Typical discharge time is 15 seg for foils of about 5-10 $\mu g/cm^2$. The foils are covered with colodion, floated in water and mounted in the standard NEC frames.

Work is in progress to set up an irradiation chamber using the beam from the injector to test the foils in order to optimize foil life.

The following targets have been prepared in the laboratory for use in experiments:

Cu, Au, Al, Ta, self supported; 50-2000 $\mu g/cm^2$

UF4, BrK, IK, ClNa, Ho, U, Ca, ZiO, Ta-H, Pb, Ho.

I.2.2 Radiation safety

C.Galia, H.Di Paolo and C.Giménez

Since 1984, when the Radiation Safety group was formed, the main tasks performed were:

- Preparation of the Operational Safety Procedure Manual. This document establishes requirements and recommendations pursuant to radiation safety operation.
- Installation and testing of interlocks activated system.
- Shielding evaluation.
- Review of the experiments in advance of their scheduling to alert to any potential radiation hazards.
- Routine radiation survey of working environment.
- Special radiation survey for new or unusual situations.
- Keeping of radiation survey, and personnel monitoring records.
- Trainning programs for operation personnel and Safety officers.

I.2.3 Turbomolecular pump power supply

J.Professi

The need of this type of power supply comes from the fact that a standard motor was used. Conventional power supplies generate rectangular wave forms which will produce an excessive increment of temperature in the motor. To avoid this problem, sinusoidal wave forms are generated in three phases to have a better torque during the start.

The output voltage varies from 0 to 40 V and the frequency from 50 to 600 Hz allowing a smooth acceleration.

The signal from a main square wave oscilator is sent to a digital circuitry which provides a stair-case wave form (see fig.1) next, active filters regain the fundamental wave form, having by means of this method the three sinusoidal waves with 120 degrees between them. The digital circuitry warranties a constant phase shift between them and allows easy frequency control with only adjusting the one on the main square oscilator.

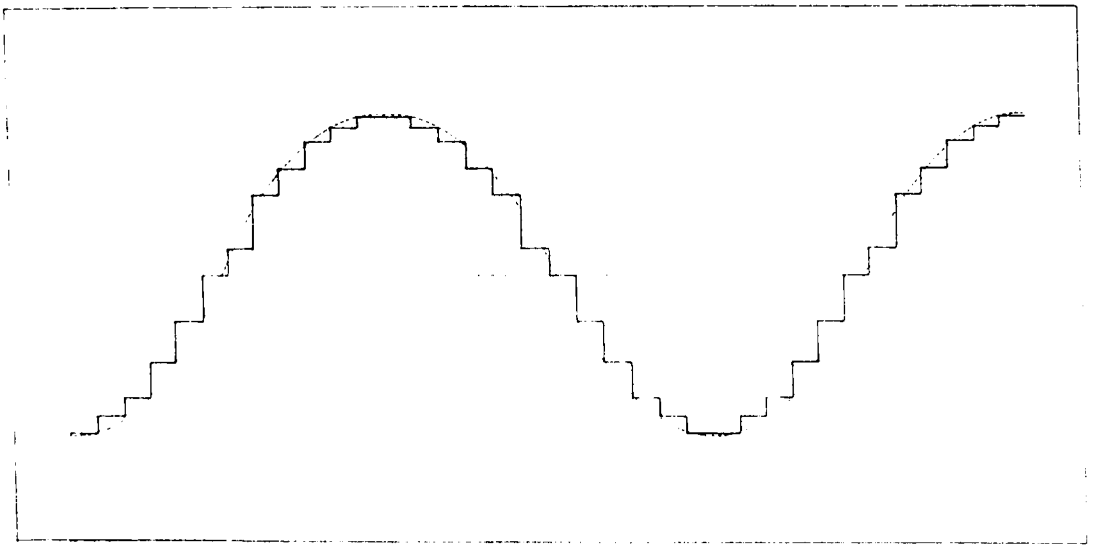


Fig.1

It is possible to change the three output amplitudes together by means of a tracking connection between three variable gain amplifiers. The power stage was built with three special complementary amplifiers to supply 40 V, 8 A needed to have the motor running during the worse loading case.

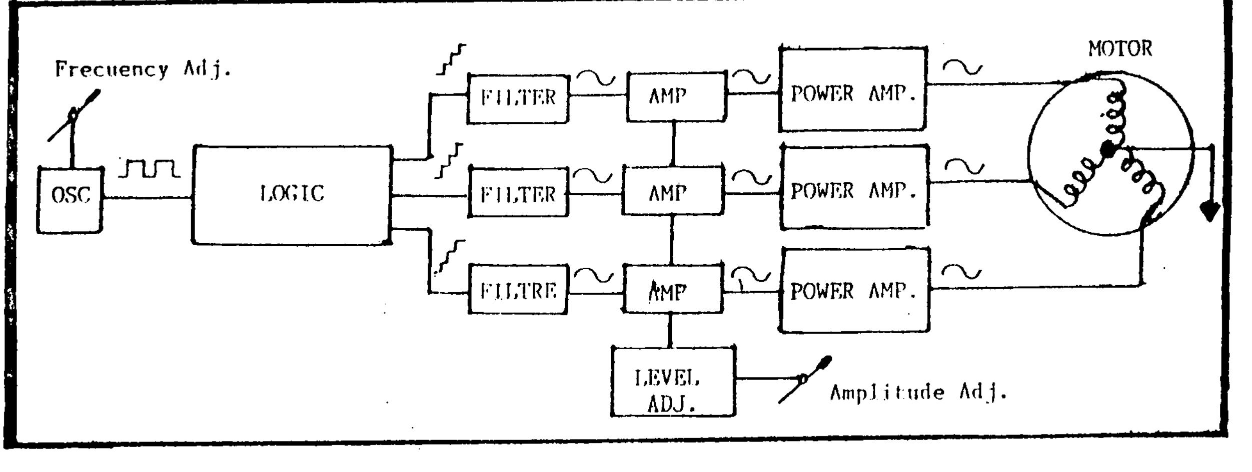


Fig.2

I.2.4 Remote controller for the multipurpose scattering chamber

C.A.Bolaños and J.Professi

The different movements of the multipurpose scattering chamber can be handle from the adquisition room by means of this controller. A digital display gives good precision on the readings.

The chamber has six movements which can be activated in a fast, slow or step by step way with a maximum precision of 0.05%.

I.2.5 High voltage power supply for glow discharge

C.A.Bolaños and J.Bergaglio

A high voltage power supply was built to be used during the stripper process manufacture. The output range is from 0 to $\pm$ 5 KV, 250 mA.

I.2.6 Control system for the electromagnetic isotope separator (NAVE Project)

J.Mónico, M.Satinosky and R.Tau

The system was described before, during this period, the circuitry needed to control and read-back the different parameters was finished, and the software was completely debugged.

During the test, many problems due to electromagnetic interference were found, it was necessary to shield the electronics and cables within a Faraday Cage. Better spark protections for CAMAC modules were designed, having finally, a reliable system.

I.2.7 Interface for comunication of a HP2116B and a PDP11/34 Computer

D.S.Camín

The first prototype used in the Synchrocyclotron Data Acquisition System was described in Progress Report 1980-1981. Definitive implementation was required for the TANDAR Laboratory. Slight modifications were done in order to avoid the use of discrete components trying to replace them by integrated circuit.

Fast optocouplers such as the HCPL2630 were ideally suited for this application. Since no fast optocouplers were available in local market only the general purpose MCT2, more circuitry was added to fulfil transmition requirements of good shaped pulses (1 µs). Furthermore, the optocupler's output transitor was diode-connected, and a very sensitive-fast amplifier was used to shaped the output current pulse.

I.2.8 Improvements on the 16 input 16 bit Digital Multiplexer for the HP2116 Computer

D.S.Camín

A digital multiplexer was developed in order to improve the computer input capability. Its main use is the Data Acquisition System of the TANDAR Laboratory. The first prototype was described in Progress Report 1980-1981. Though it was functionally correct, many improvements were made to allow an easier and more efficient application. This led to a second version which is the one actually in use. The new version keeps all the functions that were provided by the original one and many more facilities. Almost all of them are computer-controlled which gives great versatility, only the logical condition of generating a request in the Ready Lines was hardware implemented by a front panel switch.

I.2.9 Analyzing magnet power supply interlock

D.V.Camín and D.S.Camín

In case of high temperature in the refrigeration water or no flow of it or high temperature in any of the coils, this interlock will shutdown the power to the power supply and give the necessaries warnings.

I.2.10 Interface for CAMAC readings

C.A.Bolaños, R.Tau and S.Tau

To have the high energy quadrupoles and steerers current reading on the color CRT in the control console, it was needed to design an interface. Differents polarities and ranges on the inputs but only one type, positive and from 0 to 10 V is required on the outputs. Op-amp 741 with gain adjustment is suitable to do this work. Current readings are now in the CAMAC serial highway of the accelerator control system.

I.2.11 Vacuum valve interlock

C.A.Bolaños and J.Professi

An electrical signal from a vacuum indicator, is compared with and adjustable reference signal. If the first is smaller than the second one (porr vacuum), the interlock gives two types of signals. One to fire fast acting valves (80 μs) and the other to close pneumatic valves (100 ms).

I.2.12 Radiation safety system

S.Tau

Components installation and its interconnection was finished during the present period. The system was dividied in two groups to do the performance test.

a) Logics of area verification

b) Detection system

b.1) gamma radiation

b.2) Neutron radiation

a) Proper work was checked as well light indictors in control panel and areas.

b.1) After adjusting warning levels, this system showed great reliability.

b.2) This system was fully specified and now is in fabrication process.

I.2.13 Beam pulsing system

L.Parpar[a] and S.Tau

Once components installation and wiring was finished, some test and calibrations were carried out. The system can be divided in four subgroups:

a) Chopper

b) Travelling wave deflector

c) Light ion buncher

d) Heavy ion buncher

Various problems were found like power shortage and frequency drift, spare parts to fix them have to come from the maker.

---

[a]National Electrostatic Corporation, U.S.A.

I.2.14 Germanium detectors repairing and maintenance

M.Scacerra and G.Martí

During the period covered by the present report, the method described in[1,2] was continuously applied when our detectors had operating problems and also as the preventive maintenance.

Several evacuations followed by crystal warning-up and/or clean-up drifts procedures were performed to the detectors: ORTEC N#11 Model 8001-10221-V, ORTEC N#1 Model 8113-16300 and ORTEC N#2 Model 8111-15190 W. The cooled F.E.T. of the first amplification stage was changed to this last detector. At this time several clean-up drift are being performed but positive results are not obtained yet.

Several hiper-pure Germanium detectors belonging to other laboratories at CNEA were repaired. They are:

Detector 1: Princeton Gamma Tech; Model: IGC 10 serial 546 Hp.Ge; Bias Voltage polarization : +3000 Volts. Owing to a vacuum leakage in the cryostat, the detector starts loosing resolution and finally it didn't gave signal pulses anymore.

A new cryostat vacuum valve was designed and constructed compatible with our vacuum system operator. With the crystal mounted inside the cryostat, vacuum valve was replaced and after all the system was exhaustively evacuated during 6 hs at room temperature, up to $< 10^{-7}$ mmHg final pressure. Simultaneously with this operation the molecular sieve inside cryostat was heated up to 200°/300°C for regeneration.

Afterward all the system was cooled down at liquid nitrogen temperature and its main characteristics now measured at 3000 Volts bias giving:

FWHM = 2.06 keV   P/C = 30/1 ε = 10.3%   at 1.33 MeV of ^{60}Co.

Detector 2: Canberra Model:7229P HpGe; Bias voltage polarization: +2500Volts. It starts with resolution deterioration and it would be used with lesser bias polarization than the factory specification. It was evacuated as described above and checked at liquid nitrogen temperature giving an acceptable resolution (2.52 keV FWHM, 1.33 MeV ^{60}Co at 2500 Volts).

One week later the bias voltage operation was about 1500 Volts with very bad resolution. Leakage current showed very deteriorated at voltages greater than 1800 Volts ($I_L \approx 1 \times 10^{-8}$ Ampers). The crystal was removed from the cryostat, and the cryostat was then vacuum leakage proved. The cryostat value was the cause of the vacuum leakage.

A new value was constructed and replaced. The crystal was mounted inside the cryostat and all system was then evacuated and checked at liquid nitrogen temperature giving the same resolution as mentioned before.

Detector 3: Canberra Model 7229P-7500-1023 HpGe; bias voltage polarization + 4000 Volts.

Owing to a severe vacuum leakage in the cryostat valve a similar procedure as described in detector 2 was performed on this detector.

---

1) CNEA NT- 23/78.

2) Report CNEA 469.

I.2.15 ΔE-E telescope for the identification of heavy ions

M.Elgne, D.E.DiGregorio and G.Martí

Heavy-ion induced reactions yield a large variety of nuclei with different charges and different masses. In order to study a specific reaction the identification of the reaction products is necessary.

One of the most common mehtods of particle identification consists in measuring the energy loss ΔE of an ion in a thin transmission detector and the residual energy E in a second detector placed behind it. Thus the total energy of the ion is $E+\Delta E$. This method is based on the Bethe-Bloch formula:

$$-\frac{dE}{dx} \alpha\, f\, MZ^2/E$$

where the rate of the energy loss of the ion is a function of its energy E, its atomic number Z, its mass M and the stopping medium, f. Plots of ΔE versus E yield a family of curves, each of them corresponding to a different Z. If the resolution of the detector is good enough a substructure corresponding to different values of M can also be observed.

A ΔE-E telescope for the identification of heavy-ions has been designed and constructed. A schematic diagram of the detection system is shown in Fig.1. It consists of a gas-flow ionization chamber for the ΔE counter and a position-sensitive solid-state detector for the E element. The walls of the ionization chamber, the anode, the cathode and the frame of the Frisch grid are machined from brass. The grid itself consists of a nickel mesh having 97% transmission. The anode, the cathode and the grid are mounted on insulators and have independent electrical connections. The anode is biased through a conventional charge-sensitive preamplifier and provides a signal proportional to

ΔE. The position-sensitive solid-state detector, with a sensitive area of $0.7 \times 4.5\ cm^2$, is mounted on insulators and has electrical connections for the energy and position signals. An inlet and outlet for the gas flow system are provided at the back of the counter housing. Particles get into the detector through a 200 $\mu g/cm^2$ thick Mylar window.

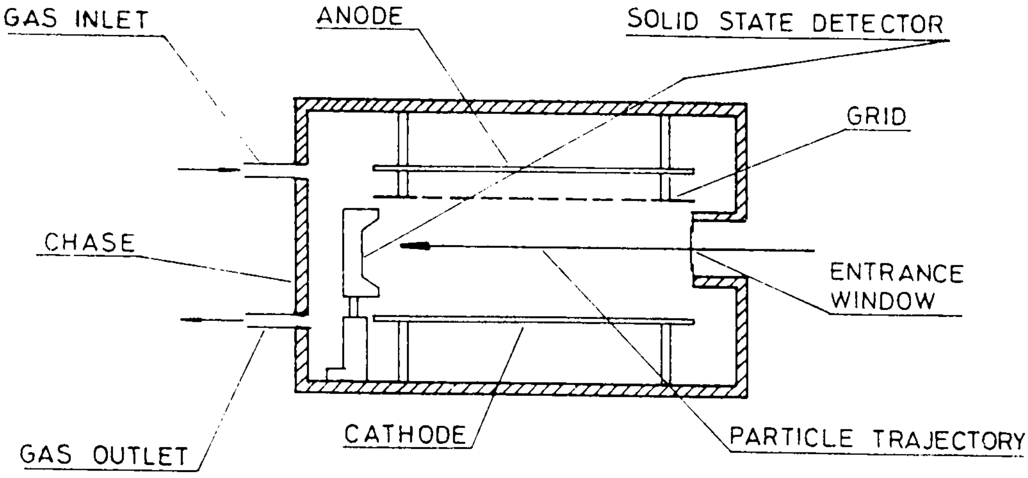


FIG. 1

Typical operating voltages on the anode, Frisch grid and cathod are +200 V, OV and -100 V, respectively. The ionization chamber is operated with a steady flow ($\sim$0.5 l/min) and argon (90%)-methane (10%) mixture. The gas pressure, typically between 20 to 100 torr, was stabilized with a cartesian manostat.

The telescope may be used to study a variety of heavy-ion induced reactions. Fig.2 shows a typical ΔE-E spectrum obtained from the reaction of ^{16}O with a 130 $\mu g/cm^2$ F_2Ca target at a bombarding energy of 100 MeV and at a laboratory angle of 20°. The beam was delivered by 20 UD tandem accelerator TANDAR. The target was chosen for presentation in this work since a wide range of particles is produced in these reactions. As it can be seen elements with Z up to 14 are clearly resolved.

Since the successful completion of the tests, this counter has been used in measurements of few-nucleon transfer reactions.

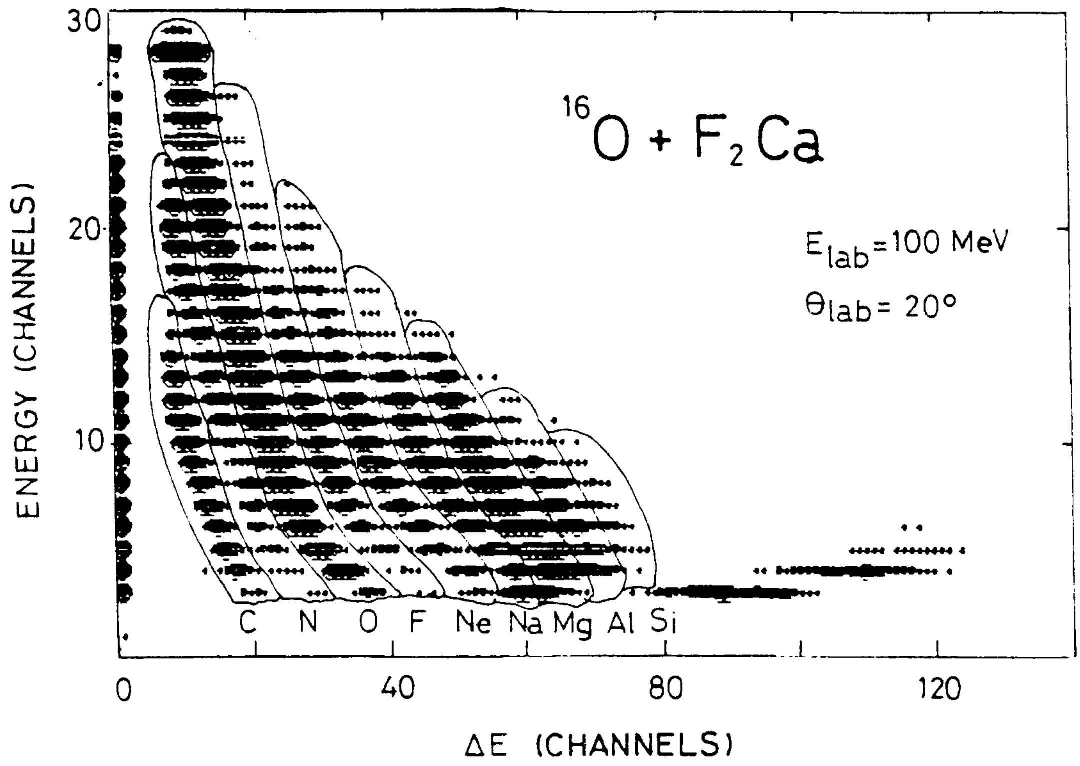


FIG. 2

I.2.16 <u>The data acquistion system</u>

The data acquisition system for the TANDAR accelerator consists at present of the following main components:

a) Analog-to-digital converters: only a few of these are available, just enough to take some singles spectra o a pair of biparameter data. There are 4 LABEN ADC's, the converters (CT102 and CT103) included with our INTERTERCHNIQUE MCA's, and an ORTEC AD811 CAMAC type ADC, which is not yet in use.

b) Data collection and storage: We have two INTERTECNIQUE 4096 channel MCA's, which can be used in singles and 2-dimensional modes. A locally developed interface allows the use of these MCA's as buffers for list mode (EMR) data collection. Each time the memory is full the data are dumped to an AMPEX tape unit.

We also have a HP5406 data acquisition system, provided with an Hewlett-Packard 2116B minicomputer, which in turn is connected to a

PDP-11/34 computer. The PDF is interfaced for downloading of the acquisition program into the HP2116 memory, and for accepting the spectra accumulated in the HP's memory and dumping them to tape. At present this combination is only able to handle singles spectra using a LABEN 8119 ADC (see also under d) below). Program routines have been developed to enable the access of the PDP magtapes (or its disks) as peripherals of the HP2116 computer, for use of the system in singles spectra accumulation, as well as for multiparameter data in list mode. Further software is being developed to allow a more flexible operation of this facility.

c) Experimental data processing: The handling of the data collected during the experiments is performed using the following facilities:

1) a VAX-11/780 computer, with 2.5 Mbyte of memory, two 67 Mb RM03 disks and a 176 Mb RP06 disk, and two TE16 tape units. There are 6 VT100 CRT terminals, one VT240 terminal and a GIGI system. Also available is a PRINTORNIX P600 printer/plotter. The operating system is VMS version 3.5 .

2) two PDP-11/34A minicomputers, with 256 Kbyte of memory. One of them has two RL01 5 Mbyte disks and two TE16 magnetic tape drives. There are also 2 VT100 CRT terminals, a VT11 graphic display unit, a VERSATEC 1200 printer/plotter, and a LA180 printer. The operating system in use is RSX-11m version 4.1 .

The data acquisition system is based on the use of the PDP-11/HP2116 combination as a front-end for the collection of data from the experiment and its storage on the PDP mass storage devices, while the main use for the VAX consists in the evaluation of the collected information.

The VAX and the PDF systems are interconnected via DECNET. Unfortunately, due to the small memory capacity of the PDP, it is not possible to have DECNET installed at the same time as data collection is proceeding, significantly limiting the usefulness of the net.

d) Other equipment: A second interface for a second LABEN 8119 ADC has been built by the Electronics group, for use in the biparameter list mode acquisition to be implemented shortly using the PDP-11/HP2116 combination. The construction of a 14 channel Multiplexor for the HP 2116 computer has been finished which will allow to perform multiparameter experiments. This module allows selective readout of the data from those ADC's actually active in a given experiment.

Routing to allow the acquisition of multiple spectra from a single ADC has also been provided. At present the requisite software for this device is being developed. Another facility which we expect to be able to put into service in a short time is the use of CAMAC modules using a CAMAC crate with an UNIBUS crate controller. This would allow the use of an 8 channel, 11 bit, CAMAC ADC which we have available.

I.3 NUCLEAR FACILITIES

I.3.1 A ΔE-E telescope for heavy-ion identification with axial charge collection

D.H.Abriola, S.Gil, A.Jech, R.Eusebio[a] and P.Martinelli[a]

We designed and started the construction of a compact telescope, with a very large solid angle, for the determination of the charge Z and the energy E of heavy ions. A large solid angle is important both, for the efficient measurement of angular distributions, and in kinematic coincidence experiments; while the compactness of the detector allows the obtention of differential cross sections near the beam direction.

The telescope is composed of a parallel plate ionization chamber, where the particles loose a small amount of their energy (ΔE), and a solid state position sensitive detector (PSD) where they loose the rest of their energy. In this kind of detectors the quality of particle identification depends on the uniformity of electron collection by the anode of the ionization chamber for all the possible trayectories of the incident particles. This uniformity depends in turn on how homogeneous the electric field is inside the chamber.

For transversal charge collection, the main distortions of the field appear near the ends of the detector, i.e. near the entrance window and near the solid state detector[1)]; in order to minimize the relative importance of these inhomogeneities the distance between the window and the solid state detector has to be large (typically 13 cm) which prevents the obtention of large solid angles.

Using axial charge collection, it is possible to drive the inhomogenities of the field away from the active area of the detector; allowing the design of telescopes with good Z-resolution in which the separation between the window and the solid state detector is as small as wanted (consisted with a given amount of energy lost (ΔE), and spanning in this way a very large angle.

