

Abstracta

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Trabalhos Aceitos para Publicação

A009-03 à A011-03

Trabalhos Publicados

P155-03 à P174-03

TRABALHOS ACEITOS PARA PUBLICAÇÃO

A 009-03 "Thermal Expansion and Magneto-volume Effects in the Heavy-Fermion System Ce₂RhIn₈"

Malinowski A., Hundley M.F., Moreno N.O., Pagliuso P.G., Sarrao J.L., and Thompson J.D.

We present the results of thermal expansion $\alpha(T)$, magnetostriction $\tilde{\epsilon}(H,T)$, and specific heat $C_p(T)$ measurements made on the heavy-fermion antiferromagnet (AFM) Ce₂RhIn₈. The effects of magnetic order are clearly evident as anomalies in $\alpha(T)$ at $T_N = 2.8$ K and at $T_m = 1.65$ K. $C_p(T)$ data indicate that the upper transition corresponds to the onset of long-range AFM order while the lower transition involves only a subtle rearrangement of the ordered state. Both C_p/T and α/T grow with decreasing temperature below 20 K in a manner consistent with Kondo renormalization. Kondo interactions appear to be responsible for the large electronic Grüneisen parameter which extrapolates to $Oe \sim 48$ as $T \rightarrow 0$, while the characteristic Kondo energy is $T_K \sim 10$ K as determined from the C_p/T ratio at T_N . Above 20 K $\alpha(T)$ is dominated by crystalline electric field (CEF) effects. The data are consistent with a CEF level scheme consisting of excited $\tilde{A}_7(1)$ and \tilde{A}_6 doublets lying 71 ± 6 K and 195 ± 10 K above a $\tilde{A}_7(2)$ ground-state. In the paramagnetic state ($T > T_N$) the volume magnetostriction follows a simple scaling law, $\tilde{\epsilon} \propto \mu [H/(T+T_l)]^2$. The scaling parameter $T_l = 5$ K is consistent with the Kondo temperature determined from $\alpha(T)$ and $C_p(T)$ data. Analysis of $\tilde{\epsilon}(H,T)$ data also indicates that the magnetic and electronic energy scales associated with the Kondo state in Ce₂RhIn₈ result from competition between magnetic exchange, Kondo, and CEF interactions.

Physical Review B 68[18], 184419, 2003.

A 010-03 "Avoided Antiferromagnetic Order and Quantum Critical Point in CeCoIn₅"

Bianchi A., Movshovich R., Vekhter I., Pagliuso P.G., and Sarrao J.L.

We measured specific heat and resistivity of heavy fermion CeCoIn₅ between the superconducting critical field $H_{c2} = 5$ T and 9 T, with field in the [001] direction, and at temperatures down to 50 mK. At 5 T the data show Non Fermi Liquid behavior down to the lowest temperatures. At field above 8 T the data exhibit crossover from the Fermi liquid to a Non Fermi Liquid behavior. We analyzed the scaling properties of the specific heat, and compared both resistivity and the specific heat with the predictions of a spin-fluctuation theory. Our analysis leads us to suggest that the NFL behavior is due to incipient antiferromagnetism (AF) in CeCoIn₅ with the quantum critical point in the vicinity of the H_{c2} . Below H_{c2} the AF phase which competes with the paramagnetic ground state is superseded by the superconducting transition.

Physical Review Letters 91[25], 257001, 2003.

A 011-03 "Elastic positron scattering by C₂H₂: differential cross sections and virtual state formation"

Claudia R. C. de Carvalho, Márcio T. do N. Varela and Marco A. P. Lima, Euclimar P. da Silva

We present calculated elastic differential cross sections for positron-acetylene scattering, obtained by using the Schwinger multichannel method (SMC). Our results are in very good agreement with quasielastic experimental data of Kauppila et al. (Nucl. Instrum. Meth. Phys. Res. B 192,162 (2002)). We also discuss the existence of a virtual state (zero-energy resonance) in e^+ -C₂H₂ collisions, based on the behavior of the integral cross section and of the s-wave phase shift.

As expected the $\sigma_{\text{ann}}^{\text{virtual}}$ nuclei cross section and annihilation parameter (Z_{eff}) present the same energy dependence at very low impact energies. As the virtual state energy approaches zero, the magnitude of both cross section and Z_{eff} are extremely enhanced (at zero impact energy). The possibility of shifting from a low-lying virtual state to a shallow bound state is not expected to significantly affect room-temperature annihilation rates.

