

CENTRO ATOMICO BARILOCHE

COMISION NACIONAL DE ENERGIA ATOMICA

A R G E N T I N A

MATERIAL RESEARCH ACTIVITIES

JANUARY 1979 - JULY 1980

INDEX

	Page
1. Phase Transformation in Zirconium Alloys	1
2. Phase Stability in Noble Metal Alloys	2
3. Diffusion and the Martensitic Transformation in Cu Zn Al Brasses	4
4. Surface Martensite in β Cu Zn Al	6
5. Trapping Centers in Red Mercuric Iodide Single Crystals	7
6. Thermodynamic Study of the Fluorite Phase in the Uranium- Cerium-Oxygen System	8
7. Stress Effects in the Ion Ligand Interaction	9
8. Spin Lattice Coefficients of Dilute Magnetic Impurities	10
9. Intermediate Valence	11
10. Intermetallic Compounds with Intermediate Valence Characteristics	13
11. Magnetic Impurities in Superconductors	15
12. Applications of the Phenomenological Theory of Superconductivity	16
13. Quantum Effects in Superconductors	17
14. Surface Superconductivity and Kapitza Resistance	19
15. Thermodynamic and Transport Properties of Metallic Amorphous System	20
16. Condensed Matter Studies Using a Pulsed Neutron Source	22
17. Secondary Electron Emission From Both Surfaces of Foils Traversed by Ion Beams	24
18. Collisional Electron Transfer into the Continuum of Projectiles Traversing Gaseous and Solids Targets, Experimental & Theory	25
19. Passage of Swift Ions and Ion Clusters through Thin Solid Foils	27
20. Backscattering of Light Ions From Solid Targets Combined with Charge Analysis of the Enclosing Projectiles	28
21. Inner-Shell Excitations in Low-Energy Ion Surface Collisions	29
22. Theory of Energy Loss of Charged Particles in Condensed Matter	30
23. Atomic Collisions in Solids: Sputtering, Particle and Energy Reflection and Correlation effects on Rutherford's Back- scattering	31

PERSONNEL

	Pages
ABRIATA, J.P.	8
AHLERS, M.	1-2-4-6
ALASCIO, B.	11
ALIGIA, A.	11
ALONSO, E.V.	29
ALLUB, R.	11
ARCE, R.	17
ARISTA, N.	24-30
BALSEIRO, C.	11
BARAGIOLA, R.	29
BARCELO, G.	2-4
BOLCICH, J.C.	1
BRANDT, W.	30
CANEIRO, A.	8
CAUSA, M.T.	10
CEVA, H.	11
CHANDRASEKARAN, M.	1-2-4-6
DAUDIN, B.	20
DE LA CRUZ, M.E.	20
DE LA CRUZ, F.	17-19-20
ECKARDT, J.C.	27-28
ESQUINAZI, P.	20
FAINSTEIN, C.	9-10
FAVARON, J.	20
FINK, H.	17
FOCKE, P.	28
GARCIA, E.	13
GARIBOTTI, C.R.	25
GRANADA, J.R.	22
GREGORY, B.	17
GRUNFELD, V.	17
GONZALEZ LE PERA, C.	24-25
HUBER, J.	15
JAKAS, M.	27-29-31
KROPFF, F.	22
LANTSCHNER, G.	27
LOPEZ, A.	11-16
LOVEY, C.	4-6
LUZURIAGA, J.	17

MARTINEZ, E.	19
MAYER, R.	22
MAZZAFERRO, J.	11
MECKBACH, W.	24-25-28
MIRAGLIA, J.E.	25
NEMIROVSKY, I.B.	24-25
NOLLMAN, I.	7
OLCESE, J.L.	13
PERETTI, H.	1
PONCE, V.H.	25-31
PROETTO, C.	11
RAPACIOLI, R.	2-4-6-
RAMOS, C.	9
RAITI, H.	29
REGOLINI, J.L.	7
RIDNER, A.	19
SALVA, Ada Guillarducci	4
SAURA, J.	7
SERENI, J.	13-15
SIMONIN, J.M.	16
TOVAR, M.	10
WIECKO, C.	11

PHASE TRANSFORMATION IN ZIRCONIUM ALLOYS

The program was started in 1978 with the aim to study the martensitic transformation from the high temperature bcc to the low temperature hex phase its kinetics, morphology and transformation mechanism, in order to compare with the related transformation in the brasses and in steels.

The preparation and treatment of the samples requires great care due to its reactivity with oxygen, and equipment for melting, annealing, quenching and deformation had to be built. In the Zr-Nb system the M_s temperature for spontaneous transformation on cooling falls abruptly from 400°C to below -200°C around 7Wt% Nb due to the appearance of the omega phase. By adding 1Wt% Al the martensitic transformation is facilitated, although omega remains present, making it possible to study the morphology of spontaneous and stress induced martensite by x-rays, electron and optical microscopy.

PERSONNEL: J.C.Bolcich
H.Peretti
M.Ahlers
M.Chandrasekaran

- PUBLICATIONS: - J.C.Bolcich, H.A.Peretti; "Preparación de probetas en aleaciones del Zirconio en horno de arco por colada en vacío", VIII Reunión Científica AATN 1979.
- J.C.Bolcich, H.A.Peretti; "Estudio de la estabilidad de la fase β en la aleación Zr-10% Nb", VIII Reunión Científica AATN 1979.
- H.A.Peretti, J.C.Bolcich, M.Ahlers; "Transformación martensítica observada con microscopía óptica durante la deformación en la aleación Zr-10% Nb-1% Al." VIII Reunión Científica AATN 1979.
- J.C.Bolcich, H.A.Peretti, M.Ahlers; "Transformación martensítica inducida por deformación en la aleación Zr-10% Nb-1% Al", Informe CNEA-NT 4180.
- J.C.Bolcich, H.A.Peretti, M.Ahlers; "Omega and the Martensitic Transformation in Zr-10 Nb and Zr-10 Nb-1 Al", submitted to J.Nucl.Mat.

PHASE STABILITY IN NOBLE METAL ALLOYS

This program was started in 1969 and aims at a better understanding of the factors which control the stability of equilibrium and martensitic phases in the noble metal alloys. The alloys studied hitherto are Cu Zn and Cu Zn Al. The phases analyzed are the ordered and disordered β phases, various martensitic phases viz the orthorhombic 3R ordered martensite obtained on quenching from β , the fcc ordered martensite stress induced from 3R, and hexagonal ordered martensite also induced by stresses. The phases were analyzed, using optical and electron microscopy, x-rays and electrical resistivity. The critical transformation stress between 3R and fcc martensite was measured as a function of electron concentration and order. From these results it was deduced that the 3R martensite is less stable thermodynamically than the hexagonal phase, and that 3R is formed only because of the existing constraints from an undistorted interface between β and the martensite. Concerning the stability of the various phases, an analysis in terms of pairwise interchange energies which depend on pair distance but not on structure proved promising in relating the stability of the equilibrium α , β and martensitic phases.

PERSONNEL: M.Ahlers
G.Barceló
R.Rapacioli
M.Chandrasekaran

PUBLICATIONS: - M.Ahlers; "The stability of martensite in Cu-Zn Alloys", Z.Metallkunde 70 (1979) 379.
- G.Barceló, M.Ahlers, R.Rapacioli; "The Stress Induced Phase Transformation in Martensitic single crystals of Cu Zn Al Alloys"; Z.Metallkunde 70 (1979) 732.
- M.Ahlers; "The stability of martensite in Binary Cu Zn Alloys", Proc.International Conf.on Martensite Transf.Cambridge 1979, p.271.