This work was based on a paper of Zurmühle and Csihas[2)]. The main difference with the original design lies in the field configuration (see Fig.1); we also increased the hight of the electrodes getting better homogeneity of the field in the active area.

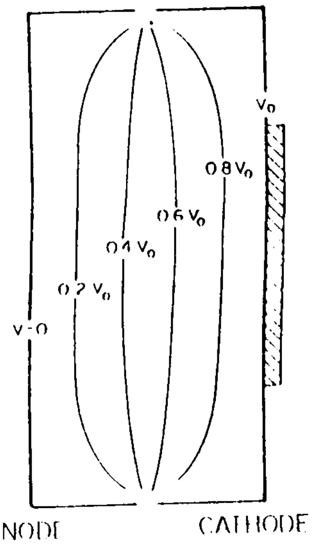


Figure 1-A

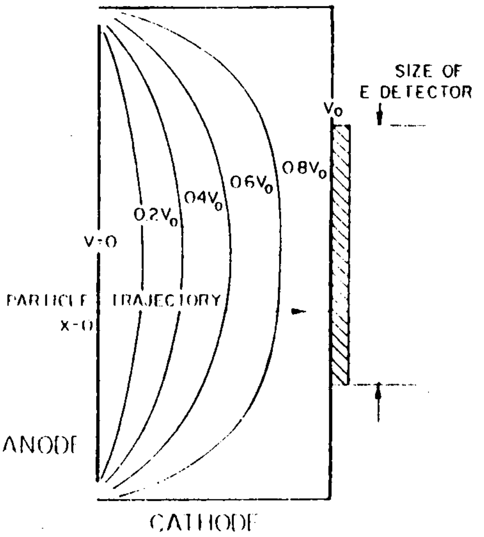


Figure 1-B

Figure 1: Equipotential lines

A) Original design B) This work

In our design the walls of the ionization chamber are themselves part of the electrodes, getting in this way a more compact and simplified detector.

Our telescope, that works with a continous flux of P-10, has a window, which is also part of the anode, made of aluminized Mylar (250 $\mu g/cm^2$) while the cathode, in front of the PSD is made with an aluminized foil of VYNS[3] of 50 $\mu g/cm^2$.

The front face of the detector meassures 81 x 81 mm and we have build two different main bodies, one of 38 mm and the other of 52 mm, with a separation between electrodes of 15 and 28 mm respectively. Fig.2 shows the cross section of the shortest one, which placed at 5 cm from the target, and using a PSD with an active area of 8 x 47 mm, spans an angle of 38°; the smallest angle that can be meassured is, in this configuration 21°. If the detector is placed at 15 cm from the target the angle spanned is 16° and the minimum angle 7°.

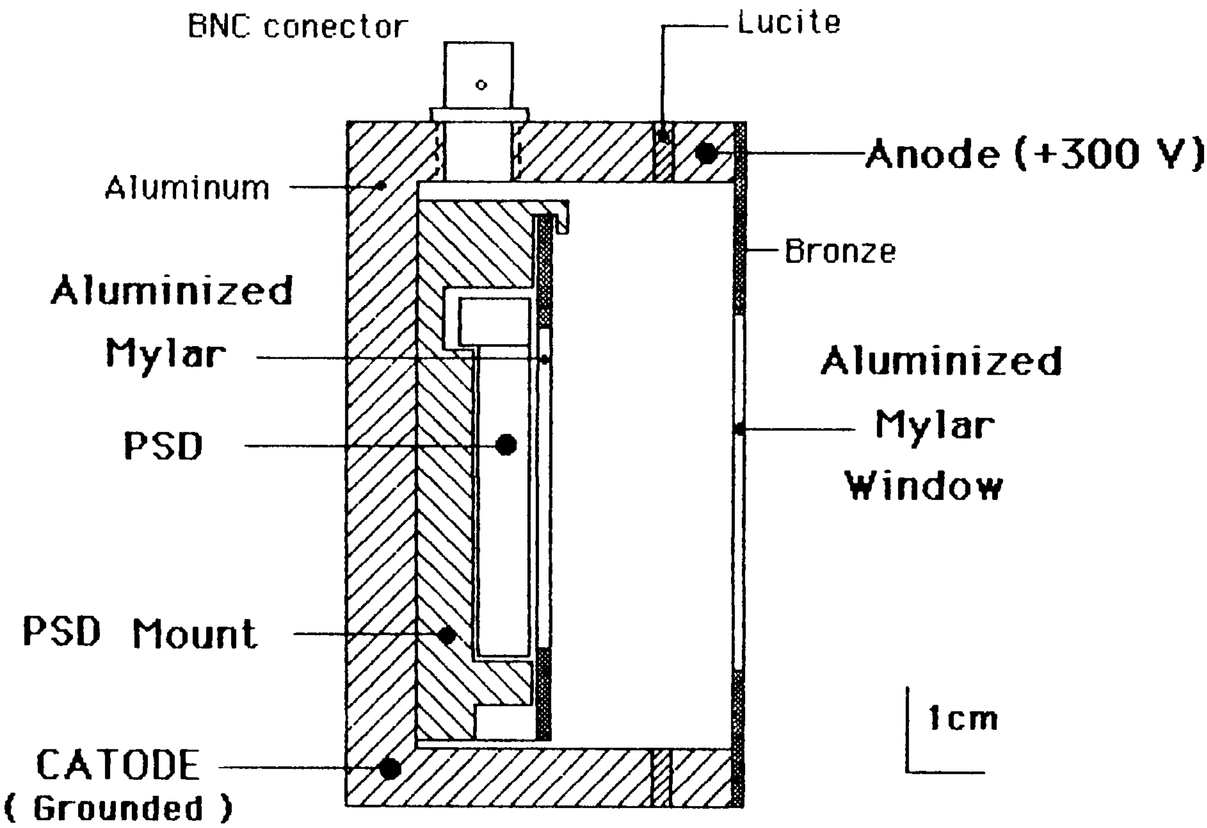


Figure 2

---

[a] FCEN, University of Buenos Aires, Argentina.
1)J.Barrette, P.Braun-Munzinger and C.K.Gelbke, Nucl.Instr.& Meth. 126(1975)181
2)R.W.Zurmühle and L.Csihas, Nucl.Instr.& Meth. 203(1982)261.
3)B.D.Pate and L.Yaffe, Can.Jour.of Chem 33(1954)15.

1.3.2 An electrostatic separator for heavy ions*

M.L.di Tada, G.V.Martí, J.O.Fernândez Niello and
A.O.Macchiavelli

The evaporation residues produced in reactions with heavy ions are strongly focused in the beam direction. It is necessary, in order to identify these residues to separate them from the transmited beam.

In the Tandar Laboratory was made an electrostatic separator that allows the separation of beam and residues due to their difference in E/q rates. The device consists of a stainless steal plate which can be connected up to 40 kVolts and a grounded grid separated 30 mm from the plate. This grid is composed of 36 parallel and longitudinal CuBe wires of 0.05 mm diameter with a separation of 1.5 mm, allowing a very good transmission for the deflected ion.

Monte Carlo calculations were used to determine the best configuration of the separator with the geometry of the scattering chamber where it will be installed.

The system was tested with alpha particles from ^{241}Am and calibrated with fusion reactions induced by ^{16}O in different targets.

I.3.3 External users and Atomic Physics beam line

I.B.Nemirovsky

For experiments in Atomic Physics and Radiobiology an high-vacuum beam line containing and approximately 1 m long differentially pumped gas target zone was constructed.

Two graphite blades adjustable collimators were installed at about 5 m one from the other to control the beam angular spread. To compensate for earth and stray magnetic fields in the target region a set of Helmholtz coils were installed. A long, suppressed Faraday Cup was mounted at the end of the line.

At present the beam line, without the target chamber, was vacuum tested up to 10^{-8} Torr.

Radiation damage behaviour as a function of projectile charge state: With the assitance of O.Bernaola (Dept. of Radiobiology) several plastic foils of Makrofol E were irradiated with 50 MeV ^{12}C ions in different charge states. The aim of the work is to evaluate the possibility of observing radiation damage variations as the charge state of the incoming ion is changed. Nuclear track techniques will be used to observe the damage along the ion trayectory in the solid.

1.3.4 Magnetic spectrometer

J.J.Rossi

A magnetic spectrometer of the MDD type has been designed with the following mean characteristics:

$B_{max} = 1,6$ T	Dispersion $\sim$ 1,6 cm/%
$\rho_{med} = 0,8$ m	$R_p \sim 1/3000$
$\Omega \sim 30$ msr	Mag.(horizontal)$\sim$ 0.3

Construction has been ordered to INVAP S.E. and it is on the way.

1.3.5 Nuclei far from the stability valley (NAVE Facility)

During 1984 the assembly of the isotope separator have been completed in the TANDAR Laboratory. Improves in the mechanical mounting of the ion source, electrostatic lens, vacuum pumps, etc. gives better optical properties of the ion beam. The power supplies of the ion source are now remotely operated through optical fibers by the CAMAC system.

In 1985 the entire facility have been currently operated off line with the Xe beams, improving the overall efficiency for noble gases. Also Ar beams have been collected with Fe samples for metalurgical studies requested by the Material Department of CNEA.

As soon as the TANDAR accelerator developed a deuteron beam, the first on line experiments have been performed in order to evaluate the production of radiactive samples from the natural uranium target-ion source assembly bombarded by the fast neutron flux produced in the Be(d,n) reaction.

These experiment allowed also to check the induced radiactivity in the target room as well as the background in the measuring room; being both low enough from radiological protection and gamma counting point of view.

I.3.6 Heavy-ion scattering chamber. Present status

D.R.Napoli, D.Otero and A.N.Proto

The scattering chamber is installed in the experience room. The final vacuum is 10^{-6} torr and the internal plates can be operated externally. Details on the precision of the movements are being studied (Description of the chamber was made on Progress Report 1980/1981[1]).

Two multiwires detectors similar to that published in ref.2 constructed by INVAP, are also installed in the chamber. They are parallel plate avalanche counters (PPAC) and serve predominantly as time-sensitive detectors. Their active areas are around 8 x 10 cm^2 and the time resolution is of 600 pseg for alpha particles of 5 MeV.

---

1) CNEA NT - 5/82

2) Y.Eyal and H.Stelzer, Nucl.Instr.& Meth. 155(1978)157.

I.3.7 In beam K X-ray fragment coincidence measurements using thick targets

J.L.Aliaga, D.R.Napoli, D.Otero and A.N.Proto

In this work we shall deal with one of the methods more broadly used to obtain information on binary processes. It involves simultaneous measurements of the kinetic energies of the complementary fission fragments and the characteristic K X-ray. Through this procedure it is possible to identify the nuclear charges of the fragments.

Usually, very thin targets are used in all the above described K X-ray fragment coincidence experiences, although sometimes thick targets are more easily available. If this is the case, only one of the fission fragments can be detected and the other is definitely catched by the backing. This fact, commonly diminishes the qualities of the experimental not the case of the characteristic K X-rays which can be emitted (and detected) both, by the fragments in flight or by the fragments trapped in the backing. We present a new method which allows us to separate both components which are, then used to analyse fragment-mass-sorted K X-ray spectra obtained with a high resolution lithium - drifted silicon detector.

As we use a source with a thick backing, one of the two complementary fission fragments of the ^{252}Cf is trapped in it, while the other flies to the silicon detector. The former then, will emit the characteristic K X-ray from its location into the backing and the latter during its flight time. The K X-ray spectra measured in coincidence with the fission fragments will be different, depending on the situation of the emisor fragment, allowing us to stablish the procedence of the K X-ray emission. Turning things around, the method we propose here, can be used to take into account the contributions to the K X-ray spectra coming from the source.

When a biparametric fragment K X-ray plot is sorting as is shown in Fig.1 (background sustraction was made before plotting) four regions can be clearly separated:

Coincidences between

I) Heavy fragment and heavy K X-rays

II) Light fragment and heavy K X-rays

III) Heavy fragment and light K X-rays

IV) Light fragment and light K X-rays

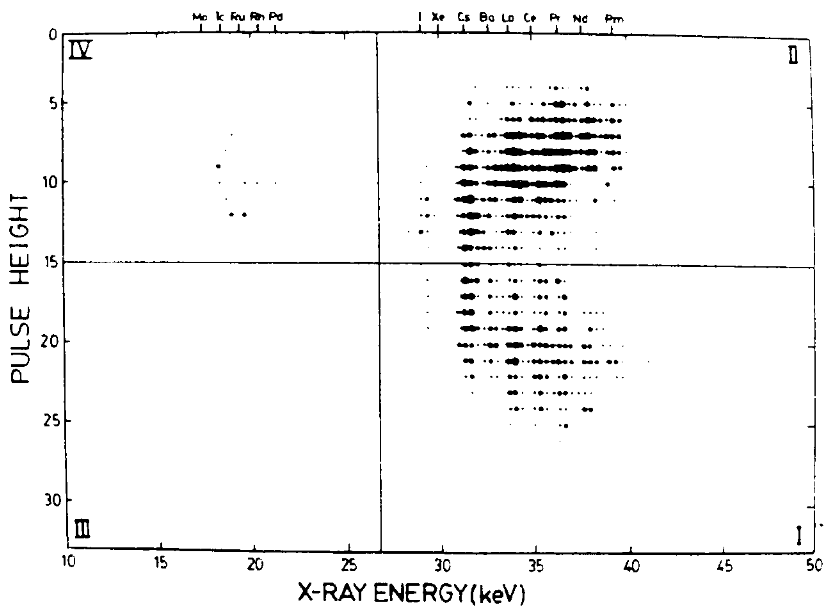


Figure 1

Biparametric spectrum (see text).

From the results outlined above, it is easy to understand that regions II and III correspond to coincidences with the K X-rays emitted by fragments trapped in the backing of the source, while regions I and IV should be associated with coincidence with K X-rays emitted by fragments in flight.

Then, summing up over regions I and IV or regions II and III we can obtain the spectra of the K X-rays coming from fragments in flight or from those stopped in the backing respectively. The results are shown in Fig. 2 a,b).

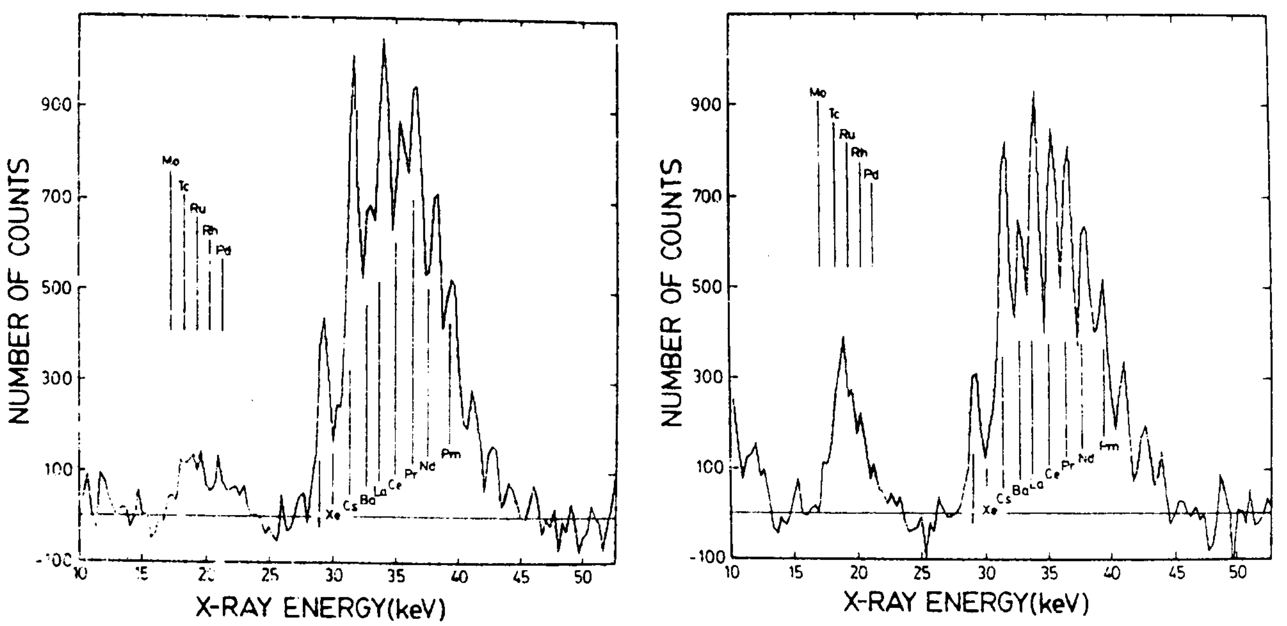


Figure 2

K X-ray spectra emitted by: a) fragments stopped in the backing of the source and b) fragments in flight. The separation was done through the method outlined in the text.

II. Nuclear Physics

II.1 Nuclear Structure

II.2 Nuclear Reactions

II.3 Intermediate Energies

II.1 NUCLEAR STRUCTURE

II.1.1 A self-consistent description of systems with many interacting bosons*

J.Dukelsky, G.G.Dussel, R.P.J.Perazzo, S.L.Reich and H.M.Sofía

A self-consistent description for the ground state of many interacting bosons is discussed. The excited bandheads are obtained by solving the TDA and RPA equations. The latter can be used to isolate the spuriours states that arise as a consequence of broken symmetries. The rotational moment of inertia is obtained in different approximations. The interband and intraband electromagnetic decay modes are also analyzed.

---

*Nucl.Phys. A425(1984)93-119

II.1.2 s-d-g boson model description of the isovector $K=1^+$ mode in deformed nuclei*

S.Pittel[a], J.Dukelsky, R.P.J.Perazzo and H.M.Sofía

Properties of the isovector $K=1^+$ mode in deformed nuclei are studied in an s-d-g boson model using Hartree-Bose and Tamm-Dancoff approximations. The results suggest that this mode may be fragmented over several $K=1^+$ bands and that the most strongly excited may not be the lowest.

---

*Phys.Lett. 114B(1984)145.

[a]Delaware University, U.S.A.

II.1.3 Phase ambiguities in the O(6) limit of the interacting boson model*

P.Van Isacker[a], A.Frank[b] and J.Dukelsky

We present a generalization of the O(6) limit of the interacting boson model by considering an E2 transition operator, which is different from the quadrupole operator used in the Hamiltonian. We analize, both quantum mechanically and in the classical limit, under which conditions this more general O(6) limit is invariant under time reveral.

---

*Phys.Rev. C31(1985)671
[a]Instituut voor Nucleaire Wetenschappen, Belgium
[b]Centro de Estudios Nucleares, UNAM, Mexico

II.1.4 HFB in a restricted space*

J.Dukelsky, G.G.Dussel and H.M.Sofía

A restricted Hartree-Fock-Bogoliubov method is developed with a restriction on the angular momenta of the Cooper pairs that conform the vacuum (SD or SDG). The method is applied to ^{176}Yb. The quadrupole moment in the SD subspace is found to be 80% for neutrons and 91% for protons of its value in the full space. The inclusion of the G part of the Cooper pairs improves the agreement. The descriptions in terms of boson condensate and coherent states are discussed.

---

*J.Phys.G:Nucl.Phys. 11(1985)91-96.

II.1.5 Self consistent picture of the interplay of quadrupole and octupole of freedom in many body systems*

J.Dukelsky, R.P.J.Perazzo, S.L.Reich and H.M.Sofía

The interplay between quadrupole and octupole distortions is analysed within a self consistent description of many interacting bosons systems. The coupling between these degrees of freedom is studied through the relative positions of the positive and negative

parity rotational bands. Excited bandheads, moments of inertia and multipole moments are also analysed.

---

*Phys.Lett. 158B(1985)361

II.1.6 Comparison between semiclassical and classical descriptions of the collective M1 mode in the interacting boson model*

S.Pittel[a] and J.Dukelsky

Semiclassical mean field techniques are used to describe the M1 scissors mode in the neutron-proton interacting boson model. The resulting expressions for the energy of the mode are as simple as those obtained recently in the classical limit. The mean field approach, however, yields much better agreement with exact neutron-proton interacting boson model results.

---

*Phys.Rev. C32(1985)335

[a]Delaware University, U.S.A.

II.1.7 Perturbative treatment of rotating fermion systems. A) A reformulation of the perturbative treatment of a system of fermions in a deformed basis*

V.Alessandrini[a], D.R.Bes, O.Civitarese and M.T.Mehr

The constraints that eliminate infrared divergences which are characteristic of a deformed basis are perturbatively taken into account through the coupling to an extra phonon, in analogy to QED in the Lorentz gauge. The method is free from cumbersome limiting procedures which are present in previous treatments of the same constraints. It is exemplified in the case of a two-dimensional, exactly soluble model, for which it yields exact results.

---

*Phys.Lett. 148B(1984)395

[a]LPTHE, 91504 Orsay, France

II.1.8 Perturbative treatment of rotating fermion systems B) The quantum mechanical calculation of the nuclear moments of inertia*

D.R.Bes, M.T.Mehr and R.Liotta[a]

Corrections to the Inglis and Thouless-Valatin moments of inertia are obtained within the framework of a perturbative procedure which is adequate for the treatment of a deformed system. The mehtod is applied to the case of ^{24}Mg.

---

*Nucl.Phys., to be published.

[a]Research Institute of Physics, Sweden.

II.1.9 The pairing phase transition in rotational nuclei*

D.R.Bes, R.A.Broglia[a], J.Dudek[b], W.Nazarewicz[a] and Z.Szymanski[c]

The two level model is used to study the effects associated with the fluctuations in the pairing gap in the vicinity of the critical frequency. Applications to realistic situations are also made.

---

*Part of this work has been presented by Z.Szymanski in Niels Bohr Centennial Conf., Nucl. Struc. 1985. North Holland, Amsterdam (1985) 343.

[a]Niels Bohr Institute, Denmark and Univ. of Tennessee, U.S.A.

[b]Centre de Recherches Nucléaires, Strasbourg, France

[c]Univ. of Lund, Sweden

II.1.10 The radial dependence of the pair transition density in superfluid nuclei

P.Lotti[a], E.Maglione[a], A.Vitturi[a] and D.R.Bes

The radial dependence of the pair transition density in superfluid nuclei is studied. An approximate expression is derived which relates the transition density of particles. The proportionaly constant is the measure of the collectivity of the system and is directly given in terms of the pairing gap Δ . The above proportionality was also found to hold on the nuclear surface when using a macroscopic parametrized expression for the density, leading to a description of the excitation of the pairing modes that formally parallels the standard one used in the case of surface variations.

---

[a]Univ. di Padova and INFN, Italy.

II.1.11 <u>The convergence of the Nuclear Field Theory in a realistic four-hole problem</u>

N.N.Scoccola and D.R.Bes

We perform NFT calculations in the case of four holes moving in realistic levels below the ^{208}Pb closed shell core. We consider two different interactions: i) a monopole pairing force and ii) a non-separable realistic pairing force. In both cases we obtain satisfactory results provided that in case ii) we include second order diagrams and diagonalization procedures. Both energies and parentage coefficients are calculated in the two cases and compared with exact and approximate results and with the experimental data.

---

*submitted to Phys.Rev.C.

II.1.12 <u>The applicability of the Nuclear Field Theory to shell model calculations</u>*

N.N.Scoccola and D.R.Bes

Previous NFT calculations of the four particle spectrum reached different conclusions concerning the applicability of the lowest order Rayleigh-Schroedinger perturbation expansion. In the present paper, we show that the inclusion of second order diagrams and/or diagonalization procedures yield satisfactory results both for the energies and for the transfer matrix elements even for j-shells as small as the j=7/2 and j=11/2 shells.

---

*Nucl.Phys. <u>A425</u>(1984)256-274.

II.1.13 Generalized rotational motion and the cranking prescription in systems with many interacting bosons

R.P.J.Perazzo and H.M.Sofía

The cranking prescription to calculate moments of inertia for rotational motion is discussed for the case of a rotational motion in an abstract many dimensional space. The special case of a Hamiltonian with an O(6) symmetry is worked out. The prescription to use the Thouless-Valatin formula yields the exact result for the moment of inertia.