Physical Review A 68[6], 062706, 2003.

TRABALHOS PUBLICADOS

P 155-03 "Analysis of the contributions of three body potentials in the equation of state of He-4"

Ujevic, S. and Vitiello, S.

The effect of three-body interatomic contributions in the equation of state of He-4 are investigated. A recent two-body potential together with the Cohen and Murrell [Chem. Phys. Lett. 260, 371 (1996)] three-body potential are applied to describe bulk helium. The triple-dipole dispersion and exchange energies are evaluated subjected only to statistical uncertainties. An extension of the diffusion Monte Carlo method is applied in order to compute very small energies differences. The results show how the three-body contributions affect the ground-state energy, the equilibrium, melting and freezing densities.

Journal of Chemical Physics 119[16], 8482-8491. 2003

P 156-03 "Discovery and measurement of optically pumped far-infrared laser emissions in (CD₃OH) C-13"

Vasconcellos, E. C. C., Jackson, M., Hockel, H., Lauters, M., Allen, M. D., and Evenson, K. M.

We report the discovery of four laser emissions from the partially deuterated C-13 methanol isotope (CD₃OH)-C-13 when optically pumped with a cw carbon dioxide (CO₂) laser. The wavelengths of these lines, ranging from 45.3 to 108.9 μm , are reported along with their polarizations relative to the CO₂ pump laser, operating pressure, and relative intensity. A three-laser heterodyne system was then used to measure the frequencies of eight optically pumped laser emissions from this methanol isotope. These emissions range from 53.4 to 126.1 μm and are reported with fractional uncertainties up to $\pm 2 \times 10^{-7}$.

Applied Physics B-Lasers and Optics 77[6-7], 561-562.2003.

P 157-03 "Dressed-band approach and Coulomb corrections to the light-induced exciton Stark shift"

Brandi, H. S., Latge, A., and Oliveira, L. E.

In the present work, we perform a comparison of theoretical approaches involving Coulomb-interaction corrections within the Hartree-Fock approximation and the renormalized dressed-band scheme in the large detuning limit. We focus on the well-studied optical Stark shift of the exciton peak in bulk and GaAs-(Ga,Al)As semiconductor quantum wells. It is argued that the Hartree-Fock scheme has severe limitations concerning its application to real experimental situations, even in the simplest laser field-perturbative regime. It is also shown, through a comparison between experiments and a three-band Kane-dressed GaAs-(Ga,Al)As quantum well calculation,

that a proper treatment of band structure and confinement effects due to the quantum well is of fundamental importance in a theoretical understanding of Stark shift experimental measurements, and that the renormalized dressed-band approach is a very convenient tool to treat, in the large detuning limit, processes involving the laser-semiconductor interaction in low-dimensional heterostructures.

Journal of Applied Physics 94[9], 5742-5747. 2003.

P 158-03 “Electric potential for a resistive toroidal conductor carrying a steady azimuthal current”.

Hernandes, J. A. and Assis, A. K. T.

In this work we treat a resistive toroidal conductor carrying a steady azimuthal current. We calculate the electric potential everywhere in space. We also present the electric field inside and outside the toroid and the surface charge distribution along the conductor. We compare our theoretical result with Jefimenko's experiment.

Physical Review e 68[4]. 046611. 2003.

P 159-03 “Estimation of optical parameters of very thin films”.

Birgin, E. G., Chambouleyron, I. E., Martinez, J. M., and Ventura, S. D.

In recent papers, the problem of estimating the thickness and the optical constants (refractive index and absorption coefficient) of thin films using only transmittance data has been addressed by means of optimization techniques. Models were proposed for solving this problem using linearly constrained optimization and unconstrained optimization. However, the optical parameters of “very thin” films could not be recovered with methods that are successful in other situations. Here we introduce an optimization technique that seems to be efficient for recovering the parameters of very thin films.

Applied Numerical Mathematics 47[2], 109-119. 2003.

P 160-03 “Exact general relativistic perfect fluid disks with halos”.

Vogt, D. and Letelier, P. S.