- M.Ahlers, G.Barceló, R.Rapacioli, "The stress Induced Transformation between Orthorhombic and Face Centered Martensite in Cu Zn Alloys", Proc.International Conference on Martensite Transf., Cambridge 1979, p.277.
- M.Ahlers, "On the stability of the Equilibrium α and β Phases in Cu Zn", to be submitted.
- M.Ahlers, "The Influence of DO₃ order on the Martensitic Transformation in Cu Zn Au and Cu Zn Al Alloys". Z. Metallkunde 71 (1980).

DIFFUSION AND THE MARTENSITIC TRANSFORMATION IN Cu Zn Al BRASSES

This program was started in 1976 after it became apparent that quenching and aging effects had a strong influence on the martensitic transformation in Cu Zn Al alloys.

The diffusional processes are being analyzed by the internal friction technique. Quenched β phase samples show several resonance peaks at low temperatures, which decay with time and whose characteristics, as orientation dependence and activation energy, are being investigated to obtain information on the underlying diffusion mechanisms.

The influence of quenched in defects on the martensitic transformation has been studied relating the changes in martensitic transformation temperature to quenched in disordered pairs in the long range ordered matrix, which lead to a change in the stability of the phases involved.

Aging effects are also responsible for the rubber like behaviour of Cu Zn Al martensitic single crystals. Here diffusional processes stabilize the existing martensite variant with respect to others which, after being induced by applied stresses, disappear again after unloading, at least partially, depending on the number of cycles.

Quenching also leads to the formation of γ precipitates whose nucleation and growth kinetics are being investigated mainly by transmission electron microscopy, in order to relate them to excess vacancies and long range order processes.

The γ precipitates have a strong effects on the martensitic transformation by changing the transformation temperature and hysteresis, and also the characteristics of stress induced martensite. The underlying processes are being analyzed by transmission electron microscopy, acoustic emission, x-rays and mechanical tests.

PERSONNEL: M.Chandrasekaran
R.Rapacioli
G.Barceló
A.G.de Salva
M. Ahlers
F.C.Lovey

- PUBLICATIONS: - R.Rapacioli, M.Ahlers, "The influence of Short Range Disorder on the Martensitic Transformation in Cu Zn and Cu Zn Al Alloys", Acta Met. 27 (1979) 777.
- M.Ahlers, G.Barceló, Proc.Int.Conf.on Martensiitic Transf., Cambridge, Mass.1979, 649. "The influence of cycling on the Rubber like Behavior in Cu Zn Al martensite".
- R.Rapacioli, M.Chandrasekaran; Proc.Int.Conf.on Martensitic Transf., Cambridge, Mass.1979.

SURFACE MARTENSITE IN β Cu Zn Al

It was observed that β phase Cu Zn Al which transformed to martensite only at lower temperatures in bulk contained a surface layer of martensite. Therefore a program was started in 1978 to study the influence of surfaces on the stability of the phases. An analysis of this phenomenon required first a determination and evaluation of the crystallography and morphology of the martensites which was done by studying mainly with transmission electron microscopy thin foils of various surface orientations cut from β phase single crystals. It was found that the number and selection of martensite variants and their structure was strongly dependent on the surface orientation. These results could be interpreted on the basis that a minimum distorted interface between β and martensite parallel to the foil surface had to be created. Not only the selected variants could thus be accounted for but also their structure which varied from hexagonal to orthorhombic with stacking ABCBCACAB, according to the foil orientation, in excellent agreement with the results.

PERSONNEL: F.C.Lovey
M.Chandrasekaran
M. Ahlers
R.Rapacioli

PUBLICATIONS: - F.C.Lovey, M.Chandrasekaran, R.Rapacioli, M. Ahlers; "Diffraction Effects in β Cu Zn Al. Observation and Interpretation of Extra Maxima". Z.Metallkde. 71 (1980) 37.
- F.C.Lovey, M.Chandrasekaran, M.Ahlers; "Diffraction Effects in β Cu Zn Al. II: Analysis of Surface Martensite Particles" subm.Z.Metallkde.

TRAPPING CENTERS IN RED MERCURIC IODIDE SINGLE CRYSTALS

The photoelectronic properties of red HgI_2 have been studied by several authors. In general, one makes use of models involving the presence of traps or recombination centers in the forbidden band gap of the material. In 1971 it was found that HgI_2 was a suitable semiconductor for the detection of nuclear radiation. For this application traps play a significant role capturing excited carriers produced by the incoming radiation. In particular we are studying the properties of hole traps which are very important in HgI_2 due to the low mobility of these carriers. Parameters which describe the behaviour of these traps are determined from measurements of photoconductivity, thermally stimulated current and related techniques.

Mercuric iodide crystals grown by sublimation in vacuum are obtained in our laboratory. They allow the preparation of detectors suitable for low energy gamma ray spectrometry room temperature.

PERSONNEL	Ida Nöllmann
	Jorge L. Regolini
	J. Saura

THERMODYNAMIC STUDY OF THE FLUORITE PHASE IN THE URANIUM-CERIUM-OXYGEN SYSTEM

The fluorite phase of the U-Ce-O system presents a convenient wide range of non-stoichiometry at high temperatures. In order to measure oxygen partial thermodynamic properties, a thermogravimetric experimental facility has been constructed. Particular attention has been given to the control and production of oxygen atmospheres of a given chemical potential, and a precise electrochemical technique is now available to this end. The preliminary study of the phase boundaries of the fluorite phase in the range 700 to 1200 °C has been started.

PERSONNEL: A.Caneiro
 J.P.Abriata

- PUBLICATIONS:
- A.Caneiro, M.Bonnat and J.Fouletier
"Measurement and regulation of oxygen content in selected gases using solid electrolyte cells. IV Accurate preparation of CO₂-CO and H₂O-H₂ mixtures" accepted for publication in Journal of Applied Electrochemistry.
 - A. Caneiro, J.Fouletier, and M.Kleitz "Determination of standard Gibbs energy change of the system CO-CO₂-O₂ using an electrochemical pump and gauge" submitted to publication to J.Chem.Therm.

STRESS EFFECTS IN THE ION LIGAND INTERACTION

Ligand ENDOR spectroscopy has been performed in fluorite type single crystals under uniaxial stress with either Yb^{3+} or Tm^{2+} paramagnetic impurities. By following Baker and Fainstein (J.M.Baker and C.Fainstein, J.Phys C:Solid State Phys, Vol 8, 3685-94 1975) the frequency shift of the ENDOR spectral lines is related to the change in ion-ligand interaction with stress, the results thus obtained are compared with current models for an impurity ion in a lattice.

This work is intended as a contribution towards obtaining added information regarding impurity ions in crystal lattices. We have focused our attention to the correlation found by Anderson et al (C.H.Anderson, P.Call, J.Stott and W.Hayes, Phys.Rev B, Vol.11 N°9, 3305-10, 1975) between superhyperfine and crystal field parameters in the system $\text{Tm}^{2+}:\text{MF}_2$ ($\text{M}=\text{Ca}, \text{Sr}, \text{Ba}$), and the calculations by Ivanenko and Malkin (Z.I.Ivanenko and B.Z.Malkin, Soviet Phys-Solid State, Vol 11 N°7, 1498-503 1970) that gives for the mentioned system an estimation for the ion-ligand distance with and without stress applied along the bonding axis.