---

*Phys.Lett.B (in press).

II.1.14 A two level solvable model involving competing pairing interactions

G.G.Dussel, A.Evans[a], E.E.Maqueda and R.P.J.Perazzo

A model is considered consisting of nucleons moving in two non-degenerate l-shells and interacting through two pairing residual interactions with (S,T)=(0,1) and (1,0). These, together with the single hamiltonian induce mutually destructive correlations, giving rise to various collective pictures that can be discussed as representing a two dimensional space of phases. The model is solved exactly using a $O(8) \otimes O(8)$ group theoretical classification scheme. The transfer of correlated pairs and quartets is also discussed.

---

[a]University of Sussex, Brighton, United Kingdom.

II.1.15 Periodic trayectories in a model with SU(3) symmetry

M.Saraceno

Following a method suggested by M.Baranger[1)] we have found the periodic trayectories in a three level Lipkin model in the Time Dependent Hartree Fock approximation. The phase space is four dimensional and the classical problem is non-integrable. We are studying the role of the periodic trayectories in the semiclassical requantization. The computer program allows the calculation of bifurcation trees of periodic trayectories and their monodromy exponents.

---

[1] I.Zahed, M.Baranger; Phys.Rev. C29(1984)1010.

II.1.16 Expansions of semiclassical type in coherent state representation for some elementary groups

M.S.Gravielle and M.Saraceno

Using the coherent states of some elementary groups (Weyl, SU(2), SU(1)) we have found expansions of semiclassical type whose natural expansion parameter is the maximum (or minimum) weight of the representation. The zero order is the classical problem derived from the Time Dependent Variational Principle and the method provides for example the leading corrections to Bohr-Sommerfeld requantization rules.

II.1.17 Determination of chaotic regions in the spectrum of a simple quantum model

P.Leboeuf and M.Saraceno

There are several ways of characterizing energy levels that correspond to chaotic regions in phase space. We have adopted Percival[1] criterion of looking at the behaviour of the spectrum under perturbation and calculated the quantities

$$\Delta_i^2 = \frac{\partial^2 \varepsilon_i}{\partial \chi^2}$$

where ε_i are the exact eigenvalues of a three level Lipkin model and X is the interaction parameter. We observe that in the limit of high degeneracy there is a definite energy region in the spectrum where the values of Δ_i^2 are very large, thus indicating the presence of a chaotic region. A comparison with results of Williams and Koonin[2] has been attempted over.

---

1)I.C.Percival; Regular and irregular spectra of molecules, in G.Casati, J.Ford (eds.), Lecture Notes in Physics Vol.93, Springer, Berlin (1979).
2)S.E.Williams, S.Koonin, Nucl.Phys. A391 (1982)72.

II.1.18 Microscopic description of four body excitations in heavy nuclei

G.G.Dussel and A.J.Fendrik

Under the assumption that the ground state of a many body system is formed by a condenstate of quartets, the structure of these quartets, as well as the equations that describe the excitations of such system are obtained. It is shown that such a description can be applied to well deformed nuclei. In particular it is found that the one and three body excitation will have a description that is similar to the one provided by the Nilsson model. Some experimental differences are predicted.

II.1.19 Isovector $K^{\pi}=1^{+}$ vibrational mode in deformed nuclei

D.R.Bes and J.Kurchan

Recently several states have been observed in deformed nuclei that seem to correspond to $K^{\pi}=1^{+}$ modes. These excitations were studied within the single particle + pairing force + quadrupole force model. The pairing force was treated in the BCS approximation in the residual quadrupole force in the RPA. The transition probabilities obtained are of the order of the ones observed while the energies are not in such good agreement. Later, some of these states were experimentally found to be splitted and it has been suggested that these splittings may be caused by a (small) deformation away from axial symmetry. Such a deformation was introduced in the single particle potential but the results of the calculations could not be made to agree with the experimental ones. The A and Z dependence of the energies and transition probabilities are being studied including in the Hamiltonian the spin-spin interaction.

II.1.20 Constrained Hartree approximation for systems with many interacting bosons*

M.C.Cambiaggio, J.Dukelsky and G.R.Zemba

An extension to bosons of a constrained Hartree variational method is developed in which an angular momentum constraint is imposed. The method is applied to a soluble bosonic model, the Q-consistent Hamiltonian of Warner and Casten. The results are compared not only with the exact ones but also with those obtained from the cranked Hartree variational approximation.

---

*J.Phys. G11(1985)L163.

II.1.21 Validity of the self-consistent cranking approximation in the SU(3)-U(5) phase transition*

M.C.Cambiaggio, J.Dukelsky and G.R.Zemba

The validity of the self-consistent cranking approximation is studied in a soluble bosonic model which presents a first-order phase transition from an SU(3) (axially deformed) to an U(5) (spherical) limit. It is shown that the results are good not only in the SU(3) limit but also throughout the transition and even in the U(5) limit.

---

*Phys.Lett.B 162B(1985)203.

II.1.22 Maximum overlap, critical phenomena and the coherence of generating functions*

J.Nuñez, A.Plastino, R.Rossignoli and M.C.Cambiaggio

Kümmel's maximum overlap idea is generalized so as to pase the way for an algorithm independent of the underlying symmetries of the corresponding hamiltonian. This is achieved by recourse to some aspects of atomic coherent states that enable one to work with suitable generating functions within the framework of the generator coordinate method.

*Nucl.Phys. A444(1985)35.

II.1.23 Systematic behaviour at large degeneracies in a soluble model*

M.C.Cambiaggio, G.G.Dussel and M.Saraceno

In general the Time Dependent Hartree Fock (TDHF) method as a zero order approximation lacks an expansion parameter on which to base a systematic analysis of higher order corrections. In this work we show that in the Lipkin model this parameter is the degeneracy N. We study the effects that the existence of this large N limit has on the calculation of eigenvalues, its 1/N corrections and on the evolution of correlations in the exact wave function.

Eigenvalues: Plotting the normalized (divided by N/2) exact energies as a function of the ordering number, also normalized, for increasing values of N it can be seen that the spectrum crowds along an universal (independent of N) curve. This curve can be interpreted as the action as a function of energy of a classical hamiltonian with one degree of freedom. This classical limit is exactly reproduced by TDHF. On the other hand, assuming an expansion of the action

$$S = S_o(E,X) + 1/N\, S_1(E,X) + \ldots$$

where S is the exact result and S_o the TDHF one, we have obtained the universal curve $S_1(E,X)$.

Evolution of statistical properties: We have studied the time evolution of the quantity

$$k = \sqrt{\frac{2\hbar(\rho^2-\rho)}{\hbar\rho} + 1}$$

and obtained that at zero order it is $k = 1$, as predicted by TDHF. At order $1/N$, instead, a very definite decay is observable with a time of order $\sqrt{N}$. The study of k is important because the deviation of k from unity signals the growth of correlations in the evolution.

---

*Proceedings del IX International Workshop on Condensed Matter Theories, San Franciso, U.S.A., 1985 (ed. Plenum Press).

II.1.24 Damping of collective modes in DIC: quantal versus statistical fluctuations

M.E.Spina and H.A.Weidenmüller[a]

A model is developed to describe the transformation of relative kinetic energy into intrinsic excitation energy in DIC. Energy dissipation is viewed as an indirect process, in which collective vibrational modes are first excited coherently and then damped due to the coupling to the remaining non-collective degrees of freedom. Both collective and intrinsic degrees of freedom are included explicitly, and the coupling between them is treated in a random-matrix model. Under certain assumptions it is shown that, in the weak-coupling limit, the collective probability distribution in phase space obeys a Fokker-Planck equation. This transport equation is used to derive equations of motion for the expectation values of some "macroscopic" quantities characterizing the process. Some numerical results are presented and a qualitative comparison with the Copenhagen model is attached.

---

*Nucl.Phys. A425(1984)354.

[a]Max-Planck-Institut für Kernphysik, Heidelberg, West Germany.

II.1.25 Electromagnetic decay of the giant quadrupole resonances. II: Nuclear structure aspects*

D.R.Bes, P.Curutchet, S.L.Reich, N.N.Scoccola and H.M.Sofía

We analyze the experiment on the electromagnetic decay of the GQR from the point of view of the microscopic theory of the nuclear structure. The calculations are made systematically in the lowest contribution order of perturbation theory within the NFT formalism. Care is taken in order to prevent spurious mixing of the isoscalar and isovector parts of dipole operators. As well as in previous theoretical calculations, the results are consistent with the experimental limit of the ratio between the transition populating the 2.62 MeV 3^- state and the g.s. in ^{208}Pb. However they fail to reproduce the strong dipole transition to the 4.97 Mev 3^- state.

---

*Nucl.Phys.A, in press.

II.1.26 Structure of ^{186}Ir and decoupling phenomena in doubly-odd deformed nuclei*

A.J.Kreiner, D.E.DiGregorio, A.J.Frendrik, J.Davidson and M.Davidson

States of ^{186}Ir, excited through several (HI,xn) reactions, were studied using in-beam gamma-ray spectroscopy techniques. A completely new high-spin level scheme, comprising several rotational bands, is presented. The positive-parity $\Delta I=2$ ground-state band is possibly a first example of a hitherto unreported scheme called double decoupling associated with a proton and neutron both occupying $\Omega=\frac{1}{2}$ orbits of decoupling parameters larger than unity. A prominent $\Delta I=1$ negative-parity structure is interpreted as the $\tilde{\pi} h_{9/2} \otimes \nu \tilde{i}_{13/2}$ band known in Tl isotopes but in a prolate-deformed situation.

---

*Nucl.Phys. A432(1985)451.

II.1.27 Band structure in $^{180}Re^{*}$

A.J.Kreiner, J.Davidson, M.Davidson, D.Abriola, C.Pomar and P.Thieberger[a]

Rotational bands in the odd-odd nucleus, ^{180}Re, have been studied via the $^{176}Yb(^{10}B,6n)$ and $^{181}Ta(\alpha,5n)$ fusion-evaporation reactions. A completely new high-spin level scheme has been obtained comprising three $\Delta I=1$ and tentatively, a $\Delta I=2$ band. The $\Delta I=1$ structures have most likely high K values and the $\Delta I=2$ band is interpreted as a new example of a double decoupled sequence based on the decoupled $h_{9/2}$ proton and a $\frac{1}{2}^{-}[521]$ neutron.

---

*Submitted to Phys.Rev.C.
[a]Brookhaven National Laboratory, N.York, U.S.A.

II.1.28 Doubly decoupled structures in $^{182,184}Ir^{*}$

A.J.Kreiner, P.Thieberger[a] and E.Warburton[a]

A search for structures, in which both valence neutron and proton occupy predominantly $\Omega=\frac{1}{2}$ orbits, called doubly decoupled, has been successfully conducted in $^{182,184}Ir$. These evaporation residues were populated through the $^{172,174}Yb(^{14}N,4n)$ fusion reactions and studied using gamma-ray spectroscopy techniques.

---

*Submitted to Phys.Rev.C (Rapid Communications)
[a]Brookhaven National Laboratory, N.York, U.S.A.

II.1.29 High spin states in ^{98}Tc via the $^{94}Zr(^{7}Li,3n)^{98}Tc$ reaction

A.M.Bizzeti-Sona[a], P.Blasi[a], A.A.Stefanini[a] and A.J.Kreiner

The doubly odd nucleus ^{98}Tc was produced through the $^{94}Zr(^{7}Li,3n)$ fusion-evaporation reaction and its high-spin state decay was studied using in-beam gamma-ray spectroscopy techniques. These measurements reveal a decay scheme strikingly similar to the one found in the heavier isotone ^{100}Rh. A two-quasiparticle-plus-soft rotor calculation, were the configuration space for the particle is $\tilde{\pi}g_{9/2} \otimes \tilde{\nu}(g_{7/2},d_{5/2})$, is shown to be able to account for the main features of the high-spin level scheme of ^{98}Tc.

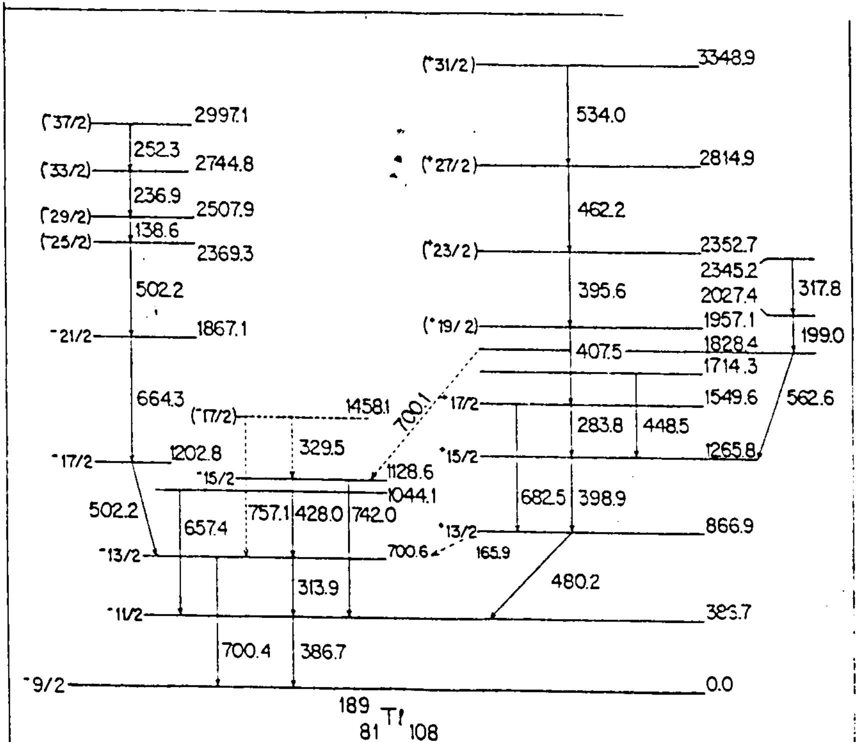
[a]Universita di Firenze, Italy.

II.1.30 High-spin structure of ^{189}Tl

J.Davidson, M.Davidson, A.J.Kreiner, H.Mosca and L.Riedinger[a]

High spin states of ^{189}Tl have been populated through the fusion-evaporation reaction ^{169}Tm(^{24}Mg,4n) at E(^{24}Mg)=125 and 130 MeV, and its subsequent decay studied by in-beam gamma-ray spectroscopy tecnhiques comprising singles and coincidence measurements.

An almost completely new level scheme was identified, shown in Fig.1, which is built on the $9/2^-$ ($h_{9/2}$) high spin isomer[1]. Among the firmly established features there are two band structures resulting from the coupling of the $h_{9/2}$ and $i_{13/2}$ proton intruder states to the oblate ground state band of the ^{188}Hg core[2]. The two level sequences shown at the extreme left (502 keV, etc.) and the extreme right (562 keV, etc.) may be related on a speculative basis to the prolate-deformed band which appears as an excited band in ^{188}Hg.



[a]University of Tennessee, U.S.A.

1)A.G.Schmidt et al., Phys.Lett. B66(1977)133
2)D.Proetel et al., Nucl.Phys. A231(1974)301

II.1.31 Search for doubly decoupled structures in $^{176,178}Re$

J.Davidson, M.Davidson, M.Debray, G.Falcone, D.Hojman,
A.J.Kreiner, I.Mayans, C.Pomar and D.Santos

Doubly odd Ir nuclei[1] (A=182,184 y 186) have revealed a novel type of structure, called doubly decoupled, in which both valence proton and neutron occupy predominantly $\Omega = \frac{1}{2}$ orbitals with decoupling parameters equal or larger than unity. These orbitals are the $\frac{1}{2}^-[541]$ ($h_{9/2}$ parentage) for the odd proton and the $\frac{1}{2}^-[521]$ for the neutron. The proton orbit gives rise to decoupled $9/2^- \frac{1}{2}[541]$ band in many odd Z nuclei of the rare earth region and in particular in odd Re isotopes ($A \simeq 177$) these bands are or lie very near to the respective ground states. On the other hand the $\frac{1}{2}^-[521]$ neutron orbit provides the ground state structure for $^{175,177}W$. Thus, it is expected that the $\tilde{\pi}\, \frac{1}{2}^-[541] \otimes \tilde{\nu}\, \frac{1}{2}^-[521]$ doubly decoupled structure will appear also at or very near the ground state of $^{176,178}Re$. (In ^{180}Re it has probably been identified as an excited band).

A search for these structures has been successfully conducted in $^{176,178}Re$, wich were produced through the ^{169}Tm (^{12}C,xn) fusion-evaporation reactions. A gamma-ray excitation function was measured at 57,62,67,72,77,82 and 87 MeV with a ^{12}C beam delivered by the TANDAR Tandem accelerator. The 3n and 5n reactions (leading respectively to ^{178}Re and ^{176}Re) were found to peak approximately at 62 and 84 MeV. The measurements performed at these energies comprise gamma- and X-ray singles in beam and activity spectra, conversion electrons with a miniorange spectrometer and gama-gama coincidences.

We shall briefly discuss the results for ^{176}Re where the analysis is almost complete yet. Fig.1 shows a singles low-energy gamma-ray spectrum measured with a high resolution small Ge(Li) counter and Fig.2 displays a spectrum in coincidence with a 70.5 keV line, the lowest transition of one of the two cascades identified in ^{176}Re.

Fig.3 shows the level scheme which is completely new (only the ground state decay was known up to now) and consist of two independent cascades, one of $\Delta I=1$ and the other of $\Delta I=2$ caracter. The dipolar cascade is most likely associated with the $\tilde{\pi} h_{9/2}(\frac{1}{2}^-[541] \otimes \tilde{\nu} i_{13/2}(7/2^+[633])$ configuration space (see ref.1) and the $\Delta I=2$ cascade, composed of stretched E2 transitions, is the above mentioned doubly decoupled band.

An alignment[2)], i, can be extracted from the decoupled sequence (namely i=3.18 $\hbar$) which is very similar to the one obtained in ^{180}Re (i=3.35 $\hbar$) and a good additivity is verified with the alignments obtained for ^{175}Re (extrapolated value from heavier odd Re isotopes is i=2.94 $\hbar$) and for the 1/2$^-$ 521 ground state band of ^{175}W (i=0.43$\hbar$).

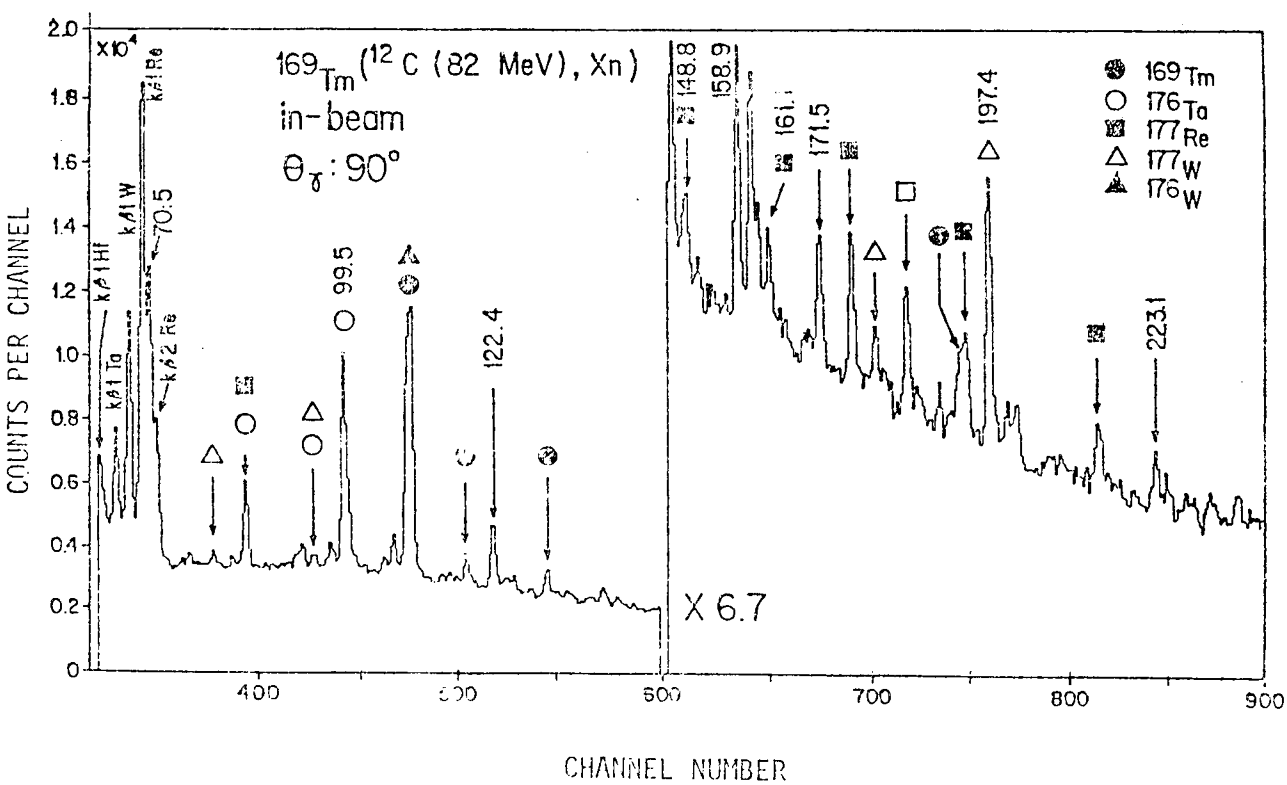


Figure 1

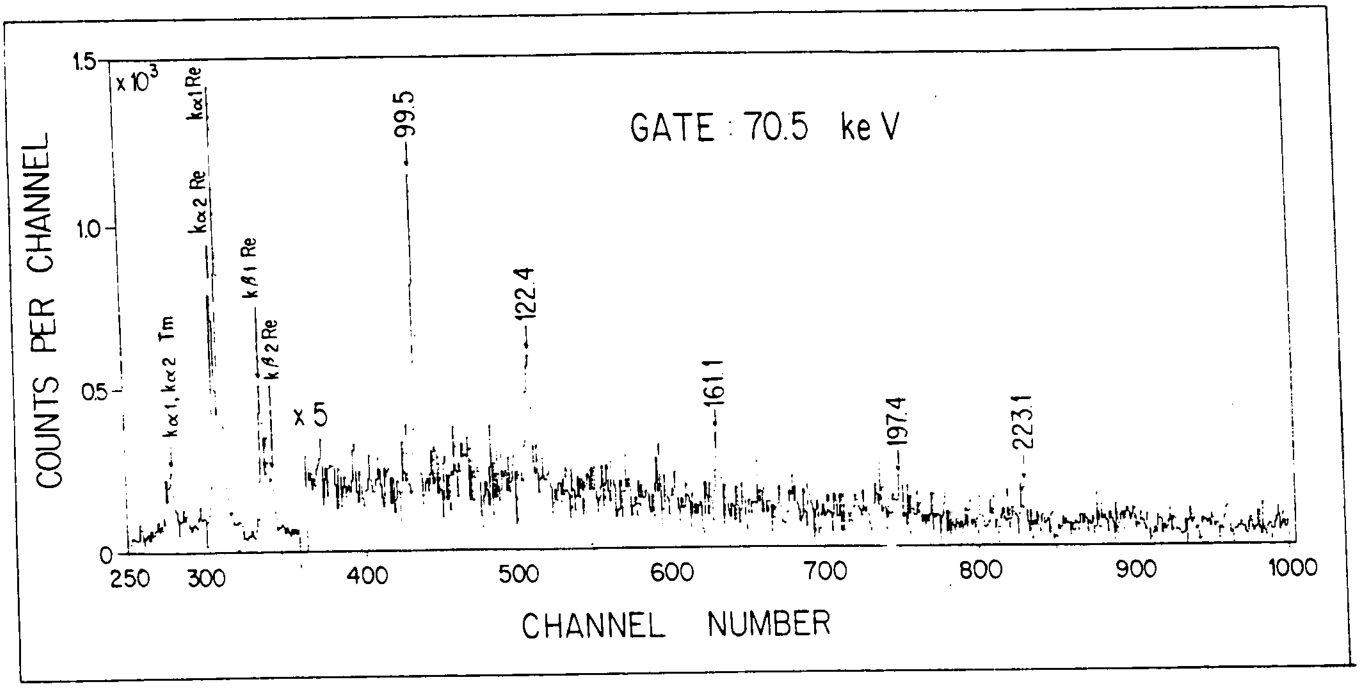


Figure 2

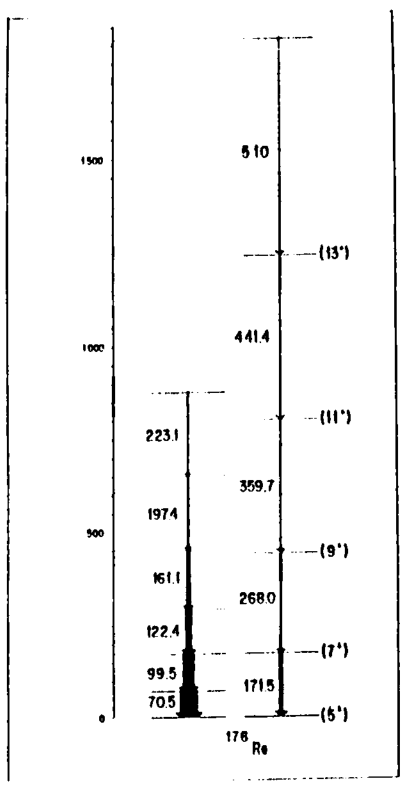


Figure 3

1)A.J.Kreiner, D.E.DiGregorio, A.J.Fendrik, J.Davidson and M.Davidson, Phys.Rev. C29(1984)1572.
2)R.Bengtsson and S.Frauendorf, Nucl.Phys. A314(1979)27; A327(1979)139.