Using the well-known “displace, cut, and reflect” method used to generate disks from given solutions of Einstein's field equations, we construct static disks made of a perfect fluid based on vacuum Schwarzschild's solution in isotropic coordinates. The same method is applied to different exact solutions to Einstein's equations that represent static spheres of perfect fluids. We construct several models of disks with axially symmetric perfect fluid halos. All disks have some common features: surface energy density and pressure decrease monotonically and rapidly with the radius. As the “cut” parameter a decreases, the disks become more relativistic, with the surface energy density and pressure more concentrated near the center. Also, regions of unstable circular orbits are more likely to appear for high relativistic disks. Parameters can be chosen so that the sound velocity in the fluid and the tangential velocity of test particles in circular motion are less than the velocity of light. This tangential velocity first increases with radius and reaches a maximum.

Physical Review D 68[8]. 084010. 2003.

P 161-03 “Extension of the method of continued fractions to molecular photoionization: an application to ammonia”.

Nascimento, E. M., Ribeiro, E. M. S., Brescansin, L. M., Lee, M. T., and Machado, L. E

A computational code based on the method of continued fractions, previously developed by our group for electron-molecule scattering calculations, is extended to treat photoionization of molecules of arbitrary symmetry. This new computational code is applied to study the photoionization of the two outermost valence orbitals of ammonia in the exact static-exchange level of approximation. The method has proved to be very accurate and rapidly convergent. Our results obtained for cross sections agree well with both experimental and theoretical results available in the literature.

Journal of Physics B-Atomic Molecular and Optical Physics 36[17], 3621-3627. 2003.

P 162-03 “Local anisotropy in strained manganite thin films”.

Souza-Neto, N. M., Ramos, A. Y., Tolentino, H. C. N., Favre Nicolin, E., and Ranno, L.

We report on an angular resolved x-ray absorption spectroscopy study of the local atomic structure around the manganese ions in $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ thin films epitaxially grown on tensile and compressive substrates. Ab initio calculations provide strong support to the analysis of the experimental data and make possible the unambiguous derivation of a model of local distortion around the manganese atoms, without modification of the tilt angle Mn-O-Mn, among the octahedra. This distortion, tending to localize the charge carriers, is the driving parameter in the modifications of the magnetic and transport properties observed in thin films with respect to bulk systems.

Applied Physics Letters 83[17], 3587-3589. 2003.

P 163-03 “Localization effects and inelastic scattering in disordered heavy electrons”.

Aguiar, M. C. O., Miranda, E., and Dobrosavljevic, V.

We study ground-state and finite-temperature properties of disordered heavy fermion metals by using a generalization of dynamical mean-field theory which incorporates Anderson localization effects. The emergence of a non-Fermi-liquid metallic behavior even at moderate disorder is shown to be a universal phenomenon resulting from local density of states fluctuations. This behavior is found to have a character of an electronic Griffiths phase, and can be thought of as a precursor of Anderson localization in a strongly correlated host. The temperature dependence of the conducting properties of the system reveal a non-trivial interplay between disorder and inelastic processes, which are reminiscent of the Mooij correlations observed in many disordered metals.

Physical Review B 68[12]. 125104. 2003.

P 164-03 “Magnetothermal conductivity of highly oriented pyrolytic graphite in the quantum limit”.

Ocana, R., Esquinazi, P., Kempa, H., Torres, J. H. S., and Kopelevich, Y.

We report on the magnetic field ($0 < T \leq 9$ T) dependence of the longitudinal thermal conductivity $\kappa(T, B)$ of highly oriented pyrolytic graphite in the temperature range $5 < K \leq 20$ K for fields parallel to the c axis. We show that $\kappa(T, B)$ shows large oscillations in the high-field region ($B > 2$ T) where clear signs of the quantum-hall effect are observed in the Hall resistance. With the measured longitudinal electrical resistivity we show that the Wiedemann-Franz law is violated in the high-field regime.

Physical Review B 68[16]. 165408. 2003.

P 165-03 “Magnetotransport, magnetic, and structural properties of TM-SiO₂ (TM=Fe, Co, Ni) granular alloys”.

Socolovsky, L. M., Denardin, J. C., Brandl, A. L., and Knobel, M.