PERSONNEL: Carlos Fainstein
Carlos Ramos

PUBLICATIONS: C.Fainstein y C.Ramos "Ligand ENDOR and stress in $\text{Yb}^{3+}:\text{CaF}_2$, $\text{Tm}^{2+}:\text{CaF}_2$ and $\text{Tm}^{2+}:\text{BaF}_2$ ", to be presented at the International Conference on Magnetic resonance ISMAR-Ampere 1980, in Delft, Holland.

SPIN LATTICE COEFFICIENTS OF DILUTE MAGNETIC IMPURITIES.

The application of uniaxial stresses to monocrystalline samples adds small components of variable symmetry and magnitude to the host crystal field. This technique has been used in ESR experiments to determine the spin lattice coefficients of magnetic impurities in ionic insulators. In this project we plan to extend these measurements to some semiconducting and metallic systems. The series of semiconductors chosen are dilute samples of Mn and Eu in the isostructural compounds CdTe and ZnTe. These samples were grown at the Instituto Venezolano de Investigaciones Científicas using a Bridgeman technique. The ESR measurements are being carried out here using a 35 GHz spectrometer.

We have determined the spin-lattice coefficients of Mn^{2+} in CdTe and ZnTe and the results obtained enabled us to estimate the contribution of internal strains to the low temperature linewidth of the ESR spectra. This broadening mechanism is also assumed to be responsible for a considerable part of the residual linewidth of very dilute rare earth in metallic hosts. We plan to study the system Ag Dy to evaluate quantitatively this contribution.

PERSONNEL: M.Tovar
 M.T.Causa
 C.Fainstein

PUBLICATIONS: M.T.Causa, M.Tovar, S.B.Oseroff, R.Calvo and W.Giriart
 "Spin lattice coefficients of Mn^{2+} in II-VI
 Compounds" accepted for publication in Physics Letters
 A (1980).

INTERMEDIATE VALENCE

Theoretical studies of Intermediate valence systems (I.V.) started in 1970 in Bariloche. During the last two years different aspects of the problem were investigated:

- 1) Lattice dynamics of $\text{Sm}_{.75}\text{Y}_{.25}\text{S}$.- A non-adiabatic breathing-shell model was developed to explain the anomalies found by Mook et al. (Phys.Rev.B 18 2925,1978)
- 2) Magnetic order in I.V. Ce compounds. After inclusion of spin-spin interactions in a simplified model of I.V. previously studied, the possibility of "magnetic reentrance" in these compounds was proposed.
- 3) I.V. in transition metal-compounds. Using an heuristic approach I.V. together with the Falicov-Kimball model the phase diagram of $\text{NiS}_{2-x}\text{Se}_x$ was obtained.
- 4) Intermediate valence impurities in superconductors. The model mentioned in 2) was adopted to describe the effect of I.V. impurities in superconductors. The simplicity of the model permits to obtain an exact expression for the free energy and to clarify aspects of the more realistic theory previously developed in Bariloche (C.Wiecko, A.López, Solid State Comm 23 131(1977)).
- 5) Dynamical properties of paramagnetic TmSe. Assuming valence fluctuation between two magnetic configurations, the zero temperature spin and charge dynamical susceptibilities were calculated. The peculiar properties of TmSe can be understood from the analysis of the model.
- 6) Magnetic interaction in rare-earth compounds. A canonical transformation to the Anderson Hamiltonian up to fourth order in the hybridization was performed. Effective interactions between 4f electrons in different sites of the Lattice arising from the hybridization are obtained.

PERSONNEL:

B. Alascio
 A. López
 C. Wiecko
 C. Balseiro
 R. Allub
 A. Aligia
 C. Proetto
 J. Mazzaferro
 H. Ceva (CNEA-Sede Central)

PUBLICATIONS:

J. Mazzaferro and H. Ceva, "The Falicov-Kimball model: An intermediate solution" *Solid state Comm.* 29, 137 (1979)

J. Mazzaferro, H. Ceva and B. Alascio "Intermediate Valence effects on the phase diagram of $\text{NiS}_{2-x}\text{Se}_x$ " To be published in the *Physical Rev. B* (July 1, 1980)

J. Mazzaferro, C. A. Balseiro and B. Alascio "Theory of the spin fluctuation in Tm compound" submitted to the *Phys. Rev. Letters*

R. Allub, O. Machiavelli, C. Balseiro and B. Alascio "Magnetic Reentrance in Intermediate Valence Compounds" To be published in *Solid State Comm.*

R. Allub, C. Wiecko and B. Alascio "Ce Impurities in superconductors: Zero band width limit" Submitted to the *Phys. Rev. B*

B. Alascio, R. Allub and A. A. Aligia. "Localized description of valence fluctuations" *J. Phys. C* (to be published)

B. Alascio, H. Wio, A. López, "Intermediate valence: Phase diagram and Kondo behaviour in a simple model" *Z. Physik B* 36, 37 (1979)

A. López, C. Proetto, "Four Order effective Hamiltonian for the Anderson Lattice" Submitted to the *Phy. Rev. B*.

INTERMETALLIC COMPOUNDS WITH INTERMEDIATE VALENCE CHARACTERISTICS

The study of valence instabilities was centered in metallic Ce and its intermetallic compounds.

a) Ce Sn₃

In the period covered by this report we have analyzed our previous experimental results (magnetic susceptibility, at normal pressure and under a pressure of 6 k bars, magnetization under high magnetic fields and electrical resistivity) together with other experimental results on specific heat and thermoelectric power. By applying the theoretical picture proposed by Alascio et al., J.Phys. F 3, 1324 (1973), it was possible to describe the behaviour of these parameter on the basis of a "two-configuration hybridization model".

b) Ce Laves Phases

The previous magnetic susceptibility measurements on the Ce Ir_a Laves phases were complemented by specific heat measurements performed in the range of 0.5K to 8K. The values of $\gamma = 29 \text{ mJ/K}^2 \text{ mole}$ and $\theta_D = 133\text{K}$ were obtained in this compound.

A systematic study of all known Ce Laves phases was carried out. By applying the "Laves rules" (optimum space filling and optimum metallic radius ratio) it was possible to estimate the metallic radius of Ce atom in those compounds and from that its valence.

c) X-ray Photoelectron Spectroscopy

The binding energy of the 3d and 4d electrons in the Ce atom as component of the Ce Sn₃ and Ce Pd₃ compounds were studied by means of XPS techniques. Because of the strong dependence of this technique on the surface quality, it was not possible to distinguish the presence of two electronic configurations in Ce Sn₃. Better Ce Pd₃ samples had permitted to detect some structure in the Ce peaks. This structure was attributed both electronic configurations and a change in their respective intensities was detected by changing the temperature from 100 K to 600 K.

d) Other studies in progress, related to Ce compounds are:

- 1) Relationships between electron transference, change in the work function and the heat of formation of the Ce compounds;
- 2) Auger spectroscopy in metallic Ce;
- 3) The occurrence of martensitic transformation in the $\text{Ce In}_x \text{Au}_{1-x}$ system.