II.1.32 The LMG Model as a many body probe

A.P.Zuker[a], M.Dufour[a] and C.Pomar

The Linked Cluster Theory[1)] (LCT) that transform the linear Schroedinger problem into a set of coupled non linear equations is applied to the solution of the LMG model[2)]. This simple model allow to illustrate why the truncation of a linear system must involve non linear effects. The study of the ground state shows how the coupled cluster (exp S)[3)] form of the wave function emerge naturaly within the LCT formalism, while the excited states demand a degenerate treatment. The critical behaviour of the model is analyzed in detail. The different approximations are compared with exact diagonalizations. Valuable indications emerge from this simple model suggesting how to tackle more complicated cases.

---

[a]Physique Nucléaire Théorique, CRN, Strasburgo, France.

1)A.P.Zuker,Springer Lecture Notes 209(1984)157 and references therein.
2)H.J.Lipkin, M.Meshkov, A.J.Glick, Nucl.Phys. 62(1965)188.
3)J.Arponen and J.Rantakin, Nucl.Phys. A407(1983)141.

II.1.33 Collective structure in ^{204}Hg

L.Rydström[a], J.Blomqvist[a], R.J.Liotta[a] and C.Pomar

The spectrum of ^{204}Hg is calculated using the multistep shell model method (MSM)[1)]. The basis states are given by the states in ^{206}Pb and ^{206}Hg as calculated by Kuo and Herling[2)]. The neutron-proton interaction is given by the states in ^{206}Tl which were also taken from the caclulation of Kuo and Herling[2)]. It is found that the calculated ^{204}Hg spectrum consist of two well defined set of states. There is a quasi-rotational band of even positive parity states up to spin 8^+. The electromagnetic transition among members of this set of states correspond to collective transitions. These states are mainly builts upon the single particle shells $\nu_{p\frac{1}{2}}$ $\nu_{p3/2}$ $\nu_{f5/2}$ and $\pi_{s\frac{1}{2}}$ $\pi_{d3/2}$ $\pi_{d5/2}$. The other set of states shows the usual shell model features.

---

[a] Research Institute for Physics, Stockholm, Sweden.

1)R.J.Liotta and C.Pomar, Nucl.Phys. A382(1982)1 and references therein
2)Kuo and Herling, Naval Research Laboratory, Report 2258, Washington D.C. (1971).

II.1.34 Multiplet structure in ^{205}Pb and ^{203}Pb*

J.Blomqvist[a], L.Rydström[a], R.J.Liotta[a] and C.Pomar

The multistep shell-model method is used to analyse the multiplet structure of ^{205}Pb and ^{203}Pb in terms of single-hole states (^{207}Pb) coupled to two-(^{206}Pb) and four-(^{204}Pb) hole excitations respectively. It is found that at least one member of a given multiplet is generally completely blocked by the Pauli principle. The standard shell-model method is also applied to analyse the spectrum of ^{205}Pb and the results of both calculations are compared. Good agreement with available experimental data is found.

---

*Nucl.Phys. A423(1984)253.

[a]Research Institute for Physics, Stockholm, Sweden.

II.1.35 Excited states in ^{86}Y*

M.Davidson, J.Davidson, A.J.Kreiner and C.Pomar

High spin states in ^{86}Y were studied through the ^{85}Rb(α,3n) reaction at energies between 30 and 55 MeV, using techniques of in-beam gamma-ray spectroscopy. Eight levels were observed on top of the $J^{\pi}=8^{+}$(218.3 keV) metastable state which are connected by gamma rays in cascade and five levels decaying to the $J^{\pi}=5^{-}$ (208.1 keV) excited state. The former were interpreted in terms of the weak coupling of the proton $\pi(1g_{9/2})$ and the neutron hole $\nu^{-1}(1g_{9/2})$ coupled to the ^{86}Sr states on the basis of the shell model.

---

*Phys.Rev. C29(1984)1717.

II.1.36 Experimental results with the NAVE facility

M.Ballesteros, H.Huck, A.Jech, G.Martí, M.Pérez and J.J.Rossi

A $\sim$ 100 μA , $\sim$ 30 MeV deuteron beams have been used to produce fast neutrons from the Be(d,n) reaction. Those neutrons induced fission into the natural uranium incorporated to isotope separator ion source in order to perform on line nuclear spectroscopy studies with mass separated samples.

Fast neutron fission of uranium will give a much more symmetric mass distribution comparing with ^{235}U thermal fission and higher relative yields of "valley" nuclei. Masses from 117 to 137 has been collected and the corresponding gamma-spectra observed, giving a rather flat yield-mass relationship as was expected.

Different isotopes of Ag, Cd, In, Sn, Sb, Te, I and Xe have been identified. Future experiments will be devoted to study the numerous transitions not reported yet in the literature.

II.1.37 Effective shell model interaction for $A \simeq 40$ nuclei

A.Etchegoyen and E.Vergini

An important limitation for shell model analysis is the lack of effective interaction for nuclei beyond the s-d shell. Work is being performed in an effort to obtain an interaction for mass 40 nuclei.

II.1.38 Quenching of the $2p_{1/2}$-$2p_{3/2}$ proton spin-orbit splitting in the Sr-Zr region

P.Federman[a], S.Pittel[b] and A.Etchegoyen

The constancy in excitation energy of the lowest 2^+ state in the Sr isotopes across the N=56 subshell closure is shown to result from a reduction in the $2p_{1/2}$ - $2p_{3/2}$ proton spin orbit splitting as the $2d_{5/2}$ neutron orbital is filled.

---

*Phys.Lett. 140B(1984)269.

[a]FCEN, U.B.A., Argentina

[b]University of Delaware, U.S.A.

II.1.39 Empirical corrections to the free nucleon values of the single-particle matrix elements of the M1 operator for the s-d shell

M.C.Etchegoyen, B.H.Wildenthal[a], A.Etchegoyen and B.A.Brown[b]

A survey of experimentally measured M1 transitions of the s-d shell nuclei has been performed from which an effective M1 operator has been extracted. This effective operator will hopefully encompass the corrections to the "free nucleon" values arising from isobaric and mesonic exchange currents and core polarizations. The free nucleon values do not appear to give room for quenching effects for the isovector transitions. Quenching seems to be present for the isoscalar transitions, which is removed with the present effective operator.

---

[a]Drexel University, Penn., U.S.A.
[b]Michigan State University, Michigan, U.S.A.

II.1.40 A comparison of weak coupling and shell model analysis for mass 20 and 21 nuclei

A.Etchegoyen, M.C.Etchegoyen y B.H.Wildenthal[a],

A weak coupling approach, in which proton and neutron spaces are solved initially separated, based on a truncation of shell model basis is applied to mass 20 and 21.

---

[a]Drexel University, Penn., U.S.A.

II.1.41 Four body correlations in heavy nuclei

G.G.Dussel, A.J.Fendrik and C.Pomar

The origin of four body correlation in heavy nuclei is studied. It is found that while in light nuclei the four body excitaions are related to a wave function that has only a single component, in heavy nuclei, a small attractive interaction between deuteron like bosons can, in principle, provide an alternative structure for the four body excitations yielding a wave function that is a coherent superposition of many terms. This excitation is similar in many aspects to an alfa-like structure. It is shown that the origin of the transition between deformed and spherical nuclei is related to the existence of this alpha-like structure, and that the deformed nuclei can be described as a condensate of this excitations. An application to the ^{208}Pb region is done.

II.2 NUCLEAR REACTIONS

II.2.1 The contribution of one- and two-step processes to inclusive (p,d) reactions

A.O.Gattone, A.M.J.Ferrero and O.Dragún

Absolute one- and two-step angular cross sections are calculated for (p,d) inclusive reactions up to very large ejectile energy loss. Several targets and incident energies are considered in the applications. The (p,p',d) and (p,d',d) routes chosen for the two-step mechanism show a very different behaviour as a function of the excitation energy. As a main result we observe that the one-step process exhausts the total experimental yield only in the energy loss range of 0 to 7-10 MeV. For excitation energies greater than 25 MeV more-than-two-step processes must be included to account for the experimental result.

---

*Nucl.Phys. A424(1984)1.

II.2.2 Extension of the angle dependent phase shift formalism to vibrational excitations*

M.Bernath, O.Dragún, J.Testoni, H.Massman[a] and G.Ramírez[a]

The angle dependent phase shift formalism for a permanently deformed target is generalized to include the excitation of vibrational states. In this extension, the S-matrix depends on the intrinsic angle describing the deformed surface as well as on the amplitude of the vibration. Numerical examples are given.

---

*submitted to Zeitschift für Physik.

[a]University of Chile, Chile.

II.2.3 The use of a modified CCBA formalism for the study of the excitation of the octupole band

M.Bernath, O.Dragún and H.Massman[a]

In this work we use the CCBA approximation for analyzing the excitation of the octupole band of permanent deformed nuclei. We substitute the coupled wave functions by the corresponding to the same channels but calculated by means of the intrinsice coordinate S-matrix method. Two approximations are used for the perturbation potential: a) a vibration on an spherical nucleus, b) a vibration on a permanent deformed nucleus. Preliminary results reproduce the cross section of the 3^- state of ^{150}Nd excited via ^{12}C+^{150}Nd reaction.

[a]University of Chile, Chile.

II.2.4 Sequential fission angular distributions from mass-asymmetric heavy-ion reactions*

D.J.Morrissey[a], G.J.Wozniak[b], L.G.Sobotka[b], R.J.McDonald[b], A.J.Pacheco and L.G.Moretto[b]

The angular distributions of sequential fission fragments haven been measured for the reactions of ^{40}Ar+^{197}Au and ^{40}Ar+^{238}U as a function of reaction Q-value and charge transfer. These angular distributions are used to study the angular momentum and alignment of the deep-inelastic products which undergo fission. All of the fission fragment angular distributions are strongly focused into the plane defined by the beam and the projectile-like fragment velocity vectors. The in-plane angular distributions from reactions with uranium are isotropic for small energy losses and become anisotropic as the energy loss increases. For large negative Q-values, the in-plane anisotropy increases as the deep-inelastic products become more symmetric. The variation of the in-plane anisotropy with mass asymmetry for the two systems in this work was compared to a compilation of previous work and a consistent pattern was found. These alignment data are compared to equilibrium statistical calculations.

---

*Nucl.Phys. A442(1985)578.

[a]Michigan State University, MI, U.S.A.
[b]Lawrence Berkeley Laboratory, CA, U.S.A.

II.2.5 <u>Fusion and peripheral reactions in the systems $^{16}O + ^{148,152}Sm$ at sub-barrier energies</u>*

J.A.Kittl and J.Testoni

Cross sections for fusion and peripheral reactions in the sub-barrier region obtained with the method of coupled channels and that of equivalent spheres are compared for the systems $^{16}O + ^{148,152}Sm$. A barrier like real potential plus a residual surface imaginary potential is introduced as an alternative approach that allows the simultaneous fits of elastic, inelastic, fusion and peripheral reactions cross sections.

---

*to be published in Nucl.Phys.A

II.2.6 <u>Methods for the calculation of form factors for many nucleon tranfers</u>*

S.M.Lenzi and E.E.Maqueda

Methods for the numerical calculation of form factors for many nucleon transfer reactions are reviewed with the aim of discussing different approximations commonly used. A new procedure is introduced that avoids some of the short comings of the previous methods, to which it is compared.

---

*submitted to Nucl.Phys.A.

II.2.7 <u>Four particle wave function</u>

O.Dragún, S.M.Lenzi, R.Liotta[a], E.E.Maqueda and C.Pomar

We have studied the wave function of four particles on top of different closed shell cores obtained within the Multistep Shell Model (MSM)[1] formalism. This formalism describes the nuclear system in terms of correlated states containing the two body interaction. These wave functions have been used to search for alpha-clustering phenomena in different states of ^{20}Ne and ^{44}Ti. To that purpose a code developed by

B.Bayman, S.M.Lenzi and E.E.Maqueda has been applied to calculate the overlap of the four particle system with the internal alpha-particle wave functions.

The present results suggest the existence of α-clustering in the nuclear surface.

[a)] Forskinstitutet, Stockholm, Sweden.

[1)] R.J.Liotta and C.Pomar in Nucl.Phys. A382(1982)1.

II.2.8 α-transfer and a tetrahedral shape for ^{16}O*

J.P.Elliott[a], J.A.Evans[a] and E.E.Maqueda

The addition of a tetrahedral perturbation to the shell model in ^{16}O produces α-particle clustering and has a strong influence on α-transfer processes. The cross-section enhancements for the reaction $^{12}C(^{6}Li,d)^{16}O$ are studied as a function of the strength of perturbation and reasonable agreement with experiment is found for the three final states 0^+,3^- and 4^+ in ^{16}O which are described as members of the tetrahedral rotational band.

---

*Nucl.Phys. A437(1985)208.

[a] University of Sussex, Brighton, U.Kingdom.

II.2.9 Maximum entropy approach to nuclear fission processes

R.D.Levine[a], D.R.Napoli, D.Otero, A.Plastino and A.N.Proto

The conservation of the number of nucleons is shown to be an important constraint that governs the nuclear fission process. Both cold and energy rich fission processes are analyzed. Particular attention is paid to the role of pairing effects in governing the fine structure in the mass and charge distributions. Symmetric and asymmetric fission processes are studied using a maximal entropy procedure. The interpretation of the results in terms of the Planck potential of the nucleons is discussed.

---

[a] Hebrew University, Israel.

II.2.10 Electromagnetic decay of the giant quadrupole-resonances I: Reaction mechanism and angular distributions of the emitted photons*

B.Bayman[a], D.R.Bes, P.Curutchet, O.Dragún, N.N.Scoccola and J.Testoni

A study is made of the electromagnetic decay of the ^{208}Pb giant quadrupole resonance excited by inelastic scattering of ^{17}O at 380 MeV. Due to the instability of the giant quadrupole resonance with respect to compound nucleus formation and to neutron emission, the time over which the radiation is produced is not much greater than the time in which the direct reaction occurs. Angular distributions of the gamma-rays produced in transitions to several low lying states of the residual nucleus are calculated and their dependence on effects due to the proximity of the interacting nuclei is discussed.

---

*Nucl.Phys.A in press.

[a]Univ. of Minesotta, Minneapolis, U.S.A.

II.2.11 Three particle transfer on ^{14}N*

M.C.Etchegoyen, D.Sinclair[a], A.Etchegoyen and E.Belmont-Moreno[b]

(^{3}He,α) and (t-α) angular correlations for the reaction processes ^{14}N(^{6}Li,^{3}He)^{17}O* $\rightarrow$ (α)^{13}C and ^{14}N(^{6}Li,t)^{17}F* $\rightarrow$ (α)^{13}N, respectively, were measured at 36 MeV of ^{6}Li beam. Shell model, EFR DWBA calculations were performed to obtain structure information for mass-17 nuclear states.

---

*Journ.of Physics G10(1984)823.

[a]Oxford University, Oxford, U.Kingdom

[b]Instituto Nacional de Investigaciones Nucleares, Mexico.

II.2.12 Beam intensities in an electrostatic accelerator as a function of the charge state and terminal voltage*

A.Etchegoyen, J.O.Fernãndez Niello and A.J.Pacheco

A set of graph is provided for which the charge state percentage of a large variety of beams is shown both for a ^{12}C stripper foil and certain gas strippers.

---

*CNEA NT - 13/85

II.2.13 The $^{10}B(^{7}Li,^{7}Be)^{10}Be$ a change exchange reaction at 38 MeV ^{7}Li

A.Etchegoyen, D.H.Abriola, M.C.Etchegoyen, J.Fernãndez Niello, A.Ferrero, A.O.Macchiavelli, A.Pacheco, S.Gil and J.Testoni

It is an open question which is the reaction mechanism for this type of charge exchange reactions one or two steps (sequential) mode. Also, the one step mechanism can take place via central, non-central or exchange forces and work is under progress in an effort to understand this reaction mechanism.

II.2.14 Fusion of $^{16}O+^{144}Sm$ at sub-barrier energies*

D.E.DiGregorio, J.O.Fernãndez Niello, A.J.Pacheco, D.Abriola, S.Gil, A.O.Macchiavelli, J.Testoni, P.R.Pascholati[a], V.R.Vanin[a], R.Liguori Neto[a], N.Carlin Filho[a], M.M.Coimbra[a], P.R.Silveria Gomes[b] and R.G.Stokstad[c]

In this work we present results for the fusion of two spherical nuclei, the doubly magic nucleus ^{16}O and the neutron magic nucleus ^{144}Sm, at energies near and below the Coulomb barrier. The experiment was performed at the Instituto de Física da Universidade de Sao Paulo. Beams of ^{16}O delivered by the 8 UD Pelletron with laboratory energies from 63 to 72 MeV were used to bombard a 94 $\mu g/cm^2$ ^{144}Sm target isotopically enriched to 88.6%. Fusion cross sections have been measured by observation of delayed X-rays emitted by the evaporation residues.

The measured fusion cross sections for the system $^{16}O+^{144}Sm$ are presented in Fig.1 as a function of laboratory bombarding energy. The measurements for $^{16}O+^{148,150,152,154}Sm$ are taken from Ref.1. At the highest bombarding energies the values of σ_{fus} are similar for all the systems, while at sub-barrier energies there is a clear enhancement for the fusion of ^{16}O with the more deformed isotopes relative to the spherical ^{144}Sm.

Since ^{154}Sm is a well deformed nucleus, the simplest approach to discuss the systematic behaviour of the fusion cross sections at sub-barrier energies for the different isotopes is to use a one-dimesional barrier penetration model that includes explicitly the effect of deformation.

For this purpose we use Wong's model[2)], in which σ_{fus} is evaluated in terms of four parameters: the interaction barrier height V_B, its radial position R_B, its curvature $\hbar\omega$ and the quadrupole deformation of the target nucleus β_2. The parameters V_B and R_B govern the fusion cross sections at energies above the interaction barrier, whereas β_2 and $\hbar\omega$ control the behaviour of the excitation function at sub-barrier energies. Although Wong's model is derived on the basis of a static deformation, the value of β_2 represents, quite generally, a range of interaction barrier heights arising from effective variations in the radius of the target nucleus due to either changing orientation or zero point vibrational configurations.

The $^{16}O+^{144}Sm$ system was used as a reference to obtain the shape of the interaction barrier, which was consistent with the shape given by theoretical static nuclear potentials and from analysis of other experimental data. The quadrupole nuclear deformation parameters for the deformed sumarium isotopes were then deduced and found to be consistent with previous results. The systematic enhancement of σ_{fus} observed for ^{16}O on Sm isotopes, which span the region from spherical to well-deformed nuclei, can be explained in terms of a one-dimensional barrier penetration model when these deformation parameters are included. Therefore, we found no need to include an extra degree of freedom, such as the formation of a neck, for these systems.

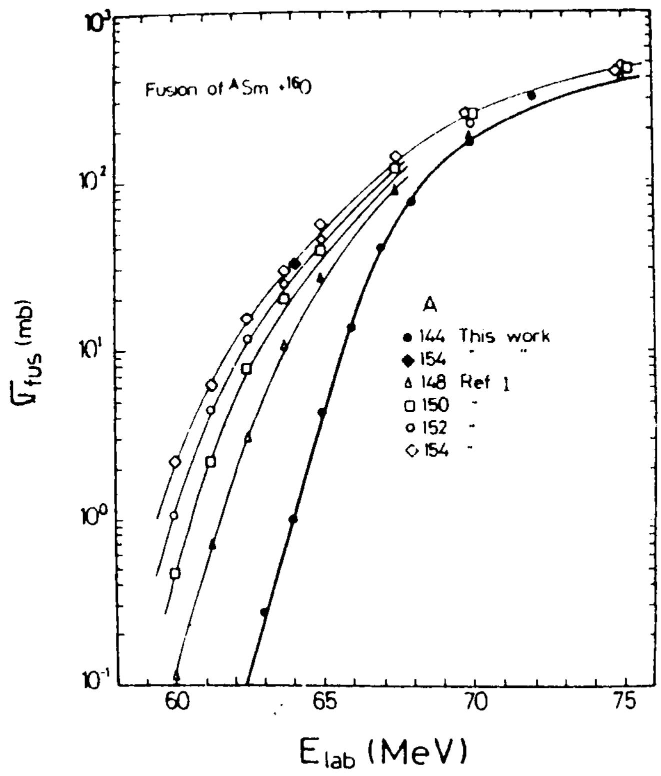


Fig.1: Fusion cross section as a function of bombarding energy. The solid curves are fits to the data using Wong's model.

---

*Submitted to Phys.Rev.Lett.
[a]Instituto de Fisica, Universidade de Sao Paulo, SP, Brazil.
[b]Universidade Federal Fluminense, Niteroi, Brazil.
[c]Lawrence Berkeley Lab., Univ.of California, CA, U.S.A.
1)R.G.Stokstad et al., Phys.Rev.Lett. 41(1978)465; Phys.Rev.C21(1980)2427
2)C.Y.Wong, Phys.Rev.Lett. 31(1973)766.

II.2.15 Neutron transfer reactions with very heavy ions*

A.O.Macchiavelli, M.A.Deleplanque[a], R.M.Diamond[a], F.S.Stephens[a], E.L.Dines[b] and J.E.Draper[b]

We have studied neutron transfer reactions induced by ^{132}Xe on three rare-earth targets at $E/V_c \sim 1.1$. By using particle-particle-gamma coincidence techniques we were able to identify final products and states populated in the one- and two-neutron reactions.

The dependence of transfer probabilities on the distance of closes approach is discussed in terms of effective penetration factors. The results seem to indicate the importance in two-neutron transfer of intermediate states with $\simeq$ 6 MeV of excitation energy. The effect of excitation energy on the enhancement of the two-neutron transfer is discussed. A qualitative interpretation of the spin dependence of the one-neutron gamma-ray yields in terms of the spatial localization of the wave functions involved is given.

---

*Nucl.Phys. A432(1985)436.

[a]Lawrence Berkeley Lab., Univ.of California, CA, U.S.A.
[b]Department of Physics, Univ.of California, CA, U.S.A.