PERSONNEL: J.G.Sereni (CAB)
 E. García (CAC-CNEA)
 G.L. Olcese (Istituto di Chimica Fisica - Univ.di Genova, Italia)

- PUBLICATIONS:
- J.Sereni, "Evidences for valence fluctuations in the Ce Sn_3 compound". Accepted for publication in Journal of Physics F: Metal Physics.
 - J.Sereni, "Calor específico del Ce Ir_2 a bajas temperaturas", Communication to the "Journes de Calorimetrie et d'Analyse Thermique", Barcelona Spain, June 1980.
 - J.Sereni and G.L. Olcese, "Magnetic Susceptibility and Specific Heat of Ce Ir_2 ", to be published.

MAGNETIC IMPURITIES IN SUPERCONDUCTORS

As a complement to the study of 3d,4f and 5f impurities effect in the same metallic environment the measurement of the specific heat of the superconductive Th Cr alloy was performed.

By analysing the preliminar results, the specific heat jump (Δc) at the transition temperature (T_c) show a $\Delta C/\Delta C_0$ vs. T_c/T_{c0} dependence that is characteristic of a strong pair breaking magnetic impurity.

PERSONNEL: J.G.Sereni (CAB)
J.G.Huber (Tufs Univ.-USA)

APPLICATIONS OF THE PHENOMENOLOGICAL THEORY OF SUPERCONDUCTIVITY

A theory of the Landau domain structure for thin samples of type I superconductors has been developed. Results for the perpendicular critical field obtained, compare quite satisfactorily with experiments on Al and Cd.

Known results for the supercooling field of small superconductive samples have been rederived using a series expansion solution of the second Ginzburg-Landau equation. The method is particularly useful in the case of the hollow cylinder, where the exact expressions are rather involved due to the complications imposed by the boundary conditions and fluxoid quantization conditions.

PERSONNEL: J.M.Simonin
A.López

PUBLICATIONS: J.M.Simonin and A.López; "Theory of Landau domain structure for thin Samples" to be published in J. of Low Temp. Phys.

J.M.Simonin and A.López: "Supercooling of moderately small superconductors", to be published

QUANTUM EFFECTS IN SUPERCONDUCTORS

It has been shown that a superconductor with surface nucleation in a presence of a magnetic field parallel to its axis, has a reversible temperature dependent magnetization between the surface critical temperature, T_{c3} , and the bulk, T_{c2} . The magnetization is diamagnetic near T_{c3} and can become paramagnetic before T_{c2} is reached. This behaviour has been explained by assuming fluxoid conservation. The corresponding quantum number, b , is fixed at the transition from the normal state. Although the proposed theory gives an adequate qualitative explanation, quantitative agreement is far from perfect. There are experimental and theoretical weaknesses that can be responsible for the lack of agreement. From the theoretical point of view it was assumed that the order parameter goes to zero at T_{c3} , disregarding the contribution from the diamagnetism induced by thermodynamic fluctuations. On the experimental side it was known that the quantum state at which the sample is locked is determined by the surface treatment of the sample, in an unpredictable way. During the period covered by this report only the experimental problem has been investigated. By a thorough investigation of the magnetization of type II materials, at temperatures higher than T_{c3} , it was possible to show that weak superconductivity, localized at the surface, is present. This superconductivity is affected by surface treatment although T_{c3} is not. The superconductivity is induced even at temperatures higher than the thermodynamic one at zero field. Effort is now directed to determine if the induced superconductivity is an intrinsic effect modified by surface treatment or if the surface preparation is responsible for its existence.

The temperature dependence of the magnetization of hollow cylinders, in the limit of wall thickness small compared to the coherence length, has been studied theoretically. The problem has been solved using the non linear Ginzburg-Landau equations without limitations on the size of the penetration depth. The influence of fluxoid quantization in the specific heat of hollow cylinders has been investigated showing a periodic discontinuity related to the transition from one quantum state to the next.

PERSONNEL:

R.Arce (Becario de CNEA)

F.de la Cruz

H.J.Fink (Universidad de California,Davis)

B.Gregory (Trinity College,USA)

V.Grunfeld.

J.Luzuriaga(on leave in Imperial College,London)

PUBLICATIONS:

F.de la Cruz,H.J.Fink and J.Luzuriaga,

"Temperature Dependence of the Superconducting Giant Vortex State.Theory and Experiment" .-Phys. Rev.B 20,1947(1979)

H.J.Fink,V.Grunfeld

"Temperature Dependence of Fluxoid Quantization in a Superconducting Hollow Cylinder"
Accepted in Phys Rev. B.

R.Arce,B.Gregory,J.Luzuriaga and F,de la Cruz
"Superconducting Enhancement Near the Sample Surface" Submitted to Phys Rev.B.

H.J.Fink,V.Grunfeld.,

"Periodic Specific Heat Discontinuity at the Normal Superconducting Phase Boundary of a Hollow Cylinder and its Relation to Fluxoid Quantization",Submitted to Phys.Rev.Letters.

R.Arce"Licenciatura Thesis"Instituto Balseiro.

SURFACE SUPERCONDUCTIVITY AND KAPITZA RESISTANCE

It has been shown that surface superconductivity can be used as a localized thermometer to study the temperature close to an interface through which heat is being transported. Using this thermometer we have investigated the temperature profile at the Pb-He interface by means of alloying the lead, thereby changing the coherence length and hence the size of the superconducting thermometer. It is shown that the temperature profile has a characteristic length of $500 \text{ \AA}$. This length is different either from the electron or phonon mean free paths.

Using the same technique it has been studied the interface between lead and sapphire. In this case we find no measurable difference between the extrapolated, conventional temperature, and the surface temperature.

PERSONNEL: E. Martinez
A. Ridner
F. de la Cruz

PUBLICATIONS: A. Ridner, F. de la Cruz and E. Martinez "Surface Superconductivity and Kapitza Resistance" Third International Conference on Phonon Scattering in Condensed Matter, Pergamon Press, to be published.

THERMODYNAMIC AND TRANSPORT PROPERTIES OF METALLIC AMORPHOUS SYSTEMS.

In the period covered by this report the project was started.

An arc furnace was modified to be adapted to the splat cooling techniques. The investigated system $\text{La}_x \text{Cu}_{1-x}$ was chosen because similar La alloys are known to be amorphous superconductors with critical temperatures in the liquid He region; consequently was an appropriate material to check our ability for samples production. The splat cooled $\text{La}_x \text{Cu}_{1-x}$ system has been investigated in a wide range of concentration. By means of X-ray diffraction and measurements of the superconducting phase diagram it was demonstrated that homogeneous amorphous samples were only obtained at the eutectic concentration. Trying to determine the conditions for a better defined amorphous state the samples have been annealed below the crystallization temperatures. The results show that annealing produces short range order modifications that are able to reduce the superconducting critical temperature in 20% simultaneously with a similar reduction in resistivity. These results are consistent with a model in which the electrons from a d band of high density of states and low mobility are transferred to the s band, and do not support the existence of localized f states near the Fermi surface.

Thermal conductivity measurements at low temperatures show that the conductivity is due to phonons. Below T_c the dominant scattering is due to the TLS, showing the typical T^2 dependence. Above T_c electrons are the phonon scattering centers. These results show that the effective number of carriers is one, in agreement with results in liquid La.