II.2.16 Mass dependence of shell effects at high rotational frequencies*

A.O.Macchiavelli, H.Muehry[a], M.A.Deleplanque[b], R.M.Diamond[b], F.S.Stephens[b], E.L.Dines[c] and J.E.Draper[c]

The continuum gamma-ray spectra from the reactions ^{40}Ar(170-185 MeV) + ^{50}Ti, ^{68}Zn, ^{82}Se, ^{100}Mo → ^{90}Zr*, ^{108}Cd*, ^{122}Te*, ^{140}Nd*, respectively have been studied by using a sum-energy technique. The evolution of the gamma-ray spectra with sum energy (spin) suggests the presence of rotational motion at high spins. A method to correct for incomplete feeding was applied to the gamma-ray spectra and effective moments of inertia were determined. The results indicate the appearance of a new source of angular momentum at high rotational frequencies. We interpret this as the alignment of high-j orbitals from the next major shell. Simple arguments, as well as cranked-shell-model calculations, are consistent with this picture. Data on band moments of inertia, from E_γ-E_γ correlation experiments, are also in accord with our interpretation.

---

*Nucl.Phys. A443(1985)538.

[a]Physik Institut, Universität Basel, Switzerland.
[b]Lawrence Berkeley Lab., Univ.of California, CA, U.S.A.
[c]Department of Physics, Univ.of California, CA, U.S.A.

II.2.21 A two dimensional soluble model for the excitation of rotational states in deformed nuclei*

M.Bernath, D.R.Bes, M.Saraceno and M.E.Spina

We present the exact classical and quantum mechanical treatment of the scattering of a point particle off a hard ellipse in two dimensions. The model can be used to test approximation schemes used in more realistic treatments of scattering between deformed nuclei. Differential cross sections for fixed orientation and for fixed angular momentum transfer are provided and compared in both treatments. As an application we verify the validity of the results obtained by the angle dependent phase shift method.

---

*Submitted to Journal of Physics G.

II.3 INTERMEDIATE ENERGIES

II.3.1 The two-body Dirac equation for nuclear physics*

A.O.Gattone, E.D.Cooper[a] and H.H.Macfarlane[b]

The use of the two-body Dirac equation (two free Dirac Hamiltonians plus one-boson exchange potential) is analysed in the nuclear physics case. Comparison is made with the Breit equation of QED, and a similar equation used for the deuteron case and the radial equations are presented. The conclusion is that the two-body Dirac equation can not be used at face value in nuclear physics because it presents non-renormalizable singularities if the usual strength of the one-boson exchange potentials is assumed. Conversely, it may be utilizable if a proper non-relativistic limit is taken, or if the potentials are fitted to the data so as not to lead to unsolvable singular points at $r > 0$.

---

*submitted to Z.Phys.A.
[a]TRIUMF, Vancouver, BC, Canadá.
[b]Indiana University, Indiana, U.S.A.

II.3.2 Recoil effects in the relativistically corrected impulse approximation*

A.O.Gattone, B.Goulard[a] and W-Y.P.Hwang[b]

We invoke the formalism developed by Krajcik and Foldy to consistently treat recoil effects in the relativistically corrected impulse approximation in the presence of a local central potential. It is stressed that recoil effects in the case of the single-particle Dirac Hamiltonian are considerably different from those suitable for the Foldy-Wouthuysen diagonalized Hamiltonian, intuitive arguments may result in an incorrect sign for certain terms as in a preceding paper. As an illustrative numerical example, we use the resultant formulae to determine the magnetic moment and charge radius of the ^{15}N nucleus.

---

*Phys.Rev. C31(1985)1430.
[a]University of Montreal, Quebec, Canadá.
[b]Indiana University, Indiana, U.S.A.

II.3.3 Recoil effects in a bag model*

A.O.Gattone and W-Y.P.Hwang[a]

In this paper, we invoke the formalism used previously by Krajcik and Foldy to obtain the relativistic center-of-mass coordinates for a system of pointlike Dirac particles. This procedure allows us to investigate a recent dispute regarding the size, as well as the proper formulation, of recoil corrections to baryon magnetic moments in a bag model. Our results suggest that the overall center-of-system motion, when factored out properly to yield the momentum-conservation δ-functions, does not result in the additional and sizable recoil corrections as addressed specifically by Betz and Goldflam as well as by Guichon. It appears that the major recoil contribution to the baryon magnetic moment comes from the spinor rotation of the constituent quarks. Although the dispute in question is related to effects of first order in q/M with q the magnitude of the momentum transfer and M the baryon mass and so can be settled with confidence, it appears that terms of order $(q/M)^2$ or beyond are highly model-dependent.

---

*submitted to Phys.Rev.D.

[a]Indiana University, Indiana, U.S.A.

II.3.4 Contribution of the space-like vector field to nuclear magnetic moments*

A.O.Gattone

The contribution of the space-like part of the vector field to nuclear magnetic moments is investigated in the framework of the relativistically corrected impulse approximation. It is found that to second order in an expansion in powers of p/m, the space piece of the vector potential does not contribute to the nuclear current and therefore has no impact on the calculation of magnetic moments.

---

*submitted to Phys.Lett.B.

III. Solid State Physics

III.1 Vibrational Spectroscopy

III.2 Crystal Structure and Phase Transitions

III.3 Mössbauer Spectroscopy

III.4 Theoretical Solid State Physics

III.5 Crystal Growth

I. VIBRATIONAL ESPECTROSCOPY

III.1.1 Anisotropic forces in small molecule crystals*

H.Bonadeo and E.Burgos

The role of anisotropic forces in small molecule crystals is discussed in terms of a molecule centred multipole expansion for the Lennard-Jones and electrostatic interactions. The influence of the high order multipole terms on the packing energy is studied using the structures Pa3 and Cmca as an example. Two successful models for the statics and dynamics of these crystals are compared.

---

*Jour.Chim.Phys. 82(1985)91.

III.1.2 Vibrational intensities of lattice modes and the distributed dipole model: crystalline acetylene*

Z.Gamba and H.Bonadeo

The vibrational intensities of crystalline acetylene are calculated using models of increasing complexity for the molecular charge distributions and polarizabilities. It is found that it is necessary to include high order molecular multipole moments, represented by a distributed dipole model, to account for the absolute infrared absorption intensities of the two crystal phases. High order molecular polarizabilities, represented by distributed dipolar polarizabilities, have an important effect on the calculated absolute intensities and susceptibilities, although the relative intensity patterns are not too much model sensitive.

---

*J.Chem.Phys. 81(1984)4724.

III.1.3 Crystal structure of pyridazine and azabenzene crystals: A test for an intermolecular potential*

Z.Gamba

An intermolecular potencial for benzene and azabenzene crystals was tested by using it to reproduce the crystal structures of benzene, pyrimidine, pyrazine, the two known forms of s-trizaine and tetrazine by molecular packing analysis. A $Pmn2_1(C_{2v}^7)$ structure for the unknown crystal pyridazine is proposed.

---

*J.Chem.Phys. 83(1985)5892.

III.1.4 Anharmonic calculation on α-nitrogen

S.Gonçalves and H.Bonadeo

The frequency shifts and lifetimes of optical phonons of α-nitrogen, due to cubic and quartic terms in the interaction potential, are studied. It is found that the cubic and quartic shifts practically balance each other, and therefore the discrepancies between experimental values and those calculated using the harmonic approximation remain. It is concluded that the perturbative approach is unadequate for the description of this type of systems which have large librational amplitudes. It is also shown that the one-phonon anharmonic approximation leads to erroneous results, and several ways to shorten and simplifying anharmonic calculations are studied.

---

*J.Chem.Phys. in press.

III.1.5 Crystal structure and lattice dynamics calculations on CSe_2*

R.Righini[a] and E.Burgos

The lattice frequencies and the crystal structure of the CSe_2 crystal are calculated with an intermolecular potential consisting of an electrostatic part (represented by means of a distributed multipole model) and of an anisotropic atom-atom potential. The effects of the different terms of the potential are illustrated and their relative importance is discussed.

---

*Chem.Phys.Lett.(1985)115.

[a]Univ. di Firenze, Florence, Italy.

III.1.6 Experimental studies of long life phonons in molecular cyrstals by high resolution Raman spectroscopy

P.Ranson, R.Ouillon, E.Halac and S.Califano

Using an interferometer-spectrometer in tandem with a limiting resolution of 0.005 cm^{-1} we have measured the band profiles of some low frequency Raman active phonons of monoclinic tetracyanoethylene (TCNE) and α-glycine at low temperature. In this latter case we obtained by deconvolution of the observed profiles residual bandwidths at T=0 K as small as 0.004 cm^{-1} for two lattice phonons.

The observed bandwidths are interpreted in terms of three-phonon decay processes and the most important relaxation mechanism are determined. Correlation of the bandwidths with the one- and two-phonon density of states is used to localize the frequency range where decay into two acoustic phonons of the same energy is the dominant relaxation process.

The present results are compared with those obtained previously for other molecular crystals such as naphtalene, anthracene and l-alanine. It is shwon that at a given frequency the phonon bandwidths of the hydrogen bonded crystals are at least one order of magnitude smaller than those of the normal Van der Waals crystals. This effect is interpreted as due to the different anharmonicity of the intermolecular potential in the two cases.

The evolution with temperature of the phonon bandwidths has been followed for α-glycine in the range 5-50 K. An excellent fit of the experimental data is obtained assuming a maximum of two preferential up-conversion decay mechanisms.

---

*Jour.Chim.Phys. 82(1985)169.

III.1.7 Harmonic phonon dynamics of monoclinic and cubic tetracyanoethylene*

E.Halac and S.Califano

Calculations on the harmonic phonon dynamics of TCNE in both crystalline phases were performed. A suitable intermolecular potential, which includes atom-atom and electrostatic interactions was determined fitting the observed crystal structure and neutron inelastic scattering data of the monoclinic phase. The ability of this model potential to reproduce the static and dynamical properties of TCNE was checked by computing the equilibrium structure and the phonon dispersion curves of the cubic phase. A non-rigid molecule treatment is necessary since the free molecule possesses several low-frequency internal modes which give rise in the solid to highly dispersed branches, strongly coupled with the external phonon branches.

*Chem.Phys., in press.

III.1.8 Calculation of static and dynamical properties of halogen crystals*

Z.Gamba, E.Halac and H.Bonadeo

An intermolecular potential model which includes atom-atom and electrostatic interactions and a nearest neighbour dispersive term has been applied to the isostructural crystals of chlorine, bromine and iodine. The calculation includes optical and $\underline{k} \neq 0$ lattice vibration frequencies, crystal structures and thermal amplitudes; the model reproduces well this ample variety of physical properties of the crystals under consideration.

*J.Chem.Phys., in press.

III.2 CRYSTAL STRUCTURE AND PHASE TRANSFORMATIONS

III.2.1 Influence of irradiation-induced deffects on phase transitions observed in A_2BX_4 compounds

M.A.R.de Benyacar, L.Schmirgeld and H.Lanza de Dussel

Some members of the family of compounds A_2BX_4 show phase transitions involving incommensurate phases (I) which are characterizad in the neiborghood of the commensurate-incommensurate (C-I) phase transition by a periodic arrangement of solitons (walls) limiting commensurate (C) zones. Most of the papers on the subject deal with the pinning of the walls by impurities. We plan to discriminate between the influence of structural defects (interstitials, vacancies, dislocations) and that of substituional impurities; for that purpose, we shall introduce variable amounts of structural defects by irradiations with beams of different ions and energies from the TANDAR accelerator. First experiments were carried out on single crystals of K_2CrO_4 and Rb_2ZnCl_4 ; the beam parameters used are given in Table I. These first experiments allowed optimization of the experimental setup: mounting in the specimen holders, type of adhesive, etc., using samples with a typical volume of 2x2x0.1 mm^3 . No bulk amorphization of the samples was observed. Colour centers were detected only for K_2CrO_4 samples, they are bleached at aprox. 300°C. A systematic study of the irradiated surfaces using scanning electron microscopy and transmission electron microscopy of shadowed replicas is being carried out in order to identify the type of damage produced and to select the most suitable beams ot be used.

Table I:

Ion	Energy (MeV)	Charge	Current ($\times 10^{-9}$ Ag)
Ca^{40}	155	12^+	0.1
O^{16}	42.6	5^+	170
O^{16}	50	5^+	45
O^{16}	90	6^+	25

III.2.2 Phase transitions in compounds of the family A_2CrO_4 (A = K,Rb,Cs)

L.Schmirgeld, H.Lanza de Dussel and M.A.R.de Benyacar

A study of the phase transitions in K_2CrO_4 single crystals was started, using differential scanning calorimetrey, X-ray diffraction and optical and electron microscopy techniques. Dilatometry and gamma-ray diffractometry preliminary measurements were carried out in collaboration with Drs. Pierre Bastie and Marcel Vallade at the Laboratoire de Spectrométrie Physique de la Université Scientifique et Medicale in Grenoble, (France) headed by Prof. Joseph Lajzerowicz.

III.2.3 Memory effects in the solitonic regime of incommensurate phases of compounds of the family A_2BX_4 *

C.Folcia

Single crystals of tetramethyl-ammonium tetrachloride cobaltate and bis-pentil-ammonium tetrachloride zincate were grown. Experimental facilities for measuring dielectric and optical constants were built. Preliminary optical and dielectric constant measurements were carried out in order to study the memory effect in the solitonic regimen between the incommensurate and lock-in phases.

---

*Work done in the Department of Physics at the Universidad del País Vasco, Spain.

III.2.4 Flux pinning in $La_{70}Cu_{30}$ disordered system

P.Esquinazi, B.Guillet, R.Steinman and H.L.de Dussel

Superconducting critical currents were measured as a function of a perpendicular applied magnetic field in disordered $La_{70}Cu_{30}$. It is shown that the pinning force is very sensitive to inhomogeneties already present in the quenched samples, although these inhomogeneties have no obvious influence on other superconducting and transport properties.

A simple series resistance model is used to explain the magnetic field dependence of the pinning force. A large decrease of the pinning force was obtained for the annealed samples. This behaviour is consistent with the phase separation model that explains the evolution of the superconductive penetration depth. In order to obtain a better characterization of the structural evolution with annealing of the $La_{70}Cu_{30}$ system, behaviour of the electrical resistivity, superconducting critical temperature and differential thermal analysis were measured.

III.2.5 Phase transitions and incommensurate phases in M_2X $Hal._4$. compounds. Part II: Compounds including $M = (NH_{4-x}(C_nH_{2n+1})_x)$, $X = Zn, Cu, Co, Mn$, etc. y $Hal. = Cl^-$, Br^- groups

M.A.R.de Benyacar

A summary will be given on the crystal structure and physical properties changes observed in single crystals of the family of compounds with general formula M_2X $Hal._4$. undergoing phase transitions involving commensurate and incommensurate phases. Special reference will be made to compounds in which the monovalent cation M is an ammonium group with organic groups replacing one or more of the hydrogen atoms.

III.2.6 Solitons in incommensurate dielectric

H.Ceva

A summary will be given of some of the physical phenomena involved in the experiments to be performed at the TANDAR facilities on Rb_2ZnCl_4 single crystals and analogous compounds.

III.2.7 Dielectric constant anomalies in the incommensurate phases of $Rb_2Zn\ Hal._4$ compounds: An experimental proposal

L.Schmirgeld

An experimental proposal to study the influence of controlled amounts of defects on the microscopic mechanisms responsible for the phase transitions involving incommensurate phases observed in compounds of the family $M_2X\ Hal._4$ will be given.

III.2.8 Phase transitions in solid solutions $(CrO_4)_{1-x}(SO_4)_xK_2$

H.Lanza de Dussel, M.A.R.de Benyacar and L.Schmirgeld

As part of a project, in collaboration with Dr. Roberto Merlín (Department of Physics, University of Michigan, Ann Arbor, U.S.A.) on the study of phase transitions in compounds belonging to the $(XO_4)A_2$ family, an investigation on the phase transitions occurring in the $(CrO_4)_{1-x}(SO_4)_xK_2$ solid-solution system was started. Single crystals were grown from aqueous solutions; the chemical composition of the crystals is different from that of the mother solutions, particularly so in the high sulfate concentration range. For example x=0.8 for a 50% molar concentration in the mother solution. Chemical composition was determined using conventional analytical methods and EDAX; the crystals were homogeneous and there was good accord between results from both techniques. Differential scanning calorimetry showed a first order phase transition in all the samples studied; Fig.1 shows transition temperatures as a function of composition. Preliminary electron diffraction studies for pure K_2CrO_4 from ambient temperature to 980°K were carried out in order to help elucidate its space group as it has not been univocally established from the avialable X-ray diffraction data.

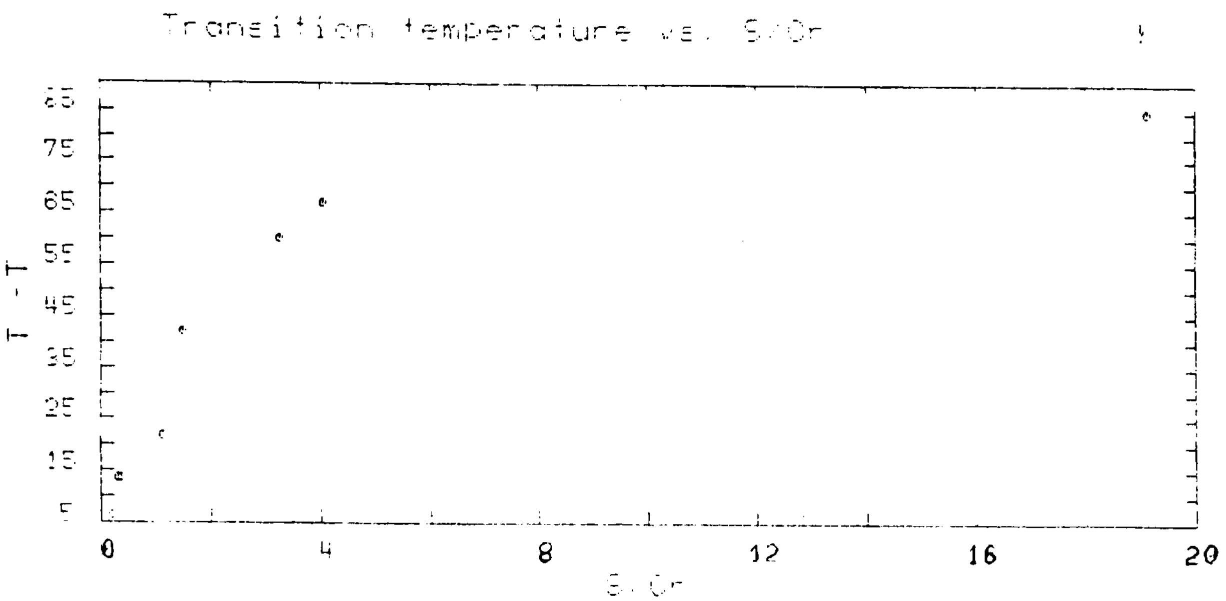


Figure 1

III.2.9 Phase transitions in guanidium sulfate

M.R.de Benyacar and R.Baggio

Phase transitions in guanidium sulfate were studied because of their relationship with some ferroelectric materials (aluminum guanidium sulfate, uranyl guanidinium sulfate). The different phases studied, obtained from aqueous solutions at temperatures between T=25°C and T=40°C are following:

Fase I. Cubic

Fase II. Orthorhombic

Fase III. Pseudotetragonal

Fase IV. Optically biaxial

On cooling, phases II, III and IV go to the cubic phase. We have not observed the formation of intermediate phases. On heating, the cubic phase does not change up to 70°C. All the observed transitions are first order. Not all the predictable phase transitions have been observed. Those mentioned here are sluggish, so much so that we have been able, by adequate succesive temperature changes, to obtain samples in which all four phases coexisted at ambient temperature.

III.2.10 Topotactic transformation of $UO_2C_2O_4.3H_2O$
R.Baggio, P.K. de Perazzo and G.Polla

Monocrystals of $UO_2C_2O_4.3H_2O$ were observed to transform topotactically on a hot stage of an optical microscope. As part of the investigation of this transformation, the crystal structure analysis of the trihydrate phase was undertaken and a first model proposed. Now some X-ray diffraction work on precession camara with a furnace is being undertaken on the dehydrated phase.

III.2.11 The dehydration of $CuSr_2(HCOO)_6.8H_2O$: A crystallographic study*
R.Baggio, M.R. de Benyacar, P.K. de Perazzo and G.Polla

The isothermal dehydration of $CuSr_2(HCOO)_6.8H_2O$ single crystals as well as powdered material has been followed by several techniques, mainly X-ray diffraction and optical microscopy. Evidence was found of a two-stage process, with an early appearance of an amorphous state (attributed to internal dissolution) and further recrystallization of the stable phases. One of these (WS $(HCOO)_4$, monoclinic, Pc, Z=2, a=7.345(10)Å, b=8,692(15)Å, c=6.702(10)Å, =97.25(5)Å] has not been reported so far in the literature. When dehydration takes place near room temperature, the remaining product ($Sr(HCOO)_2$) bears a topotactic relationship to the parent matrix [(hkO) (hkO)' y OkO OkO'). A striking metric match between both (hkO) sections as well as the absence of any common structural motive, suggest an inner epitactic growth as the most probable mechanism for the transformation.

---

*Jour. of Solid State Chemistry 56(1985)298.

III.2.12 Erratum to "kinetics of dehydration of single crystals of copper formate tetrahydrate" by Fichte and Flanagan
R.Baggio

An error has been detected in the titled paper (Fichte & Flanagan (1971), Trans.Faraday Soc. 67 1467-1479), concerning the use of X-ray powder data to infer structural information. The nature of the error is discussed and the corrected information given.

III.3 MOSSBAUER SPECTROSCOPY

III.3.1 Mössbauer studies of the corrosion reactions in arc-furnace Part I*

C.Saragovi-Badler and C.Puglisi[a]

The purpose of this paper is to show the kind of information that can be obtained from the use of Mössbauer spectroscopy in the study of corrosion reactions taking place between refractories and metallurgical environments.

Mössbauer spectroscopy provides information concerning the local surroundings of iron ions in any solid material, and this can be useful in the study of the above mentioned reactions, considering the important role of iron in them. The present paper describes the wear mechanism of the high-alumina roof and the basic magnesia bricks at the slag line of an arc-furnace. The analysis of the high alumina bricks indicate that the chemical reactions taking place in service produced mainly calcium ferrite, some cordierite and anortite. The iron oxide migrating into the brick was partially incorporated by the corundum grains as solid solution and partially remained as impurified magnetite and hematite. In the case of the slag-line magnesia bricks, the main identified products are magnesio-ferrite and magnesio-wuestite. The rest of the iron content is distributed in the silicate phase which was probably liquid at the service temperature, giving rise on cooling to glassy and crystalline silicates. From the peaks area of the Mössbauer spectra an estimation of the iron distribution among the different components can be calculated.

---

*Ceramics International 10(1984)105.

[a]Dpto. de Mecánica, INTI, Buenos Aires, Argentina

III.3.2 Mössbauer studies of the corrosion reactions in arc-furnace Part II*

C.Puglisi[a], F.Labenski y C.Saragovi-Badler

Mössbauer spectroscopy has been used, together with conventional techniques, in the study of corrosion reactions taking place in service in co-clinkered chrome-magnesite bricks from the hot spots of an electric-arc furnace. Co-clinkered bricks present a better distribution Mössbauer data show that iron uptake took place in service, being incorporated only into the spinel structure. This structure accepts considerable substitutional ions, admitting in this case impurities from the slag. Experimental results confirm the relative stability of that phase in the presence of migrating components of the slag.

---

*Ceramics International 10(1984)111.