PERSONNEL: B.Daudin (French cooperant)
 F.de la Cruz
 M.E.de de la Cruz
 P.Esquinazi
 J.Favaron (French cooperant)

PUBLICATIONS:

J.Favaron, M.E.de la Cruz, P.Esquinazi and F.de la Cruz: "Phase diagram and Superconductive properties of splat cooled $\text{Cu}_x \text{La}_{1-x}$ " Phys.Rev.B.

H.Tutzauer, P.Esquinazi, M.E de la Cruz and F.de la Cruz: "Production of Ribbon Quenched Samples Using an Arc Furnace", Rev.Sci.Instrum.51,546 (1980)

P.Esquinazi, M.E.de la Cruz and F.de la Cruz "Heat Treatement Effects in $\text{La}_{70} \text{Cu}_{30}$ Amorphous System" Submitted to Phys.Rev.Lett.

P.Esquinazi "Licenciatura Thesis" Instituto Balseiro.

B.Daudin "Thermal Conductivity of Amorphous $\text{La}_{70} \text{Cu}_{30}$ " to be published in Solid State Commun.

CONDENSED MATTER STUDIES USING A PULSED NEUTRON SOURCE

The group has been devoted for some time to two research lines, namely total cross section measurements and evaluation, and high momentum transfer neutron diffraction.

During this period, the values of the coherent (σ_c) and incoherent (σ_i) scattering cross sections and the thermal absorption cross section (σ_a) were obtained for Zn and Sn, from the measured total cross sections.

Efforts were mainly concentrated on the development of equipment and techniques for neutron diffraction measurements up to $Q \sim 40 \text{ \AA}^{-1}$, to study liquid structure factors and Debye-Waller temperature factors in solids at constant T.

The spectrometer consists of a bank of detectors following a constant Q_e (elastic momentum transfer) surface with neutrons emerging from a partially moderated pulsed (LINAC) source, thus allowing the time-of-flight technique to be employed. Measurements are then carried out at constant scattering angle with variable incident neutron wavelength, in contrast with reactor or X-ray diffraction experiments which use monoenergetic radiation and variable angle detection.

The availability of a wide range of incident neutron wavelengths, determined with high resolution, is responsible for the large Q_e range available in the backscattering measurements. In the case of solids this allows a large number of Bragg reflections to be detected, thus rendering a good determination of the atomic mean square displacements at a given temperature. In the case of liquids or amorphous substances, it permits an accurate determination of the molecular structure.

Diffraction spectra were recorded from Cu, Mo, CePd_3 , YPd_3 and D_2O at 293 K. Cu and Mo were used to check our system by comparison with previous X-ray and neutron results. CePd_3 and YPd_3 data will be confronted in search for effects due to Ce valence fluctuations.

D_2O data constitute a test of the present spectrometer's capabilities concerning liquid structure studies and will provide useful experience for the new instrument which should start operat-

ing during 1981.

Theoretical studies to account for inelasticity effects in the neutron scattering process are in progress, for both liquid and solid scatterers (the so called 'Placzek' and 'thermal diffuse scattering' corrections, respectively).

PERSONNEL: F.Kropff,
J.R.Granada
R.E.Mayer

PUBLICATIONS: F.Kropff, J.R.Granada and R.E.Mayer "Total neutron cross section of Zinc between 5.6×10^{-4} and 130 eV" Atomkernenergie (accepted for publication)

F.Kropff, R.E.Mayer and J.R.Granada "Total neutron cross section of Tin between 5×10^{-4} and 20 eV". To be submitted.

J.R.Granada "Structural Studies of Molecular Liquids by Neutron Scattering.

Part 1: Experiments on liquids of tetrahedral molecules.

Part 2: A model for the evaluation of inelasticity corrections". PhD Thesis, Instituto Balseiro Universidad Nacional de Cuyo (in Spanish)

SECONDARY ELECTRON EMISSION FROM BOTH SURFACES OF FOILS TRAVERSED BY ION BEAMS

The process of ion induced secondary electron emission is complicated in that first "internal" energetic electrons are produced by an ionic collision. This initial process is followed by a migration of these electrons to and their subsequent passage through the solid surface.

Normally secondary electrons emitted from the surface of a thick target have been observed. By passing an ion beam through a thin solid foil and measuring the electrons emitted from both surfaces, more information can be obtained. Forward emission predominates, especially for higher energy electrons which have been analyzed with a retarding field.

Studies with molecular ions and their dissociation fragments are being performed.

PERSONNEL: W.Meckbach
 I.B.Nemirovsky
 N.Arista
 C.E.Gonzalez Lepera

COLLISIONAL ELECTRON TRANSFER INTO THE CONTINUUM OF PROJECTILES
TRAVERSING GASEOUS AND SOLIDS TARGETS, EXPERIMENTAL AND THEORY.

Experimental studies of the process of electron capture into the continuum of protons, interacting with He-gas, have been performed between 40 and 250 keV. The cross section of this process diverges when the electron velocity coincides, in magnitude and direction with the velocity of the emerging ion. As a consequence the shape and width of doubly differential cusp shaped electron peaks depends decisively on the experimental acceptances in energy and angle. An electron spectrometer has been developed which permits to study this dependence systematically. Measured electron cusps show strong asymmetries which can be attributed to the Coulomb attraction by the residual target ion. These asymmetries are discussed in terms of a formal discussion of the cross section.

For He^+ ions the process of electron loss from projectile bound states into the continuum will be predominant. As there is no ionized target atom left this process leads to symmetric electron spectra.

Studies of peak shapes of electron spectra observed behind thin solid targets traversed by an ion beam are being performed and will be interpreted by comparison with the results obtained under single collision conditions.

These electrons may come from different origins in the foil which will be considered in a theoretical description of the process: wake-bound states, proper bound states around the projectile traversing the solid, or last layer states.

PERSONNEL

W. Meckbach
I. B. Nemirovsky
C. E. González Lepera
V. H. Ponce
C. R. Garibotti
J. E. Miraglia

PUBLICATIONS: V.H.Ponce and W.Meckbach "Collisional charge transfer into the continuum" to appear in Comments on Atomic and Molecular Physics(1980).

W.Meckbach,I.B.Nemirovsky and C.R.Garibotti, "Resolution Dependence and Asymmetry of Charge Transfer to the Continuum Spectra"to be published.

PASSAGE OF SWIFT IONS AND ION CLUSTERS THROUGH THIN
SOLID FOILS

Measurements are performed of energy distributions of swift ions and ion cluster traversing thin solid foils.

The interest is centered on: a) the influence of the charge state of the projectiles before and after passing through the foil, upon the energy loss, and b) correlation effects during the passage of ion clusters through thin foils; both: theoretically and experimentally.

PERSONNEL: Juan C. Eckardt
Gerardo H. Lantschner
Mario Jakas

BACKSCATTERING OF LIGHT IONS FROM SOLID TARGETS COMBINED WITH
CHARGE ANALYSIS OF THE ENCLOSING PROJECTILES.

For gaseous targets the charge distribution of emerging ions beams is a result of consecutive individual collision of electron capture and loss. The origin of charge distributions in ionic beams emerging from solid targets is still an unsolved problem. By measuring energy spectra of backscattered ions with high resolution and separating different charge states of the scattered ions we try to dilucidate how close to the solid surface the observed charge distributions are produced.

PERSONNEL: W.MECKBACH
 J.C.ECKARDT
 P.R.FOCKE

INNER-SHELL EXCITATIONS IN LOW-ENERGY ION SURFACE COLLISIONS

We are studying the excitation of the L-shell of Mg, Al and Si solid targets under bombardment with monoenergetic, mass-analyzed beams of 0.5-10 keV protons and noble gas ions, and under ultra high vacuum conditions.

Characteristic Auger electrons from the sample are energy-analyzed and detected using a high-resolution (0.1%) hemispherical electrostatic spectrometer.

It has been possible, through high resolution measurements under well defined geometry, to detect Doppler shifts of some Auger lines which indicate that they originate from sputtered atoms, thus settling a 12-years old controversy on the subject. It was also determined, through the energy dependence of the L-shell Auger yields and a theory based on general scaling laws, that for heavy projectiles, inner-shell excitations occur mainly through collisions involving fast recoiling target atoms.

For He^+ projectiles, where these recoil effects are negligible, we observed an unexpected deviation from the impact energy dependence predicted by current theories of the process, based on modified forms of the Born approximation. We are currently exploring other, higher order processes, involving two-electron excited intermediate states in the collisions.

Present studies are focused on trying to understand differences between ion- and electron excitation of bulk Auger lines.

PERSONNEL: Raúl A. Baragiola
 Eduardo V. Alonso
 Mario M. Jakas
 Humberto J.L. Raiti

THEORY OF ENERGY LOSS OF CHARGED PARTICLES IN CONDENSED MATTER

The area of interest covers the study of processes of electronic excitation in solids, single particle and plasmon excitations, dielectric response theory, excitation of wakes by swift moving ions, effective charge and dynamic screening of swift ions in solids. The study is partially related to experiments in progress at this Laboratory.

Previous work in this area includes a study of interference effects in the energy loss of correlated charges moving through a solid. The theory explains large differences in the energy loss of ions clusters in thin solid films, as observed by other authors and also at this Laboratory.

In collaboration with Werner Brandt from New York University, we have initiated a study of the energy loss of charged particles in matter under extreme conditions of temperature and pressure, similar to those found in stellar interiors and in inertial confinement of DT Pellets. This study is based on a quantum mechanical description of the dielectric response of an electron gas at arbitrary degeneracy, and it aims to cover a wide range of densities and temperatures, including also solid-state and dilute (tokamak-like) plasmas.

PERSONNEL: N. Arista
W. Brandt (New York University)

PUBLICATIONS: N.R. Arista and W. Brandt "Energy loss and straggling of charged particles in nondegenerate media", to be published

ATOMIC COLLISIONS IN SOLIDS: SPUTTERING, PARTICLE AND ENERGY REFLECTION, AND CORRELATION EFFECTS ON RUTHERFORD'S BACKSCATTERING.

The effects of energetic atomic projectiles on solids are studied by using Boltzmann's transport equation as well as computer simulation models.

The research covers the following subjects:

- 1) Sputtering: a computer simulation model has been developed to study the dependence of the sputtering yield on the projectile incidence angle. Theoretical models of sputtering consider an infinite medium, so they are not adequate to study the sputtering dependence on angle of incidence. On the other hand standard Monte-carlo programs for amorphous materials do not include the possibility of total reflection, while Monte-carlo programs for crystalline materials which consider such events are too much time consuming. Our model has a crystalline structure in the first layers and beneath them there is a random solid. Good agreement is found with experimental results obtained in our lab. in conditions of very low doses.
- 2) Particle and energy reflection: The energy reflection coefficient for light and heavy keV ions has been calculated by solving Boltzmann's transport equation; the angular distribution of the reflected energy flux is also obtained, separating that carried by reflected projectiles from that of sputtered atoms. In this way the dependence of the reflected energy on ion velocity and projectile-target mass ratio is obtained.
- 3) Correlation effects on 180° Rutherford backscattering: Recent experiments have shown that there is an enhancement on the near 180° backscattering yield for light ~ 1 MeV ions colliding with heavy solid targets. We have explained this enhancement by means of a computer simulation model which considers the correlation between ingoing and outgoing trajectories, neglecting the disturbance of the medium by the ion. A more detailed study on this subject is in progress using transport theory.

PERSONNEL: M.M.Jakas
V.H.Ponce

PUBLICATIONS: M.M.Jakas "FLUCTUATION IN THE SPATIAL DISTRIBUTION
ENERGY DEPOSITED BY ATOMIC PARTICLES"Phys.Lett.
72A 423 (1979)

M.M.Jakas and R.Baragiola"EXPLANATION FOR THE 180°
RUTHERFORD BACKSCATTERING ANOMALY IN SOLIDS"Phys.
Rev.Lett.44 424 (1980)

M.M.Jakas and M.R.Williams"ENERGY REFLECTION BY
BACKSCATTERING AND SPUTTERING.TOTAL YIELDS AND
ANGULAR DISTRIBUTIONS"J.Phys.D(in press)(1980)

INVESTIGACION BASICA

Trabajos publicados en 1980:

1. PRODUCTION OF RIBBON QUENCHED SAMPLES USING AN ARC FURNACE
H. Tutzauer, P. Esquinazi, M.E. de la Cruz y F. de la Cruz
Rev. Sci. Instrum 51(4), 546 (1980)
2. PHASE DIAGRAM AND SUPERCONDUCTIVE PROPERTIES OF SPLAT-COOLED $\text{Cu}_x\text{La}_{1-x}$.
J. Favaron, M.E. de la Cruz, P. Esquinazi y F. de la Cruz
Phys. Rev. B, 21, 2804 (1980)
3. SURFACE SUPERCONDUCTIVITY AND KAPITZA RESISTANCE
A. Ridner, F. de la Cruz y E.N. Martínez
Third Int. Conf. on PHONON SCATTERING IN CONDENSED MATTER
Brown University, USA, 1979.
Edited by Humphrey J. Maris (Plenum Publishing Corporation)
pág. 199 (1980)
4. DIFFRACTION EFFECTS IN Cu-Zn-Al . OBSERVATIONS AND INTERPRETATIONS OF EXTRA MAXIMA
F. Lovey, M. Chandrasekaran, R. Rapacioli y M. Ahlers
Z. für Metallkde. 71, 37 (1980)
5. COMMENT ON "A CLASSICAL TEST OF THE ENTROPY PRODUCTION FUNCTION. COMPATIBILITY WITH KINETIC LAWS AND LOCAL EQUILIBRIUM"
C.I. Smoglie y J.P. Abriata
J. of Physical Chemistry, 84, 464 (1980)
6. EXPLANATION FOR THE 180° RUTHERFORD BACKSCATTERING ANOMALY IN SOLIDS
M.M. Jakas y R. Baragiola
Phys. Rev. Lett. 44, N°6, 424 (1980)
7. IONIZATION AND ELECTRON CAPTURE TO THE CONTINUUM IN THE H^+ -HYDROGEN-ATOM COLLISION
C.R. Garibotti y J.E. Miraglia
Physical Review A, 21, N°2, 572 (1980)
8. THE EMISSION OF ENERGETIC ELECTRONS FROM ATOMS BY FAST IONS CONSIDERED AS A CHARGE-TRANSFER PROCESS
J.E. Miraglia y V.H. Ponce
J.Phys.B.: Atom.Molec.Phys 13, 1195 (1980)
10. TOTAL CROSS SECTION AND DIFFUSION PARAMETERS OF BENZENE
J. Lolich y M. Abbate
Atomkernenergie 35, N°1, 23 (1980)