[a]Dpto. de Mecãnica, INTI, Buenos Aires, Argentina

III.3.3 Mössbauer studies in geochemistry of As and other oligoelements in ground water of the southeastern plains of the Province of Córdoba, Argentina

F.Labenski, H.Nicolli[a] and C.Saragovi-Badler

The serious contamination of the ground waters of the southeastern plain of the Province of Córdoba, Argentina, a phenomenon mentioned in the literature for over 70 years, has given rise to this initial hydrogeochemical study covering an area of 10000 Km^2 including the Formación Pampa which is an outcrop of lessic and sandy slit sediments where the contaminated aquiferous are found. Seventy two per cent of the samples analyzed showed As contents higher than the standard set ($\sim$125 μg/l) in Argentina by Obras Sanitarias de la Nación as the maximum tolerated level, whereas the highest values determined in these waters was 3800 μg/l. This work is being performed with selected samples representative of the loess of this area. Volcanic glass shards (fresh glass + altereted glass) were succesfully separated and analyzed using the neutron activation technique, which determined As, P, V, U Se, Mo and Sb contents. It is known that As and P are toxic, and the same is asumed for U, Mo prevents vitamin B normal absorption, and Sb would not show problems. Volcanic glass, volcanic ashes (volcán Quizapú, Chile 1932) and altered glass samples are being studied by Mössbauer spectroscopy, a technique used for the first time in the study of volcanic glasses. The Mössbauer spectrum of fresh glass is composed of 3 components each consisting of a doublet produced by the electric quadrupole interaction. Mössbauer parameters show the presence of Fe^{2+} and Fe^{3+}, the last one in 2 different environments. From the Mössbauer spectrum the proportions of these ions were deduced: Fe^{2+} with 51% and Fe^{3+} with 10% and 30%. The Mössbauer parameters of volcanic ashes sample indicates the presence of Fe^{2+} and Fe^{3+} ions. The Fe^{2+} relative proportion is 86%. For the altered glass sample, the Mössbauer spectrum is resolved into 4 components: one due to a magnetic interaction of which the hyperfine mean field of $\sim$ 580 Koe. could indicate the presence of hematite or goethite small particles (< 100 Å) substituted in high degree by a magnetic ion. The other 3 components (3 doublets) Mössbauer parameters are in agreement with those corresponding to a Wyoming type montmorillonite. The line widths values are somewhat higher than those given in the literature, pointing out a certain disorder or amorphization around the Fe ions. In the literature, dehydroxilated, reduced, and oxidized Mössbauer parameters for montmorillonite of natural samples can be found. Comparing this information with experimental data of a good sampling, would be indicative of processes which could have taken place in the Formación Pampa.

---

[*] Part of this work was published in MISCELANIA 71 (1985), Academia Nacional de Ciencias, Córdoba, Argentina.

[a] Depto. Geología Económica, Comision Nacional de Investigaciones Espaciales, San Miguel, Pcia. de Buenos Aires, Argentina.

III.3.4 Mössbauer spectroscopy: applications to medical research[*]

F.Labenski

The Mössbauer spectroscopy is a nuclear technique which may be applied to the study of biological materials. The basic phenomenon, the Mössbauer effect, is described in a qualitative way. The Mössbauer effect has been observed in 43 elements. Iron (Fe) is one of them. ^{57}Fe has become the most widely used Mössbauer isotope in different fields as physics, chemistry and metallurgy, nowadays including biology, due to the general significante of iron in biological functions. Therefore this review paper is concentrated in ^{57}Fe Mössbauer spectroscopy. Two examples of the application of this nuclear technique to medical research are given. Mössbauer spectra of iron from healthy and hemosiderosis lung are compared. The second example refers to the iron Mössbauer spectra from normal and thalassemic red blood cells.

---

*Submitted for publication in "Sangre", Spain.

III.3.5 Aplication of the Mössbauer spectroscopy to the study of some hemoglobinopathies cases*

F.Labenski, S.A.de Miani[a] and J.A.Peñalver[a]

The prupose of this work is to investigate iron (Fe) intra-erythrocytic metabolism alterations in deseases produced by hemoglobin (Hb) alterations.

The present work was carried out with 16 samples of peripherical red blood cells (RBC) corresponding 6 samples to normal RBC and 10 to RBC from patients with hemoglobinopathies: thalassemia sickle-cell anemia and S-β thalassemia.

Thalassemia is a congenital desease characterized by reduced production of one of the globin chains α or β , in HbA ($\alpha_2 \beta_2$). Reduced synthesis of β chain corresponds to β-thalassemia. When the ratio between the amounts of β to α chains is <0,5 the desease is termed β-thalassemia major, which presents two forms designated β^+ and β^0 depending on whether β chains production is reduced or entirely absent. The excess α globin chains precipitate demaging its cell membrane. Consequently hemolitic anemia is produced.

Sickle cell anemia is also a congenital desease which is produced by an alteration in the β chains. The glutamic acid residues are replaced by valine.

The S-β thalassemia is a combination of sickle-cell anemia and β thalassemia. Normal RBC samples gave rise to spectra consisting of 2 doublets, one corresponding to oxy-Hb and the other to deoxy-Hb. The parameters obtained are in agreement with those described in the literature[1)].

Mössbauer spectra of 6 samples from patients with hemoglobinopathies show, in addition to the 2 doublets present in normal RBS, a third component with Mössbauer parameters which are similar to those of the Fe storage protein, ferritin. In 4 samples of patients with β-thalassemia major very small intensities of the third component (0-1%) were observed. This fact could mean taht these patients belong to the β^0 subgroup. Therefore the RBC used in these measurements could correspond to transfused blood from normal subjects, since these patients (β^0) cannot syntesize their own HbA ($\alpha_2 \beta_2$).

The mechanism through which this substance deposits in RBC of patients with deseases mentioned above, is not yet explained. At present time Mössbauer results are being analyzed and quantified in order to correlate them with these patients hematologic parameters (serum ferritin, transferrin saturation, hematimetric indices, reticnulocyte count).

---

*Part of this investigation were presented at the IX Simposio Latinoamericano of Solid State Physics, Mar del Plata, Argentina, august 1985 and 70th Argentine Physical Society Meeting, Rosario, Argentina, october 1985.

[a]Servicio de Hematología del Hospital de Niños "Ricardo Gutiérrez".

1)E.R.Bauminger, S.G.Cohen, S.Ofer, E.A.Rachimilewitz, Proc. Natl. Acad. Sci., U.S.A 76(1979)939.

III.4 THEORETICAL SOLID STATE PHYSICS

III.4.1 Thermal relaxation of the amorphous alloy $Zr_{70}Cu_{30}$ simulated by molecular dynamics

A.Levy Yeyati and M.Weissmann

Amorphous alloys obtained by rapid cooling are not stable structures, as many of their properties change when the sample is subject to thermal annealing. In particular, the system Zr-Cu, has been largely studied experimentally.

To describe the structural changes due to thermal relaxation we have used a simplified model of the $Zr_{70}Cu_{30}$ alloy. It consists basically in a random distribution of the atoms, considered as hard spheres of two sizes. The rapid cooling and the relaxation are simulated both by molecular dynamics, using a Lennard-Jones type of interaction. Our interest is to determine the local atomic configurations that are favored with the relaxation so as to apply these results in the calculation of the electronic structure of the system.

III.4.2 Localization properties of incommensurate-disordered 1D systems*

M.Weissmann and A.M.Llois

We investigate the localization properties of incommensurate-disordered 1D models already introduced in a previous work[1)]. We show that these properties depend, in our cases, more on the type of disorder introduced than on the incommensurate model or wave vector used.

---

*Phys.Rev.B, en prensa.

1) A.M.Llois, M.Weissmann and N.Cohan, Phys.Rev.B 27(1983)7379

III.4.3 Transport properties of one dimensional, disordered two band systems

M.García, A.M.LLois, G.A.Balseiro[a] y M.Weissmann

We have studied the transport properties of disordered one dimensional two band systems. The model includes a narrow d band hybridized with an s band. The Landauer formula was used in the case of a very narrow d band or in the case of short chains. The results were compared with the localization length of the wave functions calculated by the transfer matrix method, which allows the use of very long chains, and an excellent agreement was obtained.

---

1)M.García, Tesis de Licenciatura, Instituto Balseiro, 1984.

III.4.4 Electronic densities of states of bimetallic superlattices with interfacial diffusion*

A.Levy Yeyati, N.V.Cohan and M.Weissmann

The density of states at each layer of a bimetallic superlattice is calculated by expansion of the Green's function in a continued fraction. We use a three dimensional tight binding model system, with three atomic layers of each type of atoms, and study the effect of a small amount of interfacial diffusion.

We find that a small proportion of randomly located atoms of the wrong kind in an interfacial layer changes the local density of states considerably, and that this effect is also appreciable in the total density of states for the superlattice, obtained by averaging adequately the local densities of states.

---

*Phys.Rev.B 31(1985)873.

III.4.5 Charge distribution and local disorder in hard sphere fluids

M.Weissmann and N.Cohan

In this paper we study electronic and geometrical properties of computer generated hard sphere fluids. We find a well defined relation between the charge on an atom Q, calculated by the extended Huckel method, and the distance to its nearest neighbour d. Although the radial distribution function of a totally random configuration is qualitatively different from that of the same system relaxed by molecular dynamics, we find only minor differences in the charge distribution n(Q) and in the function d(Q) between both types of configurations.

III.4.6 A group theoretical method for the construction of the nonequivalent configurations of finite clusters with cellular disorder*

H.Bonadeo

The nonequivalent configurations of finite clusters with cellular disorder may be constructed by combining subconfigurations of atoms located at lattice sites that are equivalent by symmetry. The combination laws depend only on the symmetry of the cluster and are obtained from point group theoretical arguments. The method may be applied to clusters of arbitrary symmetry and composition, and is illustrated with a simple example.

---

*Can.Jour.Phys. 62(1984)904.

III.4.7 Termodynamic derivatives of the canonical distribution functions*

J.A.Hernando

The temperature and density derivatives of the canonical distribution functions and the temperature and fugacity derivatives of the grand canonical distribution functions are evaluated. The expressions obtained are general and have a hierarchical structure similar to that of the BBGKY hierarchy.

---

*J.Chem.Phys. 82(1985)4385.

III.4.8 Direct correlation function in the 2D one-component plasma at $\Gamma=2$*

J.A.Hernando

The two-body direct correlation function for the two-dimensional one-component plasma with coupling constant $\Gamma=2$ is evaluated. It is analytically shown that its long-range behavior is identical with that of the interaction potential and the remainder is explicitly evaluated in closed form. The dependence of the distribution functions and correlation functions with the size of the system is considered and it is concluded that they are size-independent in the thermodynamic limit. The bridge function, which is of interest in the MHNC approximation, is evaluated and discussed in terms of a recent universality ansatz. The relevance of these results for the mean spherical approximation is also pointed out.

---

*J.Chem.Phys., en prensa.

III.4.9 Exact and approximate expressions for the three particle direct correlation function and some related functions*

J.A.Hernando

An exact expression for the three-particle direct correlation function, c_3, of a general fluid is derived. Exact expressions for the three-particle total correlation function h_3, $\delta c_2/\delta\rho_1/h_2$, $\delta c_2/\delta h_2|\rho_1$, and $\delta h_2/\delta\rho_1$ are also found. The first terms of the black ρ_1-circle, h_2-bonds expansion of c_3 and $\delta h_2/\delta\rho h_1$ are explicitly evaluated and, in particular, it is found that the leading term of the c_3 expansion is $c_3 = \prod_{i<j=1}^{3} h_2(i,j)$. The behavior of this term is discussed for several configurations of a Lennard-Jones fluid in the neighborhood of the triple point. A comparatively more complex structure than that of c_2 is

found. The correction terms are analyzed and it is found that they are small but not negligible: they tend to enhance the excluded volume effect due to the strong repulsion of the potential. A scheme to obtain the higher order direct correlation functions is also outlined. The relevance of these results to the MHNC approximation and to the theory of inhomogeneous fluids is briefly discussed.

---

*J.Chem.Phys., in press.

III.4.10 Thermodynamic potentials and distribution functions. I. A general expression for the entropy*

J.Hernando

A mixture of components in an external field and interacting with potentials of 2,3,...,n bodies is considered. An exact equation for the entropy is derived. This equation gives the entropy as a sum of correlational contributions whose structure is increasingly complex. The first five terms are explicitly displayed.

---

*submitted to Phys.Rev.A .

III.4.11 Some remarks about the calculation of the potential field in crystals*

V.Massida

We discuss some points related to the calculation of the lattice sums giving the electrostatic potential field in crystals, such as the conditions under which the results hold, the approximation errors, the connection between the microscopic and the macroscopic potential, and the calculation of the latter for differently shaped specimens. An explicit expression is given for the potential field of a uniformly charged rectangular parallelepiped.

---

*Physica 128A(1984)318.

III.4.12 Order-disorder transitions and phase diagram in two-dimensional lattice with reorientable dipoles and quadrupoles

V.Massida and J.Hernando

We consider a two-dimensional crystal made up by one or more sublattices with charge distributions that we approximate by reorientable point dipoles and quadrupoles. The orientation of the molecules of sublattice ℓ is described by the distribution function $n_\ell(\phi_\ell)$. We write the free energy in the mean-field approximation as a functional of the n_ℓ and it is minimized with respect to the latter. A system of equations is obtained, for which we propose the solution

$$n_\ell(\phi_\ell) = A_\ell \exp[u_\ell \cos(\phi_\ell - \alpha_\ell) + 2v_\ell \cos^2(\phi_\ell - \beta_\ell)]$$

where the parameters u_ℓ, v_ℓ describe the degree of disordering and α_ℓ , β_ℓ the overage orientation. These parameters must satisfy a system of transcendental equations, which is solved numerically for fixed quadrupole moment and different values of dipole moment (the relevant variable being p/Q) and of temperature. We have found, for square and triangular lattices, a phase diagram in the p/Q-T plane exhibiting lines of first- and second-order transitions.

III.4.13 The random chessboard model: A mean field theory

S.D'Elía

We consider here a mean-field theory of a new model spin hamiltonian in d=2 dimensions that describes a system with two Ising-like variables per site that interact via a next-nearest neighbor (k_2) and a four-spin (Γ) coupling constants. The theory is formulated in terms of local averages of the order parameters. In terms of $x = \Gamma/k_2$ we find second-order phase transitions for $x \leq x_c = 1/18$ and first-order phase transitions for $x > x_c$. The critical curve corresponding to the uniform solution of the mean field equations is calculated.

We also study a particular non-uniform, periodic solution of the mean field equations that describes an order characterized by the presence of domains and walls, and resembles a chessboard. We find that this chessboard solution is more stable than the uniform one for $x \gtrsim x_c$ and temperatures below the critical temperature. The existence of these instabilities of the uniform order near criticality could suggest that this model belongs to a new class of universality, a previously proposed idea.

III.4.14 Calculation of three-body dispersive energies: Extrapolation method and application to crystals of isotropic and anisotropic bodies*

E.Burgos and H.Bonadeo

A fast and accurate extrapolation method for the calculation of three-body dispersive forces in crystals is presented. The method is checked against high-precission results for the fcc, bcc, sc, and hcp lattices, and results for the diamond lattice are presented. The effects of anisotropy and molecular orientation are studied using the Pa3 and Cmca structures as examples, and it is found that the three-body energy is not very sensitive to these parameters. Calculations for the crystals of chlorine, nitrogen, and α- and β-acetylene are performed, and it is found that in some cases the three-body dispersive energy amounts to nearly 15% of the packing energy.

---

*Phys.Rev.B, in press.

III.5 CRYSTRAL GROWTH

III.5.1 Gel growth and charaterization of bismuth oxalate single crystals*

G.Polla, R.Baggio, E.Manghi and P.K.de Perazzo

The simultaneous growth of $Bi_2(C_2O_4)_3.7H_2O$ and $Bi_2(C_2O_4)_3.H_2C_2O_4$ single crystals, by two different techniques (slow evaporation from solution and gel growth) is reported. The work includes a comprehensive characterization for both compounds, performed on the much better gel grown specimens, as well as single crystal and powder X-ray data and thorough study of the thermal behavior. Dominant hillocks giving rise to vicinal faces in $Bi_2(C_2O_4)_3.H_2C_2O_4$ are described, and a tentative explanation for their existence is given.

---

*J.Cryst.Growth, 67 N°1(1984)68.

III.5.2 Uranyl phosphate tetrahydrate (HUP) single crystals: Optical microscopy study on gel grown samples*

E.Manghi and G.Polla

HUP single crystals were grown in tetramethoxysilane gels. The crystals were identified by X-ray diffraction and characterized by SEM and optical microscopy, under different environment and temperature conditions. Changes in birefringence were the only effects observed in the gel grown samples.

A first gradual change was related to the crystal atmospheric environment and the second one, at -70°C, was ascribed to a temperature induced effect.

---

*accepted for publication in J.Cryst.Growth.

IV. Statistical Mechanics and Relation to Nuclear Dynamics

IV. STATISTICAL MECHANICS AND RELATION TO NUCLEAR DYNAMICS

IV.1 Relevant spaces in quantum dynamics and statistical physics*

D.Otero, A.Plastino, A.N.Proto and S.Mizrahi[a]

A systematic method for the decoupling a relevant subspace of the Hilbert space from the rest of it is developed, on the basis of the dynamical properties of the observables one is interested in.

---

*Phys.Rev.A, in press.

[a] IFT, Sao Paulo, Brazil.

IV.2 Quantal friction, nonlinear hamiltonians, and Information Theory*

D.Otero, A.Plastino, A.N.Proto and G.Zannoli

Information theory ideas together with entropy dynamical properties are combined in order to formulate a new algorithm for the treatment of non-linear Hamiltonians, whether time dependent or not. The approach is illustrated with reference to Kostin's Hamiltonian and the General Friction one.

---

*Z.Phys. 316A(1984)323.

IV.3 Information theory and Riemann spaces: An Invariant reformulation:

E.Duering, D.Otero, A.Plastino and A.N.Proto

A geometric representation for Information Theory is introduced by recourse to an covariant formulation, according to the customary procedure employed in connection with Riemann spaces. The central tool of this representation is the metric tensor, that characterizes the particular dynamics of a given system and yields the corresponding quantal invariants.

IV.4 Information theory and linear response approach*

E.Duering, D.Otero, A.Plastino and A.N.Proto

A generalization of the linear response theory is attempted, within the framework of information theory, with the idea of developing a formalism able to deal with small deviations from a previously well-described situation. The ensuing approach is applied to diverse physical situations that illustrate its flexibility.

---

*Phys.Rev.A, in press.

Appendix

Staff

Publications

PERSONNEL

Research Staff

Abriola D.
Achterberg E.
Baggio R.
Benyacar M.
Berisso M.C.
Bes D.R. *
Bonadeo H. * Head Solid State Physics Division
Burgos E.
Ceva H.
D'Elía S.
Denari M.
Dragún O. Head Theoretical Nuclear Physics Div.
Debray M.
Di Gregorio D.
Dussel G.G. *
Dussel H. Lanza de
Dukelsky J.
Etchegoyen A.
Fernández Niello J.
Ferrero A.
Filevich A.
Frigerio A.
Gamba Z.
García Bemúdez G. *
Gattone A. on leave at Indiana Univ., U.S.A
Gil S.
Halac B.
Hernando J.
Huck H.
Jech A. * Head Experimental Nuclear Physics Div.
Kreiner A.
Labensky F.
Macchiavelli A.
Manghi E.
Maqueda E.E. * Chairman Department of Physics
Martí G.
Massidda V.
Napoli D.
Otero D.
Pacheco A.
Perazzo P. Koning de
Perazzo R.P.J.
Pérez M.L.
Pérez Ferreira E.
Pomar C.
Proto A.
Polla G.

Reich S.L.	
Rossi J.J.	
Saraceno M.	
Saragovi-Badler C.	
Schmirgeld L.	
Sofía H.M.	
Spina M.E.	
Testoni J.	*
Ventura E.	

* Under contract of Carrera del Investigador Científico, CONICET, Argentina.

Research Staff Associated to the Physics Department

Cambiaggio M.C.	*
Civitarese O.	Univ.Nacional de La Plata, Buenos Aires
Davidson J.	U.B.A, Buenos Aires
Davidson M.	U.B.A, Buenos Aires
Levy L.	*
Waissmann M.	*

* Under contract of Carrera del Investigador Científico, CONICET, Argentina.

Engineering Staff

Camín D.V.	Head of Electronic Group
Camín D.	
Fazzini N.	
Giménez C.	
González H.	
Milberg J.	
Mónico J.	
Nicolai J.	
Requejo R.	Head of Engineering Division
Ribarich R.	
Satinosky M.	
Simoncelli D.	
Navarro D.	
Tau S.	
Tersigni A.	

Visiting Scientists

Bayman B.	Univ.of Minnesota, U.S.A.
Brandan M.E.	Univ. Chile, Chile
Brieva F.	Univ. Chile, Chile
do Barros S.	UFRJ , Brazil
Duval P.	Tucson, Arizona, U.S.A.
Giambiaggi J.J.	CBPF, Rio de Janeiro, Brazil
Gomes L.C.	CBPF, Rio de Janeiro, Brazil
Huberman B.	Xerox, California, U.S.A.
Liotta R.	Forskinstitutet, Sweden
Menchaca Rocha A.	Univ. Chile, Chile
Thieberger P.	Brookhaven National Lab., U.S.A.
Vary J.	Iowa Univ., U.S.A.
Zucker A.	Strasbourg, France
Vitturi A.	Padova, Italy
Lima C.L.	Rio de Janeiro, Brazil
Lajzerowicz J.	Grenoble, France
Baranger M.	Massachussets, U.S.A.
Köhler S.	Univ. of Arizona, U.S.A.
Bozzolo G.	Iowa State University, U.S.A.
Pittel S.	Bartol Research Foundation, Univ.of Delaware,U.S.A
Dibar M.C.	Univ. Federal Fluminense, Niteroi, Brazil
Thieberger P.	Brookhaven National Lab., N.Y., U.S.A.
Toledo Piza A.	Sao Paulo, Brazil
Salam Abdus	Intern. Centre for Theoretical Physics, Italy
Massmann H.	Univ. de Chile, Chile
Stockstad R.G.	Lawrence Berkeley Lab., Univ.of California,U.S.A
Pollarolo G.	Univ. de Torino, Italy
Vitturi A.	Inst.Naz.di Fis.Nucl., Univ.de Padova, Italy
Fergusson S.	Western Michigan University, U.S.A.
McGuidri	Univ. of Tennessee, U.S.A.
van Tendenloo G.	Rijksuniversitair Centrum Antwerpen, Belgium
Vagradov G.	Institut for Nuclear Research, Moscow, U.R.S.S.
Pascholati P.	Sao Paulo, Brazil
Löwdin Per Olov	Upsala University, Sweden
Larson J.D.	U.S.A.
Mck Hyder H.R.	Oxford University, U.Kingdom
Weisser D.	Australian National Univ., Canberra, Australia
Califano S.	Univ. de Florencia, Italy
Silberman E.	Fisk University, U.S.A.
Domany E.	Weizmann Institute, Brazil
Merlin R.	Univ. of Michigan, U.S.A.
Sanjurjo J.	Campinas, Brazil
Blum L.	Puerto Rico
Calunyuk R.	Grenoble, France
Gordon M.	Grenoble, France
Smith J.L.	Los Alamos, U.S.A.
Zittartz J.	Colonia, West Germany
Anda E.	Univ. Federal Fluminense, Niteroi, Brazil
Benemann K.	Berlín, West Germany
Parmenttier R.	Grenoble, France

Graduate students

Ballestero M.	#
Bernath M.	**
Cardona M.A.	#
García Andrada G.	# until 1985
Carcía A.	#
García M.	#
Grinberg N.	**
Kurchan J.	#
Mehr M.T.	
Santos D.	#
Scoccola N.	**
Zemba G.	#
Curutchet P.	+
Fendrik A.	+
Leboeuf P.	#
Lenzi S.	**
Llois A.M.	**
Levy Yeyati A.	**
Hojman D.	

Fellowship from CNEA, Argentina.
** Fellowship from the CONICET, Argentina.
+ Fellowship from the Comisión de Investigaciones Científicas de la Prov. de Buenos Aires, Argentina.