..// 1980

11. LOCALISED DESCRIPTION OF VALENCE FLUCTUATIONS
B. Alascio, R. Allub y A. Aligia
J. Phys.C: Solid St.Phys. 13, 2869 (1980)
12. FIELD THEORY WITH ϕ^4 and ϕ^6 SELF-INTERACTION
D. Boyanovsky y L. Masperi
Phys. Rev. D, 21, N°6, 1550 (1980)

INVESTIGACION BASICA

Trabajos aceptados para su publicación en 1980:

1. EVIDENCES FOR VALENCE FLUCTUATIONS IN THE Ce Sm₃ COMPOUND
J. Sereni
J. of Phys. F: Metal Physics
2. STUDY OF INTRINSIC POINT DEFECT IN TANTALUM AFTER PLASTIC DEFORMATION AT LIQUID HELIUM TEMPERATURES
H. Peretti, M.A. Mondino y A. Seeger
Mat.Sci.Eng.
3. OMEGA AND THE MARTENSITIC TRANSFORMATION IN Zr-10 Nb AND Zr-10 Nb-1 Al
J.C. Bolcich, H. Peretti y M. Ahlers
J. of Nuclear Materials
4. Z₁- DEPENDENCE OF ION INDUCED ELECTRON EMISSION FROM ALUMINIUM
E.V. Alonso, R.A. Baragiola, J. Ferrón, M. Jakas y A. Oliva Florio
Phys. Rev. B
5. ADIABATIC EFFECTS IN ATOMIC INNER SHELL IONIZATION BY HEAVY CHARGED PARTICLES.
E. Goldberg y V.H. Ponce
Phys. Rev. A
6. ENERGY REFLECTION BY BACKSCATTERING AND SPUTTERING. TOTAL YIELDS AND ANGULAR DISTRIBUTIONS
M. Jakas y M. Williams
J. of Phys. D
7. COLLISIONAL CHARGE TRANSFER INTO THE CONTINUUM
V.H. Ponce y W. Meckbach
Comments on Atomic and Molecular Physics
8. NEUTRON THERMALIZATION PROCESS IN BENZENE
M. Abbate, J. Lolich, y H. Wio
Atomkernenergie
9. TOTAL NEUTRON CROSS SECTION OF ZINC BETWEEN 5.6×10^{-4} AND 130eV.
F. Kropff, R. Granada y R. Mayer
Atomkernenergie

..// Aceptados 1980

10. EFFECT OF PHOTONEUTRONS ON THERMALIZATION EXPERIMENTS IN D₂O
C. Gho, M. Scaffoni, T. Parkinson y M. Abbate
Nuclear Sci. and Eng.
11. MEASUREMENTS AND CALCULATIONS OF THE EIGENVALUES "α" AND "k"
FOR A HIGHLY SUBCRITICAL ASSEMBLY
J.V. Lolich y H. Boado
12. SPIN-LATTICE COEFFICIENTS OF Mn²⁺ IN II-IV COMPOUNDS
M.T. Causa, S.B. Oseroff, M. Tovar, R. Calvo y W. Giriat
Physics Letters A
13. APPLICATIONS OF THE SEMIQUANTUM APPROXIMATION TO LATTICE
FIELD THEORIES
L. Masperi y A. Saglio
Phys. Rev. D
14. INTERMEDIATE VALENCE EFFECTS ON THE PHASE DIAGRAM OF Ni
S_{2-x} Se_x.
J. Mazzaferro, H. Ceva, B. Alascio
Phys. Rev. B
15. Ce IMPURITIES IN SUPERCONDUCTORS ZERO BAND WIDTH LIMIT
R. Allub, C. Wiecko y B. Alascio
The Physical Review
16. THEORY OF THE LANDAU DOMAIN STRUCTURE FOR THIN SAMPLES
J. Simonin y A. López
J. of Low Temperature Physics
17. MAGNETIC REENTRANCE IN INTERMEDIATE VALENCE COMPOUNDS
R. Allub, O. Machiavelli, C. Balseiro y B. Alascio
Solid State Comm.
18. TEMPERATURE DEPENDENCE OF FLUXOID QUANTIZATION IN A
SUPERCONDUCTING HOLLOW CYLINDER
V. Grunfeld y H.J. Fink
Physical Review B
19. VARIATIONAL METHOD FOR THE Z(2) GAUGE MODEL
D. Boyanovsky, R. Deza y L. Masperi
Phys. Rev. D

INVESTIGACION BASICA

Trabajos publicados en 1979:

1. TEMPERATURE DEPENDENCE OF THE SUPERCONDUCTING GIANT-VORTEX STATE. THEORY AND EXPERIMENT
F. de la Cruz, H.J. Fink & J. Luzuriaga
Phys. Rev. B, 20, N° 5, 1947 (1979)
2. LOW TEMPERATURE SPECIFIC HEAT OF Th-Gd SPIN GLASS
J.G. Sereni, T.H. Huber y C.A. Luengo
Solid State Communications, 29, 671 (1979)
3. THE INFLUENCE OF SHORT RANGE DISORDER ON THE MARTENSITIC TRANSFORMATION IN Cu-Zn-Al ALLOYS
R. Rapacioli y M. Ahlers
Acta Met. 27, 777 (1979)
4. THE STABILITY OF MARTENSITE IN Cu-Zn ALLOYS
M. Ahlers
Z. für Metallkunde 70, N°6, 379 (1979)
5. THE STRESS INDUCED PHASE TRANSFORMATION IN MARTENSITIC SINGLE CRYSTAL OF Cu-Zn-Al ALLOYS
G. Barceló, M. Ahlers y R. Rapacioli
Z. für Metallkunde, 70, N°11, 732 (1979)
6. COMMENT ON A THERMODYNAMIC PROOF OF THE INEQUALITY BETWEEN ARITHMETIC AND GEOMETRIC MEAN
J.P. Abriata
Physics Letter, 71A, N°4, 309 (1979)
7. ELECTRON EMISSION FROM CLEAN METAL SURFACES INDUCED BY LOW ENERGY LIGHT IONS
R.A. Baragiola, E.V. Alonso y A. Oliva Florio
Phys. Rev. B, 19, 121 (1979)
8. ION INDUCED ELECTRON EMISSION FROM CLEAN METALS
R.A. Baragiola, E.V. Alonso, J. Ferrón y A. Oliva Florio
Surface Science 90, 240 (1979)
9. THE INFLUENCE OF EXPERIMENTAL RESOLUTION AND BACKGROUND UPON ION INDUCED $v_e = v_i$ ELECTRON DISTRIBUTIONS MEASURED BEHIND SOLID FOILS
K.C.R. Chiu, W. Meckbach, G. Sánchez Sarmiento y J.Wm.McGowan
J.Phys.Atom.Molec.Phys., 12, N°5, 147 (1979)
10. FLUCTUATION IN THE SPATIAL DISTRIBUTION OF ENERGY DEPOSITED BY ATOMIC PARTICLES
M.M. Jakas
Phys. Let. 72A, N°6, 423 (1979)

11. COMMENT ON THE DETERMINATION OF CHARGE STATE OF IONS MOVING THROUGH SOLIDS FROM THE ANALYSIS OF X-RAY SPECTRA
R.A. Baragiola
Physical Review A, 19, N°6, 2470 (1979)
12. OPTIMIZED TRANSLATION FACTOR FOR LOW ENERGY PROTON-HYDROGEN-ATOM COLLISIONS
V.H. Ponce
J.Phys.B: Atom Molec. Phys., 12, N° 22, 3731 (1979)
13. ENERGY DEPENDENCE OF THE MOLECULAR EFFECT IN SPUTTERING
A. Oliva Florio, E. Alonso, R. Baragiola, J. Ferrón y M. Jakas
Radiation Effects Letters, 50, 3 (1979)
14. ELECTRON EMISSION FROM INCONEL UNDER ION BOMBARDMENT
E.V. Alonso, R.A. Baragiola, J. Ferrón y A. Oliva Florio
Radiation Effects, 45, 119 (1979)
15. THEORETICAL ANGULAR DISTRIBUTIONS FOR ELASTIC e-H SCATTERING
C.R. Garibotti y P.A. Massaro
Revista Brasileira de Física, 9, N° 3, 679 (1979)
16. STOPPING OF LOW ENERGY MOLECULAR IONS
J.C. Eckardt, G. Lantschner, N.R. Arista y R.A. Baragiola
Proceeding of the International Workshop on the Physics of Fast Ions Beams, Argonne, 1979
17. OUTGOING NEUTRON SPECTRUM FROM H₂O IN A H₂O-URANIUM INTERFACE
J.V. Lolich y M. Abbate
Atomkernenergie, 34, N° 4, 275 (1979)
18. NEUTRON THERMALIZATION IN HEAVY WATER. MEASUREMENT AND CALCULATION OF SPECTRA
M. Abbate y J. Lolich
Atomkernenergie 33, N°3, 195 (1979)
19. INTERMEDIATE VALENCE: PHASE DIAGRAM AND KONDO BEHAVIOUR IN A SIMPLE MODEL
B. Alascio, H. Wio y A. López
Z. Physik B, 36, 37 (1979)
20. THEORY OF MOSSBAUER EFFECT IN INTERMEDIATE VALENCE COMPOUNDS
C. Balseiro, B. Alascio y A. López
Phys. Rev. B, 19, N°10, 5131 (1979)
21. FLUXOID QUANTUM NUMBER AT Hc₃
A. López y H. Fink
Phys. Lett. A 72, 173 (1979)

22. CALCULATION OF CRITICAL POMERON INTERCEPT WITH BLOCK-SPIN
METHODS, R. Deza y L. Masperi
Nuclear Physics B154, 173 (1979)
23. PHASES OF $Z(N)$ LATTICE GAUGE THEORY
D. Boyanovsky
Nuovo Cimento, 54A, 451 (1979)

INVESTIGACION BASICA

Trabajos publicados en 1978:

1. CALORIMETRIC STUDY OF THE MAGNETIZATION OF Ce IMPURITIES IN SUPERCONDUCTING Th-Y AND Th-Sc ALLOYS
J.C. Sereni, J.G. Huber, C.A. Luengo y M.B. Maple
Journal of Low Temperature Physics 30, N°5, 6 (1978)
2. REVERSIBLE MAGNETIZATION OF SURFACE SUPERCONDUCTIVITY
J. Luzuriaga y F. de la Cruz
Solid State Communications, 25, 605 (1978)
3. A MODEL FOR THE RUBBER-LIKE BEHAVIOUR IN Cu-Zn-Al MARTENSITE
M. Ahlers, G. Barceló y R. Rapacioli
Scripta Met. 12, 1075 (1978)
3. THE RUBBER EFFECT IN Cu-Zn-Al MARTENSITE
G. Barceló, R. Rapacioli y M. Ahlers
Scripta Met. 12, 1069 (1978)
4. ACOUSTIC EMISSION AND GRAIN SIZE IN PLASTIC DEFORMATION OF METALS
S. Mintzer, R. Pascual y R. Volpi
Scripta Met., 12, 531 (1978)
5. ELECTRONIC STOPPING OF SLOW MOLECULAR IONS IN SOLIDS
J.C. Eckardt, G. Lantschner, N.R. Arista y R.A. Baragiola
J. Phys. C: Solid State Phys., 11, 851 (1978)
6. MOLECULAR EFFECTS IN ION-ELECTRON EMISSION FROM CLEAN METAL SURFACES
R.A. Baragiola, E.V. Alonso, O. Auciello, J. Ferrón, G. Lantschner y A. Oliva Florio
Physics Letters, 67A, N°3, 211 (1978)
7. ENERGY LOSS OF CORRELATED CHARGES IN ELECTRON GAS
N.R. Arista
Physical Review B, 18, N°1, 1 (1978)
8. ENERGY LOSS AND STRAGGLING OF PROTONS AND HELIUM IONS TRAVERSING SOME THIN SOLID FOILS
J.C. Eckardt
Physical Review A, 18, N° 2, 426 (1978)
9. ANALYSIS OF EXPERIMENTAL VELOCITY DISTRIBUTIONS OF CONVOY ELECTRONS
W. Meckbach, N. Arista y W. Brandt
Physics Letters, 65A, N°2, 113 (1978)

10. ON THE SUMMATION OF PARTIAL WAVE EXPANSIONS IN POTENTIAL SCATTERING
F. Grinstein y C.R. Garibotti
Proceedings of the CONFERENCE ON THE MATHEMATICAL AND COMPUTATIONAL ASPECTS OF ATOMIC SCATTERING THEORY.
Canadá 1978. Ed. by Nuttall, University of Western Ontario
11. PRODUCTION OF MULTIGROUP CROSS SECTION SETS FROM GGC-3 DATA LIBRARY
H.J. Boado, C.J. Gho y M.J. Abbate
NEA-CPL, News Letter 22, 31 (1978)
12. MEASUREMENT AND CALCULATION OF LEAKAGE NEUTRON SPECTRUM IN LIGHT WATER
J.V. Lolich y M. Abbate
Atomkernenergie, 31, N°3, 144 (1978)
13. TOTAL NEUTRON CROSS SECTION OF MOLYBDENUM IN THE THERMAL RANGE
F. Kropff, J.R. Granada, R.E. Mayer y L.A. Remez
Atomkernenergie, 31, N°1, 42 (1978)
14. POWER SPECTRUM OF VALENCE FLUCTUATIONS
A. López y C. Balseiro
Phys. Rev. B, 17, N° 1, 99 (1978)
15. DEMAGNETIZATION THROUGH LEVEL CROSSING: THE EFFECT OF CHARGE FLUCTUATIONS
H.S. Wio, A. López y B. Alascio
J. of Magnetism & Magnetic Materials 8, 71 (1978)
16. ENERGY DEPENDENCE OF THE ρ -TRAJECTORY INTERCEPT
A. García, C.A. García Canal y L. Masperi
Phys. Rev. D17, 917 (1978)
17. REGGEON FIELD THEORY WITH A THRESHOLD APPROACH TO SECONDARY REGGEONS
A. García, C.A. García Canal y N. Parga
Phys. Rev. D 18, 2684 (1978)