Undergraduate Students

Aliaga J.
Baliña C.
Bejer S.
Bercovich C.
Bertua J.
Blum B.
Carpintero E.
Di Tada M.
Elgne M.
Figliola M.A.
Folcia C.
Gonçalves S.
González A.D.
Grasso C.
Gravielle M.S.
Hernández L.
Iaría P.
Jauregui M
Kittl J.A.
Negri M.
Nievas G.
Ottaviani A.
Pinzón B.
Quinteros T.
Sainato C.
Schwarzkopf E.
Simone L.

Technical Staff

Alhadeff A.M.
Alvarez R.
Antonuccio F.
Bergaglio J.
Binda A.
Bolaños C.
Cabello B.
Coralo J.
Cordeyro S.
D'Agostino R.
Díaz Romero A.
Di Paolo H.
Fernández Quintana M.C.
Garanzini J.
Grahmann H.
González Tamburri M.
Gutierrez N.
Ietri B.
Ietri G.
Igarzábal M.
Laffranchi J.
Lolago E.
Menéndez E.
Miguez C.
Morales A.
Nigro S.
Orecchia J.
Palacio C.
Petragalli I.
Professi J.
Professi M.
Professi O.
Ramírez M.
Rendina J.
Riso J.M.
Ruffino J.C.
Rugilo A.
Sacca A.
Scasserra M.A.
Schevenels L.
Schiavino R.
Schmukler T.W.
Swiszcz S.
Tau R.
Vidallé J.

Administration

Blanco L.
Boretto J.
Cáceres A.
Escrivá G.
Galván de González L.
Ghiotti B.
Lires S.

Others

Diéguez R.
Garay Ramos E.
Gõmez L.
Gõmez D.
Gutierrez E.
Lopez Vega F.
Manavella A.M.
Molina J.C.
Piccini G.
Prieto J.
Ríos J.
Rodríguez L.
Ruiz O.
Torena A.
Soler H.

PUBLICATIONS

Papers publicated or accepted for publication at this period:

Häuser O., Andrews H.R., Horn D., Lone M.A., Taras P., Skensved P., Diamond R.M., Deleplanque M.A., Dines E.L., Macchiavelli A.O., Stephens F.S.;
"Transient Magnetic Field for Large Z Atoms Recoiling Through Gadolinium".
Nucl.Phys.: A412(1984): 141

Mariscotti M.A.J., Kreiner A.J., Behar M., Macchiavelli A.O., García Bermúdez G., Ferrero A.M.J., Baktash C., Thieberger P.;
"The High-Spin Structure of ^{100}Rh"
Nucl.Phys.: A422(1984): 167

Kreiner A.J., Alonso Arias C., Debray M., DiGregorio D., Pacheco A., Davidson J., Davidson M.;
"Excited States of ^{188}Ir Populated by the (alfa,3n) Reaction".
Nucl.Phys.: A425(1984): 397

Roy N., Decmar D.J., Kluge H., Maier K.H., Maj A., Mittag C., Fernández Niello J., Puchta H., Riess F.;
"Spectroscopy of High-Spin States in ^{217}Ra".
Nucl.Phys.: A426(1984): 379

Cambiaggio M.C., Dussel G.G., Saraceno M.;
"Time-Dependent Hartree-Fock-Bogoliubov Description of the Pairing Interaction".
Nucl.Phys.: A415(1984): 70

Dukelsky J., Dussel G.G., Perazzo R.P.J., Reich S.L., Sofia H.M.;
"A Self Consistent Description of Systems with many Interacting Bosons".
Nucl. Phys.: A425 (1984): 93

Blomqvist J., Rydström L., Pomar C., Liotta R.J.;
"Multiplet Structure in ^{205}Pb and ^{203}Pb".
Nucl.Phys.: A423 (1984)253.

Gattone A.O., Ferrero A.M.J., Dragún O.;
"The Contribution of one and two Step Processes to Inclusive (p,d) Reaction".
Nucl. Phys.: A424(1984): 1

Spina M.E., Weidenmuller H.A.;
"Damping of Collective Modes in DIC: Quantal vs. Statistical Fluctuations".
Nucl. Phys.: A425(1984): 354

Scoccola N.N., Bes D.R.;
"The Applicability of the Nuclear Field Theory to Shell Model Calculations".
Nucl. Phys.: A425(1984): 256

Norman E.B., Kellog S.E., Bertram T., Gil S., Wong P.;
"On the Half-Life of ^{180}Ta in Stelar Enviroments".
The Astrophysical Journal: 281(1984): 360

Kreiner A.J.;
"Quantal Description of the Discontinuity in Mallmann's Plot".
Phys.Rev.: C30(1984): 371.

Kreiner A.J., DiGregorio D.E., Fendrik A.J., Davidson J., Davidson M.;
"Double Decoupling in Doubly Odd Deformed Nuclei: Structure Of ^{186}Ir".
Phys. Rev. C (Rapid Comm.): C29(1984): 1572.

Davidson M., Davidson J., Kreiner A.J., Pomar C.;
"Excited States in ^{86}Y".
Phys.Rev.: C29(1984): 1717.

García Bermúdez G., Baktash C., Lister C.L.;
"Collective Bands in ^{75}Kr."
Phys.Rev.: C30(1984): 1208.

Dussel G.G., Liotta R.J.;
"Many Body Green-function of Composed Systems".
Phys. Rev.: C30(1984): 729

Llois A.M., Cohan N.V., Weissmann M.;
"Localization in Different Model for One Dimensional Incommensurate Systems".
Phys. Rev. B 29(1984): 3111

Etchegoyen M.C., Sinclair D., Etchegoyen A., Belmont-Moreno E.;
"Three Particle Transfer on ^{14}N".
J.Phys.: G10(1984): 823.

Federman P., Pittel S., Etchegoyen A.;
"Quenching of the $2p_{1/2}$ - $2p_{3/2}$ Proton Spin-Orbit Splitting in the Sr-Zr Region".
Phys. Lett.: 140B(1984): 269.

Pittel S., Dukelsky J., Perazzo R.P.J., Sofía H.M.;
"s-d-g Boson Model Description of the Isovector $K=1^{+}$ Mode in Deformed Nuclei"
Phys. Lett.: 144B (1984): 145

Murphy M.J., Gil S., Harakeh M.N., Ray A., Seamster A.G., Vandenbosch R., Awes T.C.;
"Time Scale for Proujectile Breakup into Coincident Heavy Fragments"
Phys. Rev. Lett.: 53(1984): 1543.

Häuser O., Ward D., Andrews H.R., Taras P., Hass B., Deleplanque M.A., Diamond R.M., Dines E.L., Macchiavelli A.O., McDonald R., Stephens F.S., Stager C.V.;
"Spin Precession of Unresolved High-spin States in $^{153-156}$Dy"
Phys. Lett.: 144(1984): 341.

Cambiaggio M.C., Dussel G.G., Saraceno M.;
"On the Calculation of Matrix Elements from the Time Dependent Variational Principle".
Phys. Lett.: 135B(1984): 10.

Bes D.R., Broglia R.A.;
"Rotational Isovector $K=1^{+}$ Mode in Deformed Nuclei"
Phys.Lett.: 137B(1984): 141.

Pérez Ferreira E., Achterberg E., Camín D., Ceballos A.E., Fazzini N, Filevich A., González H., Jech A., Mariscotti M.A.J., Milberg J., Nicolai J., Requejo R., Ribarich R., Rossi J.J., Tau S., Tersigni A., Testoni J., Ventura E.;
"The Buenos Aires Tandem Accelerator Facility".
Nucl. Instr.& Meth.: 220(1984): 37.

Fazzini N., González H., Nicolai J., Requejo R., Ventura E., Feimberg G., Gidekel G., Goldschmidt P.;
"The SF6 Gas Handling System for the Buenos Aires 20 MV Accelerator".
Nucl. Instr.& Meth.: 220(1984): 144.

Quick R.M., Cambiaggio M.C., Miller H.G.;
"Methods for Describing the Coexistence of Competing Degrees of Freedom in a Many Body System".
South African Journal of Physics: 7 (1984): 47

Saragovi-Badler C., Puglisi C.;
"Mössbauer Studies of the Corrosion Reactions in Arc-Furnace Refractories. Part I".
Ceramics International: 10,(1984): 105.

Puglisi C., Labenski F., Saragovi-Badler C.;
"Mössbauer Studies of the Corrosion Reactions in Arc-Furnace Refractories. Part II".
Ceramics International: 10,(1984): 105.

Gamba Z., Halac E., Bonadeo H.;
"Lattice Dynamics and Crystal Stability of Bromine"
J.Chem.Phys.: 80,(1984): 2756.

Gamba Z., Bonadeo H.;
"Vibrational Intensities of Lattice Modes and the Distributed Dipole Model: Crystalline Acetylene".
J.Chem.Phys.: 81,(1984): 4724.

Bonadeo H.;
"A Group Theoretical Method for the Construction of the Nonequivalent Configurations of Finite Clusters with Celular Dissorder".
Can. Journ. Phys.: 62,(1984): 904

Polla G., Baggio R., Manghi E., Perazzo P.K. de;
"Gel Growth and Characterization of Bismuth Oxalate Single Crystal".
J.Crystal Growth: 66(1984).

Massidda V., Hernando J.;
"Order-Disorder Transitions for a Two-Dimensional Lattice of Reorientable Quadrupoles in the Mean-Field Approximation".
Physica: 128A,(1984)318

Baggio R.F., Perazzo P.K de, Polla G.;
"Structure Of Copper (II) Distrontium (II) Formate Octahydrate, Cu $Si_{(2}(HCOOO)_6.8_2O$".
Acta Cryst.: C40 (1984)

Allub R., Ceva H., Alascio B.;
"Magnetic Susceptibility of a Model for Valence Fluctuations Between Two Magnetic Configurations: Renormalization Group-Approach".
Phys.Rev.: B29(1984): 3098.

Baggio R.F.;
"Erratum to Kinetics of Dehydration of Single Crystals of Copper Formate Tetrahydrate by Fichte and Flanagan"
Acta Cryst: C40(1984): 1299

Baggio R., Benyacar M.A.R de, Dussel H.L. de, Polla G., Schmirgeld L.;
"Transitions and Physical Properties of $Pb_8V_2O_{13}$ Single Crystals"
Ferroelectrics: 55(1984): 773.

Baggio R., Benyacar M.A.R de, Dussel H.L. de, Perazzo P.K. de, Schmirgeld L.;
"On the Influence of Different Parameters on the Phase Transition Temperatures and Ferroelectric Domain Structure in $H(UO_2)(AsO_4).4H_2O$.
Ferroelectrics: 55, (1984): 777.

Auer H., Fernández Niello J., Riess F., Puchta H.;
"Levels in ^{160}Yb from the Radioactive Decay of ^{160}Lu".
Z. Physik.: A318(1984) 323.

Otero D., Plastino A., Proto A.N., Zannoli G.;
"Quantal Friction, Nonlinear Hamiltonians, and Information Theory".
Z. Physik: A316(1984) 323.

Jauregui M., Cohan N., Weissmann M.;
"Specific Adsorption of Halogen Ions on Silver Surfaces".
J. of Electroanalytical Chemistry: 163(1984): 381.

Alessandrini V., Bes D.R., Civitarese O., Mehr M.T.;
"A Reformulation of the Perturbative Treatment of a System of Fermions in a Deformed Nuclei".
Phys. Lett.: 148B(1984): 395.

Mittag C., Fernández Niello J., Riess F., Puchta H.;
"Enhanced El Decay in Transitional Ra Isotopes"
Annals of the Israeli Physical Society: 7I(1984): 277

Esquinazi P., Guillet B., Steinman R., Dussel H.;
"Flux Pinning in La_{70} Cu_{30} Disordered System"
Jour. of Non-Crystalline Solids: 69 (1985): 171

Righini R., Burgos E.;
"Crystal Structure and Lattice Dynamics Calculation of CSe_2"
Chem.Phys.Lett.: 115(1985): 381.

Bonadeo H., Burgos E.;
"Anisotropic Forces in Small Molecule Crystals"
Jour. Chim. Phys: <u>82</u>(1985): 91.

Ranson P., Quillon R., Halac E., Califano S.;
"Experimental Studies of Long Life Phonons in Molecular Crystals by High Resolution Raman Spectroscopy".
Jour. Chim. Phys.: <u>82</u>(1985): 169.

Gamba Z.;
"Crystal Structure of Pyridazine and Azabenzene Crystals: A Test for an Intermolecular Potential".
J. Chem. Phys.: <u>83</u>(1985): 5892.

Baggio R.F., Benyacar M.A.R. de, Perazzo P.K. de, Polla G.;
"The Dehydration of Cu Si_2 (HCOO) 8 H_2O: A Crystallographic Study".
J. of Solid State Chemistry: <u>56</u> (1985): 298.

D'Elía S.;
"Nonuniversality in a Model Hamiltonian with Four-Spin Interactions".
Physica: <u>130A</u>(1985): 220.

Massida V.;
"Some Remarks about the Calculation of the Potential Field in Crystals".
Physica: <u>132B</u>(1985): 191.

Levy Yeyati A., Cohan N., Weissmann M.;
"Electronic Density of States of Bimetallic Superlattices with Interfacial Diffusion".
Phys. Rev.: <u>B31</u>(1985): 873.

Baggio R., Perazzo P.K.de, Polla G.;
"The Crystal Structure of Copper, Strontium Formate, Hydrate: $CuSr_2(HCOO)_6.8H_2O$".
Acta Cryst.: <u>C41</u>(1985): 194.

Kreiner A.J., DiGregorio D.E., Fendrik A., Davidson J., Davidson M.;
"Structure of ^{186}Ir and Decoupling Phenomena in Doubly Odd Deformed Nuclei".
Nucl.Phys.: <u>A432</u>(1985): 451

Macchiavelli A.O., Muehry H., Deleplanque M.A., Diamond R.M., Stephens F.S., Dines E.L., Draper J.E.;
"Mass Dependence of Shell Effects at High Rotational Frequencies"
Nucl.Phys.: <u>A443</u> (1985): 538.

Celler A., Briançon C., Dionisio J.S., Lefebre A., Vieu Ch., Zylicz J., Kulessa R., Mittag C., Fernández Niello J., Lauterbach Ch., Puchta H., Riess F.;
"Yrast Levels of ^{220}Ra Populated in the ^{208}Pb (^{14}C,2n) Reaction".
Nucl.Phys.: <u>A432</u>(1985): 421.

Morrissey D.J., Wozniak G.J., Sobotka L.G., McDonald R.J., Pacheco A.J., Moretto L.G.;
"Sequential Fission Angular Distribution from Mass Asymetric Heavy Ion Reactions"
Nucl.Phys.: <u>A442</u>(1985): 578.

Cambiaggio M.C., Dukelsky J., Zemba G.R.;
"Constrained Hartree Approximation for Systems with many Interacting Bosons".
J.Phys.: G11(1985): L163.

Van Isacker P., Frank A., Dukelsky J.;
"Phase Ambiguities in the O(6) Limit of the Interacting Boson Model".
Phys. Rev.: C31(1985): 671.

Elliott J.P., Evans J.A., Maqueda E.E.;
"Alpha Transfer and a Tetrahedral Shape for ^{16}O".
Nucl.Phys.: A437(1985): 208.

Dukelsky J., Perazzo R.P.J., Reich S.L., Sofía H.M.;
"Self-consistent Picture of the Interplay of Quadrupole and Octupole Degrees of Freedom in Many-boson Systems".
Phys. Lett.: 158B(1985): 361.

Nuñez J., Plastino A.L., Rossignoli R., Cambiaggio M.C.;
"Maximum Overlap, Critical Phenomena and the Coherence of Generating Functions".
Nucl. Phys.: A444(1985): 35.

Duering E., Otero D., Plastino A.L., Proto A.N.;
"Information Theory and Riemann Spaces: An Invariant Reformulation".
Phys. Rev.: A32(1985): 2455.

Lühmann L., Debray M., Lieb K.P., Nazarewicz W., Wörman B., Eberth J., Heck T.;
"Yrast Transition Strengths and Band Structure of ^{75}Br".
Phys. Rev.: C31(1985): 828.

Gattone A.O., Goulard B., Hwang W-Y.P.;
"Recoil Effects in the Relativistically Corrected Impulse Approximation"
Phys. Rev.: C31(1985): 1430.

Pittel S., Dukelsky J.;
"Comparison between Semiclassical and Classical Descriptions of the Collective M1 Mode in the Interacting Boson Model".
Phys. Rev.: C32(1985): 335.

Macchiavelli A.O., Deleplanque M.A., Diamond R.M., Stephens F.S., Dines E.L., Draper J.E.;
"Neutron Transfer Reactions with Very Heavy Ions".
Nucl. Phys.: A432(1985): 436.

Norman E.B., Kellogg S.E., Bertran T., Gil S., Wong P.;
"Equilibration of $^{176}Lu^{gm}$ during the S-Process".
Astrophysical Journal: 291(1985): 834.

Lock D.-K., Vandenbosch R., Lesko K.T., Gil S., Seamster A.G. Leach D., Lazzarini A.;
"Nucleide Distributions for Fe-like Fragments in the $^{136}Xe+^{56}Fe$ Reaction".
Nucl. Phys.: A442(1985): 142.

Taras P., Häusser O., Andrews H.R., Ward D., Deleplanque M.A., Diamond R.M., Macchiavelli A.O., Stephens F.S.;
"Neutron Alignment at High Spin in ^{156}Dy"
Nucl. Phys.: A435(1985): 294.

Gil S., Vandenbosch R., Lazzarini A.J., Lock D.-K., Ray A.;
"Spin Distribution of the Compound Nucleus in Heavy Ion Reaction".
Phys. Rev.: C31(1985): 1752.

Ray A., Gil S., Khandaker M., Leach D.D., Lock D.-K., Vandenbosch R.;
"Entrance Channel Dependence of Back Angle Yields: Orbiting in ^{24}Mg + ^{16}O".
Phys. Rev.: C31(1985): 1573.

Behar M., Ferrero A.M.J., Filevich A., Macchiavelli A.O.;
"High Spin States in ^{97}Rh"
Z. Physik: A320(1985): 467.

Dukelsky J., Dussel G.G., Sofía H.M.;
"HFB in a Restricted Space"
J. Phys. G: 11(1985): L91.

DiGregorio D.E., Fernandez Niello J., Pacheco A.J., Abriola D., Gil S., Macchiavelli A.O., Testoni J. Carlin Filho N., Coimbra M.M., Liguori Neto R., Pascholati P.R., Vanin V.R., Silveira Gomes P.R., Stockstad R.G.;
"Fusion of ^{16}O+^{144}Sm at Sub-barrier Energies"
Phys. Rev. Lett., in press.

Stephens F.S., Deleplanque M.A., Diamond R.M., Macchiavelli A.O., Draper J.E.;
"Structural Changes in ^{156}Er at High Spins".
Phys.Rev.Lett.: in press.

Duering E., Otero D., Plastino A.L., Proto A.N.;
"Information Theory and Linear Response Approach".
Phys.Rev.: A32(1985): in press.

Otero D., Plastino A.L., Proto A.N., Mizrhai S.;
"Relevant spaces in Quantal Dynamics and Statistical Physics".
Phys. Rev. A: (1985): in press.

Levine R.D., Napoli D.R., Otero D., Plastino A.L., Proto A.N.;
"Maximum Entropy Approach to Nuclear Fission Processes".
Nucl. Phys. A: in press.

Cambiaggio M.C., Dukelsky J., Zemba G.R.;
"Validity of the Self-Consistent Cranking Approximation in the SU(3)-U(5) Phase Transition".
Phys. Lett. B: in press.

Bes D.R., Mehr M.T., Liotta R.;
"The Quantum Mechanical Calculation of the Nuclear Moments of Inertia"
Nucl. Phys. A: in press.

Bayman B.F., Bes D.R., Curutchet P., Dragun O., Scoccola N.N., Testoni J.;
"Electromagnetic Decay of the Giant Quadrupole Resonances I: Reaction Mechanism and Angular Distributions of the Emitted Phonons"
Nucl. Phys. A: in press.

Bes D.R., Curutchet P., Reich S.L., Scoccola N.N., Sofía H.M.,
"Electromagnetic Decay of the Giant Quadrupole Resonances II: Nuclear Structure Aspects"
Nucl. Phys. A: in press.

Lenzi S.M., Maqueda E.E.;
"Methods for the Calculation of Form Factors for Many Nucleon Transfers"
Nucl. Phys. A: in press.

Kittl J.A., Testoni J.E.;
"Fusion and Peripheral Reactions in the Systems $^{16}O+^{148,152}Sm$ at Sub-barrier Energies"
Nucl. Phys. A: in press.

Scoccola N.N., Bes D.R.;
"The Convergence of the Nuclear Field Theory in a Realistic Four-hole Problem"
Phys. Rev. C: in press.

Bernath M., Bes D.R., Saraceno M., Spina M.E.;
"A Two Dimensional Soluble Model for the Excitation of Rotational States in Deformed Nuclei"
J. Phys. G: in press.

Kreiner A.J., Davidson J., Davidson M., Abriola D., Pomar C., Thieberger P.;
"Band Structure in ^{180}Re"
Phys. Rev. C: in press.

Kreiner A.J., Thieberger P., Warburton E.;
"Doubly Decoupled Structures in $^{182,184}Ir$"
Phys. Rev. C (Rapid Communications): in press.

Ferrero A.M.J.;
"Numerical Analysis of Terminal Charge Selector Designs for Electrostatic Accelerators"
Nucl. Instr. & Meth.: in press.

Bernath M., Dragún O., Testoni J., Massmann J.H., Ramírez G.;
"Extension of the Angle Dependent Phase Shift Formalism to Vibrational Excitations"
Z. Physik A: in press.

Gattone A.O., Cooper E.D., Macfarlane M.H.;
"The Two-body Dirac Equation for Nuclear Physics"
Z. Physik A: in press.

Gattone A.O., Hwang W-Y.P.;
"Recoil Effects in a Bag Model"
Phys. Rev. D: in press.

Gattone A.O.;
"Contribution of the Space-like Vector FIeld to Nuclear Magnetic Moments"
Phys. Lett. B: in press.

DiGregorio D.E., Fernández Niello J.O., Pacheco A.J., Abriola D., Gil S., Macchiavelli A.O., Testoni J., Pascholati P.R., Vanin V.R., Ligouri Neto R., Carlin Filho N., Coimbra M.M.;
"Fusion of $^{16}O+^{144}Sm$ at Sub-barrier energies"
Phys. Rev. Lett.: in press.

Hernando J.;
"Thermodynamic Derivatives of Classical Distribution Functions".
Jour.Chem.Phys.: in press.

Liotta R.J., Pomar C.;
"Perturbation Treatment of the Interaction Between Correlated Many-Particle States".
Phys. Scripta: in press.

Halac E., Califano S.;
"Harmonic Phonon Dynamics of Monoclinic and Culic Tetracyanoethylene"
Chem. Phys.: in press.

Ramson P., Ouillon R., Halac E., Califano S.;
"High Resolution Raman Band Profiles of Monoclinic Tetracyanoethylene at Low Temperature".
Chem. Phys., in press.

Gamba Z., Halac E., Bonadeo H.;
"Calculation of Static and Dynamical Properties of Halogen Crystals"
J. Chem. Phys.: in press.

Burgos E., Bonadeo H.;
"Calculation of three-body Dispersive Energies: Extrapolation Method and Application to Crystals of Isotropic and Anisotropic Bodies".
Phys. Rev. B: in press.

D'Elía S., Ceva H.;
"Monte Carlo Determination of the Phase Diagram of a Model Hamiltonian with Four-Spin Interactions".
Phys. Rev. B: in press.

Weissmann M., Llois A.M.;
"Localization Properties of Incommensurate Disordered One Dimensional Systems".
Phys. Rev. B: in press.

Perazzo R.P.J., Sofía H.M.;
"Generalized Rotational Motion and the Cranking Prescription in Systems with Many Interacting Bosons".
Phys. Lett.: in press.

PAPERS PRESENTED AT MEETINGS AND CONFERENCES

4th. International Conference on Recent Progress in Many Body Theories, San Francisco, U.S.A., april 1984

"Validity of the Self-Consistent Cranking Approximation in the SU(3)-U(5) Phase Transition"
M.C.Cambiaggio, J.Dukelsky, G.R.Zemba

International Conference on Nuclear Structure Physics, Bradford, U.Kingdom, april 1984

"High Spin States in ^{219}Ra and ^{220}Ra"
C.Lauterbach, J.Fernández Niello, C.Mittag, H.Puchta, F.Riess, C.Schandera, C.Briançon, J.S.Dionisio, G.Vieu, A.Celler, J.Zylicz, R.Kulessa.

5th Nordic Meeting on Nuclear Physics, Jyväskylä, Finlandia, 1984

"In Beam Gamma and Electron Spectroscopy on ^{220}Ra"
A.Celler, Ch.Biançon, J.C.Dionisio, A.Lefebre, Ch.Vieu, C.Mittag, J.Fernández Niello, C.Lauterbach, H.Puchta, F.Riess, J.Zylecz, R.Kulessa.

VII Reunión de Trabajo en Física Nuclear, Buenos Aires, Argentina, 11-15 June 1984

"Avances en el Montaje del Acelerador"
N.Fazzini

"Obstáculos Encontrados en la Instalación Eléctrica del Acelerador"
S.Tau

"El Inyector: Estado Actual y Posibilidades Futuras"
A.Tersigni, H.González

"Protección Radiológica"
C.Calia

"Factores de Forma en Reacciones con Transferencia de Varios Nucleones"
S.Lenzi

"Formalismo de la Matriz S Dependiente de Coordenadas Intrínsecas Aplicado al Cálculo de Secciones Eficaces de Fusión"
O.Dragún, J.Testoni

"Cálculo Bidimensional de Secciones Eficaces de Transición a Estados Rotacionales en Núcleos Deformados Utilizando Coordendas Elípticas"
M.Bernath

"Revisión de las Características de los Aceleradores Actuales de Energías Bajas e Intermedias"
A.Ceballos

"Protección contra Accidentes de Pérdida de SF_6"
A.Etchegoyen

"Estado Actual del Montaje de las Líneas Experimentales"
A.Filevich

"Diseño de un Detector Gaseoso para Iones Pesados"
G.Martí

"Correlaciones Angulares Partícula-Partícula para la Determinación de Radios en Núcleos Excitados"
M.E.Spina

"Espectrómetro Magnético para el Tandar"
A.Etchegoyen

"Tratamiento Cuántico Perturbativo de las Rotaciones"
D.R.Bes

"Transiciones de Fase y Fases Inconmensuradas en los Compuestos de La Serie $M_2XHal._4$. II Parte: Compuestos que Incluyen Grupos $M=(NH_{4-x}(C_nH_{2n+1})$, X=Zn. Cu, Co, Mn, etc. y Hal.=Cl^-, Br^-"
M.A.R.de Benyacar

"Solitones en Dieléctricos Inconmensurados"
H.Ceva

"Anomalías en la Constante Dieléctrica en Fases Inconmensuradas de Compuestos $Rb_2Zn\ Hal._4$: Una Propuesta Experimental"
L.Schmirgeld

"Radiación Gama del Cuasi-Contínuo"
G.García Bermúdez

"Fusión Subcoulombiana"
J.Testoni

"Resumen Final"
D.R.Bes

<u>Conference on the Intersections Between Particle and Nuclear Physics. Steamboat Springs, Colorado, U.S.A., May 23-30, 1984.</u>

"Recoil Effects in Bag Models"
A.O.Gattone

Escuela Latinoamericana de Física, ELAF'84, Santiago, Chile, july 1984

"Two Nuclear Phases and the Proton-Neutron Force"
A.J.Kreiner, C.Pomar.

"Quantal Friction, Non-linear Hamiltonians and Information Theory"
D.Otero, A.N.Proto, A.Plastino, G.Zannolli.

69a. Reunión de la Asociación Física Argentina, Buenos Aires, Argentina
15-19 October 1984

"Estructura Electrónica de Superredes Bimetálicas con Difusión Interfacial"
H.Weissmann, N.V.Cohan, A.Levy Yeyati.

"Estudio de un Hamiltoniano de Apareamiento"
L.A.Balleli, E.Düering, D.Otero, A.Plastino, A.N.Proto.

"Condiciones de Contorno en Teoría de la Información"
J.A.Diez, E.Düering, D.Otero, A.Plastino.

"Propiedades electrónicas de Sistemas Incomensurados Bidimensionales"
A.M.Llois, M.Weissmann, N.V.Cohan.

"Transiciones Orden-Desorden y Diagrama de Fases en Redes Cuadradas con Dipolos y Cuadrupolos reorientables"
V.Massida, J.Hernando.

"Métodos para describir la Coexistencia de Grados de Libertad Competitivos"
R.M.Quick, H.G.Miller-CSIR, M.C.Cambiaggio.

"Fuerzas Anisotrópicas en Cristales de Moléculas Pequeñas"
H.Bonadeo, E.Burgos.

"Crecimiento en Gel de Fosfato y Arseniato de Uranilo Hidratado. Comparación Morfológica"
E.Manghi, G.Polla.

"Determinación del Número Atómico de Fragmentos de Fisión"
J.Aliaga, D.R.Napoli, D.Otero, A.N.Proto.

"Cálculo Bidimensional de Secciones Eficaces de Transicion a Estados Rotacionales en Núcleos Deformados Utilizando Coordenadas Elípticas"
M.Bernath, D.R.Bes, M.Saraceno, M.E.Spina.

"Algunas Magnitudes Físicas de Interés en Reacciones Nucleares y su Dependencia respecto del Sistema Proyectil-Blanco: Curvas Características para un Acelerador Electrostático"
J.Fernández Niello, A.Pacheco.

"Generalización de un Método de Máxima Superposición"
M.C.Cambiaggio, J.Nuñez, A.Plastino, R.Rossignoli.

"Decaimiento Gama de las Resonancias Gigantes: I) Formalismo General"
B.Bayman, D.R.Bes, P.Curutchet, O.Dragún, S.L.Reich, N.Scoccola, H.M.Sofía, J.Testoni.

"Decaimiento Gama de las Resonancias Gigantes: II) Cálculo de la Componente de la Sección Eficaz Dependiente del Mecanismo de la Reacción"
B.Bayman, D.R.Bes, P.Curutchet, O.Dragún, J.Testoni.

"Decaimiento Gama de las Resonancias Gigantes: III) Cálculo Espectroscópico"
D.R.Bes, P.Curutchet, S.L.Reich, N.Scoccola, H.M.Sofía.

"Principio de Máxima Entropía en Aniquilación de Positrones: Estudio del Trapping Model"
E.Carpintero, E.Düering, D.Otero, A.N.Proto, A.Somoza.

"Estados de Dos Fonones de Apareamiento en el ^{101}Pb"
D.R.Bes, N.Scoccola.

"Reformulación del Tratamiento Perturbativo de un Sistema de Fermiones en una Base Deformada"
V.Alessandrini, D.R.Bes, M.T.Mehr, O.Civitarese.

"Obtención de la Función de Onda del Centro de Masa de Cuatro Nucleones"
B.Bayman, S.M.Lenzi, E.E.Maqueda.

"Deformaciones Octupolares y Proyección en Paridad dentro del Modelo de Bosones Interactuantes Generalizado"
J.Dukelsky, S.L.Reich, H.M.Sofía.

VII Reuniao de Trabalho en Física Nuclear, Itatiaia, Brazil, September 1984.

"Aplicación de las Condiciones de Gauge de Coulomb y de Lorent al Tratamiento Perturbativo de un Sistema de Fermiones en Rotación"
D.R.Bes.

"Status y Proyectos Experimentales del Tandar"
D.Otero.

"Resolution Variation Conections in Doppler Broadening Spectro"
E.Carpintero, D.Otero, A.N.Proto, A.Somoza.

"Covariant Formulation of Information an Theory"
E.Düering, D.Otero, A.Plastino, A.N.Proto.

XII Reunión de la Asociación Argentina de Tecnología Nuclear.
III Encuentro Latinoamericano,
Buenos Aires, Argentina, 3-7 December 1984.

"Estudio de Distribución Localizada de Defectos en Metales por Aniquilación de Positrones"
D.Otero, A.N.Proto, R.Romero

"Sistema de Alto Vacío del Acelerador de Iones Pesados Tandar"
N.Fazzini, H.González, J.M.Riso

"Sistema de Protección Radiológica del Personal en el Proyecto Tandar"
S.Tau, A.Ceballos, A.Filevich, C.Giménez, S.Nigro

"Evaluación Radiológica de Diversas Areas del Acelerador Tandar"
C.Galia, O.Bernaola

"Fuentes de Iones para el Acelerador Tandar. Estado Actual y Posibilidades Futuras"
A.Tersigni, M.González, O.Professi

"Controlador de Video en Norma CAMAC"
T.Schmukler, D.S.Camín

"Cámara de Dispersión para Reacciones con Iones Pesados"
D.R.Napoli, C.E.Palacio, A.N.Proto, D.Otero, J.C.Rodríguez, D.A.Simoncelli

"Controlador Autónomo para Norma CAMAC"
M.Satinosky, T.Schmukler

<u>4to. Simposio Chileno de Física, Chile, 1984</u>

"Angular Cross Sections Calculations of Collective States in Deformed Nuclei Using the S-Matrix Formalism Depending on Intrinsic Coordenats"
H.Massmann, O.Dragún, J.Testoni

<u>Reunión sobre Física Do Nucleo. Avalicao e Prospectos no Contexto Brasileiro, San Pablo, Brazil, December 1984</u>

"Consideraciones sobre la Física Nuclear en Latinoamerica"
D.R.Bes.

<u>4th. International Conference on Electrostatic Accelerator Technology and Associated Boosters, Buenos Aires, Argentina, April 15-19, 1985</u>

"Status Report on the Buenos Aires Tandar Facility"
N.Fazzini, H.González, E.Pérez Ferreira, S.Tau, A.Tersigni, E.Ventura

"A CAMAC Based System for an Electromagnetic Isotope Separator"
D.Camín, J.Mónico, M.Satinosky

"GVM Calibration Using a Capacitive Divider"
D.Camín, S.Tau

Symposium on Electromagnetic Properties of High Spin Nuclear States (ELSA), Stockholm, Sweden, June 1985.

"Present Status of Tandar"
A.Filevich

9° Simposio Latinoamericano de Física del Estado Sólido, Mar del Plata, Buenos Aires, Argentina, 19-24 de august 1985

"Expresiones Exactas y Aproximadas para la Función de Correlación Directa de Tres Partículas y algunas Funciones Relacionadas"
J.Hernando

"Transiciones Orden-Desorden y Diagrama de Fases en Redes Cuadradas con Dipolos y Cuadrupolos reorientables"
V.Massida, J.Hernando

"Diagrama de Fases de un Hamiltoniano con Interacciones de Dos y Cuatro Cuerpos"
S.D'Elía, H.Ceva

"Cálculo de Energía de Tres Cuerpos: Método de Extrapolación y Aplicación a Cristales de Cuerpos Isótropos y Anisótropos"
E.Burgos, H.Bonadeo

"Estructura Cristalina de Piridazina y Azabencenos: Prueba para un Potencial Intermolecular"
Z.Gamba

"Relajación Térmica del Amorfo $Zr_{70}Cu_{30}$ Simulada por el Método de Dinámica Molecular"
A.Levy Yeyati, M.Weissmann

"Transiciones de Fase en el Sulfato de Guanidina"
M.A.R.de Benyacar, R.Baggio

"Transiciones de Fase en Soluciones Sólidas $(CrO_4)_{1-x}(SO_4)_xK_2$"
M.A.R.de Benyacar, H.Lanza de Dussel, L.Schmirgeld

"Crecimiento en Gel de Monocristales de Fosfato de Uranilo Tetrahidratado (HUP). Estudio por Microscopía Optica de Muestras bajo Distintas Condiciones de Atmósfera y Temperatura"
E.Manghi, G.Polla

"Densidad de Hielo Obtenido por Acreción"
L.Levi, F.Prodi

"Aplicación de la Espectroscopía Mössbauer al Estudio de algunos Casos de Hemoglobinopatías"
F.Labensky de Kanter, S.A.de Miani, J.A.Peñalver

VIII Reuniao de Trabalho sobre Fisica Nuclear No Brasil, Sao Lorenço, Brazil, September 1985

"Fusion of $^{16}O+^{144}Sm$ at sub-barrier energies"
A.J.Pacheco, D.E.DiGregorio, J.Fernandez Niello, D.Abriola, S.Gil, A.O.Macchiavelli, J.Testoni, N.Carlin Filho, M.M.Coimbra, R.Lignori Neto, P.Pascholati, V.R.Vanin.

"Decaimiento Electromagnético de Resonancias Cuadrupolares Gigantes Pobladas Mediante Reacciones con Iones Pesados"
E.F.Bayman, D.R.Bes, P.Curutchet, O.Dragún, N.N.Scoccola, J.Testoni.

"Dos Transiciones de Fase en Física Nuclear"
D.R.Bes.

"Movimiento Rotacional Generalizado y la Regla de "cranking" en Sistemas con Muchos Bosones"
H.M.Sofía.

70a. Reunión de la Asociación Física Argentina, Rosario, Prov. de Santa Fe, Argentina, 7-11 October 1985

"Fusión y Reacciones Periféricas en los Sistemas $^{16}O+^{148,152}Sm$ a Energías Subcoulombianas"
J.A.Kittl, J.Testoni

"Cálculo Perturbativo de los Momentos de Inercia Nucleares"
D.R.Bes, R.J.Liotta, M.T.Mehr

"Mediciones de la Concentración de Ferritina Probable en Erititrocitos Normales y Anormales por medio de la Espectroscopía Mössbauer"
F.Labenski de Kanter, S.Abreu de Miani, J.A.Peñalver

"Quasispín e Interacción Cuadrupolar: Entropia de Jaynes, Condicional y de Memoria Nula"
P.Iaria, D.Otero, A.N.Proto, A.Plastino, M.Torres

"Validez del Método Autoconsistente de Cranked Hartree en la Transición de Fase SU(3)-U(5)"
M.C.Cambiaggio, J.Dukelsky, G.Zemba

"Expansiones de Tipo Semiclásico con Representación de Estados Coherentes de algunos Grupos Sencillos"
M.S.Gravielle, M.Saraceno

"Aproximación de Hartree con Vínculos para Sistemas con Muchos Bosones Interactuantes"
M.C.Cambiaggio, J.Dukelsky, G.Zemba

"Respuesta Lineal y Evolución Temporal"
A.López, N.Canosa, A.Plastino, D.Otero y A.N.Proto

"Oscilador Armónico Friccional en el Contexto del Principio de Máxima Entropía"
G.Crespo, D.Otero, A.N.Proto, A.Plastino

"Transferencia de Energía entre Sistemas Bosónicos"
K.Aliaga, D.Napoli, D.Otero, A.N.Proto, A.Plastino

"Acerca del Problema de Esferas Rígidas Distribuídas al Azar"
E.Burgos, H.Bonadeo

"Cálculo de Efectos Anarmónicos en α-Nitrógeno"
S.Gonçalves, H.Bonadeo

"Formulación Covariante de Sistemas Canónicos"
E.Düering, D.Otero, A.N.Proto, A.Plastino

"Longitud de Localización y Resistencia para un Sistema Unidimensional Desordenado con Dos Orbitales por Sitio"
M.García, A.M.Llois, M.Weissmann

"Matriz de Densidad para Operadores No Ligados"
J.Aliaga, M.Negri, D.Otero, A.N.Proto, A.Plastino

"Un Separador Electrostático para Iones Pesados"
M.L.di Tada, G.Martí, J.Fernandez Niello

"Formalismo CCBA Modificado Aplicado a la Reacción $^{12}C+^{150}Nd$"
M.Bernath, O.Dragún, H.Massmann

"Estudio de la Evaporación de Partículas Livianas en Reacciones de Transferencia Profundamente Inelásticas"
D.R.Napoli, D.Otero, A.N.Proto, T.Quinteros

"Fusión de $^{16}O+^{144}Sm$ a Energías Subcoulombianas"
A.Pacheco, D.E.DiGregorio, J.Fernández Niello, D.Abriola, S.Gil, A.O.Macchiavelli, J.Testoni, N.Carlin Filho, M.M.Coimbra, R.Lignori Neto, P.Pascholati, V.R.Varín, P.R.Silveira Gomes, R.G.Stockstad

"Formulación Hamiltoniana del Modelo de Atrapamiento en Aniquilación de Positrones"
E.Carpintero, E.Düering, D.Otero, A.N.Proto, A.Somoza

"Influencia del Atrapamiento Directo, alfa, sobre el Modelo de Dos Estados en Aniquilación de Positrones"
E.Carpintero, E.Düering, D.Otero, A.N.Proto, A.Somoza

"Estructura de Alto Spín en ^{180}Re"
J.Davidson, M.Davidson, A.J.Kreiner, C.Pomar, D.Abriola, P.Thieberger

"Bandas Doblemente Desacopladas en $^{182,184}Ir$"
A.J.Kreiner, P.Thieberger, E.Warburton

"Modo Isovectorial $K^{\pi}=1^{+}$ en Núcleos Deformados"
D.R.Bes, J.Kurchan

"Descripción Microscópica de Excitaciones de Dos Partículas"
A.J.Fendrik

"Descripción Microscópica de Excitaciones de Dos Partículas"
G.G.Dussel, A.J.Fendrik

"Distribuciones Angulares de Radiaciones Provenientes del Decaimiento de Resonancias Gigantes Pobladas mediante Reacciones entre Iones Pesados"
D.R.Bes, P.Curutchet, O.Dragún, N.N.Scoccola, J.Testoni

"Cálculo Perturbativo de los Momentos de Inercia Nucleares"
D.R.Bes. R.J.Liotta, M.T.Mehr

VIII Reunión de Trabajo en Física Nuclear, Buenos Aires, Argentina, 14-18 October 1985

"Altos Momentos Angulares I"
D.R.Bes

"Comportamiento Sistemático para Degeneraciones Grandes en un Modelo Soluble, Relación con TDHF"
C.Cambiaggio

"Estado Actual del Acelerador Tandar"
N.Fazzini

"Altos Momentos Angulares II"
D.R.Bes

"Captura Radiactiva"
I.Nemirovsky

"Estadística y Termodinámica Nuclear. Una Aproximación"
D.Otero

"Altos Momentos Angulares III"
A.O.Macchiavelli

"Bandas Doblemente Desacopladas en Núcleos Deformados"
A.J.Kreiner

"Modelos Colectivos Nucleares I"
R.P.J.Perazzo

"Distribución Angular de la Radiación Emitida luego de la Excitación de una Resonancia Gigante por Dispersión Inelástica"
J.Testoni

"Modelos Colectivos Nucleares II"
R.P.J.Perazzo

"Aproximación Microscópica al Modelo de Bosones Interactuantes en Nucles Deformados"
J.Dukelsky

"Resumen Final"
E.E.Maqueda

The IX International Workshop on Condensed Matter Theories, San Francisco, U.S.A., 1985

"Systematic Behaviour at Large Degeneracies in a Soluble Model"
M.C.Cambiaggio, G.G.Dussel, M.Saraceno.

Jornadas de la Asociación Física Alemana, Münich, 1985 Verhandl DPG(VI) 20(1985)563.

"Spektroskopie der Ra-Isotope in Ubgargsbereich mit N 126"
J.Fernández Niello, C.Mittag, H.Puchta, F.Riess, Ch.Briançon, A.Celler, S.Dionisio, Ch.Vieu.

Ph.D THESIS

- Gil, Salvador
"Spin Distribution of the Compound Nucleus in Heavy Ion Reaction at Near-Barrier Energies".
Dirigida por el profesor R.Vandenbosch. Nuclear Physics Lab., University of Washington, Seattle, WA, U.S.A. August 1984.

- Macchiavelli, Augusto O.
"Reacciones de Transferencia con Iones muy Pesados y Momentos Nucleares de Inercia a Altas Frecuencias de Rotación"
Instituto Balseiro. Universidad Nacional de Cuyo. October 1984.

- Gamba, Zulema B.
"Estudio de Fuerzas Electrostáticas en Cristales Moleculares"
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires. 1984.

- Hernando, Jorge A.
"Transiciones Orden-Desorden en Cristales con Multipolos Reorientables"
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires. 1984.

- Llois, Ana M.
"Propiedades Electrónicas de Sistemas Inconmensurados"
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires. 1985.

- Scoccola, Norberto N.
"Estudio de la Convergencia de la Teoría de Campos Nucleares y su Aplicación a los Isótopos del Pb"
Instituto Balseiro, Universidad Nacional de Cuyo.
August 1985.

- Düering, Edgardo
"Teoría de la Información y Sistemas Cuánticos"
Instituto Balseiro, Universidad Nacional de Cuyo.
November 1985.

- Mehr, María Teresa
"Cálculo Perturbativo de los Momentos de Inercia Nucleares"
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.
November 1985.

- Curutchet, Patricia
"Decaimiento Electromagnético de Resonancias Gigantes en Reacciones entre Iones Pesados"
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.
December 1985.

LICENCIATURA THESES

In 1984:

- Levy Yeyati, Alfredo
"Densidad de Estados Electrónica de Superredes Metálicas con Difusión Interfacial"
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Folcia, César L.
"Estudio Comparativo de algunos Métodos para el Cálculo del Potencial Electrostático en una Estructura Cristalina".
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Gravielle, M.S.
"Aproximaciones de Tipo Semiclásico Derivadas del Principio Variacional Dependiente del Tiempo".
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Sainato, Claudia
"Estudio del Esquema de Niveles del ^{133}Te"
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Bejer, Susana
"Correlaciones Angulares en Núcleos de Masa 134"
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Hojman Daniel
"Diseño, Construcción y Calibración de un Espectrómetro Tipo Mini-Naranja"
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Aliaga Jorge
"Identificación de Fragmentos de Fisión del ^{252}Cf"
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Quinteros, Teresita B.
"Evaporación de Partículas en Colisiones Fuertemente Inelásticas"
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

In 1985

- Gonçalves Sebastian
"Cálculos Anarmónicos en el Cristal de Alfa-nitrógeno"
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Kittl Jorge A.
"Fusión y Reacciones Periféricas en la Región de Energías Subcoulombianas"
Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Schwartzkopf E.
  "Estudio del desarrollo bosónico generalizado de Holstein-Primakoff Truncado en los Primeros Ordenes"
  Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Kurchan J.
  "Modo de Vibración Isovectorial $K = 1^+$ en Núcleos Deformados"
  Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Zemba Guillermo
  "Estudio de Aproximaciones Variacionales para Resolver el Problema de Muchos Cuerpos en Física Nuclear"
  Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Iaria Pablo
  "Evolución Temporal en Grupos no Simétricos de Operadores"
  Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Ottaviani, Anahí
  "Estudio de Factibilidad y Planeamiento de Reacciones de Transferencia Alfa en Núcleos de Masa 40"
  Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

- Negri Martín
  "Matriz de Densidad y Operadores No ligados"
  Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

INTERNAL REPORTS

"Algunas Magnitudes Físicas de Interés en Reacciones Nucleares y su Dependencia respecto del Sistema Proyectil-Blanco"
J.Fernández Niello, A.J.Pacheco.
CNEA-NT 5/84. Año 1984.

"Intensidad de Haces de Distintos Iones en un Acelerador Electrostático como Función de su Estado de Carga y de la Tensión del Terminal"
A.Etchegoyen, J.O.Fernández Niello, A.J.Pacheco.
CNEA-NT 13/85. Año 1985.

TABLE OF CONTENTS

II. NUCLEAR PHYSICS

IV. STATISTICAL MECHANICAL AND RELATION TO NUCLEAR DYNAMICS

IMPRESO EN CNEA - ABRIL 1986