TM_x(SiO₂)_(1-x) (transition metals, or TM=Fe, Co, Ni) thin films were prepared in a wide concentration range with the purpose of studying the giant Hall effect (GHE). The structure was studied using transmission electron microscopy (TEM), X-ray diffraction (XRD), and small angle X-ray scattering (SAXS). Magnetic, transport, and magnetotransport properties were investigated by means of magnetization, resistivity, and Hall effect measurements. TEM images show nanometer-sized spherical structures embedded in an SiO₂ amorphous matrix, with typical sizes ranging from 2 to 7 nm when TM volume concentration x is increased. SAXS measurements show a broadened peak. XRD measurements show that the system consists of amorphous SiO₂ and a crystalline peak, corresponding to small TM crystallites. The observed magnetic properties are strongly dependent on x , and clearly display an evolution resulting from the progressive increase in the mean particle size. Above the percolation threshold region all samples display GHE. Relationships between structure and magnetotransport properties are discussed.

Materials Characterization 50[2-3], 117-121. 2003.

P 166-03 “Nonlinear optical absorption of semiconductor quantum wires: Photoexcitation dynamical effects”.

Madureira, J. R., Degani, M. H., and Maialle, M. Z.

We investigate the optical absorption spectra of semiconductor quantum wires and its dependence on the optical pumping power. The absorption coefficient is obtained solving the semiconductor Bloch equations in the real-space and time domains, including corrections due to band-gap renormalization, local field, and screening. We find that the energy shifts in the spectra due to increasing photoexcitation power have different behavior when treating dynamically the carrier creation rather than using stationary carrier distribution at thermal equilibrium. Dealing with the nonequilibrium distribution dynamically, we are able to describe the observed constancy of the peak position of the fundamental transition energy with the optical pumping power. The competing effects of the dynamical band-gap renormalization and the local-field correction leads to an almost cancellation of the red/blue shift energy.

Physical Review B 68[16]. 161301. 2003.

P 167-03 “On the solutions of the Lorentz-Dirac equation”.

Vogt, D. and Letelier, P. S.

We discuss the unstable character of the solutions of the Lorentz-Dirac equation and stress the need of methods like order reduction to derive a physically acceptable equation of motion. The discussion is illustrated with the paradigmatic example of the non-relativistic harmonic oscillator with radiation reaction. We also illustrate the removal of the noncausal pre-acceleration with the introduction of a small correction in the Lorentz-Dirac equation.

General Relativity and Gravitation 35[12], 2261-2269. 2003.

P 168-03 “Optical and x-ray diffraction studies on the incorporation of carbon as a dopant in cubic GaN”.

Fernandez, J. R. L., Cerdeira, F., Meneses, E. A., Brasil, M. J. S. P., Soares, J. A. N. T., Santos, A. M., Noriega, O. C., Leite, J. R., As, D. J., Kohler, U., Potthast, S., and Pacheco Salazar, D. G.

We performed optical and x-ray diffraction experiments on carbon doped cubic-GaN samples, deposited by plasma-assisted molecular beam epitaxy on (001) GaAs substrates, for various carbon concentrations. The samples were studied by Raman, photoluminescence, and photoluminescence excitation spectroscopies. These techniques give some insight into the mechanism of carbon incorporation in the material. Detailed analysis of these spectra leads to a picture in which carbon initially enters into N vacancies producing a marked improvement in the crystalline properties of the material. At higher concentrations it also begins to enter interstitially and form C complexes, with a consequent decrease of crystalline quality. This increase and later decrease of crystalline quality of our samples with the addition of C were also detectable in x-ray diffraction scans. A model calculation of the localized vibrations of the C atom in the GaN lattice allows for the interpretation of a feature in the Raman spectrum of some samples, which reinforces this view.

Physical Review B 68[15]. 155204. 2003.

P 169-03 “Piezoelectric coefficients of L-arginine hydrochloride monohydrate obtained by X-ray multiple diffraction using synchrotron radiation”.

Almeida, J. M. A., Miranda, M. A. R., Remedios, C. M. R., Melo, F. E. A., Freire, P. T. C., Sasaki, J. M., Cardoso, L. P., dos Santos, A. O., and Kycia, S.

In this paper, a very useful development to improve the application of a method based on the multiple-diffraction technique to determine the piezoelectric coefficients of crystals is described. The idea is to choose any specific crystallographic direction (plane) through the secondary peaks in the Renninger scan instead of those directions related to the electric field by the piezoelectric tensor. For a set of multiple-diffraction planes, it is possible to obtain an equation system based on the ordinary peak position for each H secondary plane that appears in the Renninger scan. This useful development was successfully applied to the amino acid L-arginine hydrochloride monohydrate in order to provide the $d(21)$, $d(22)$, $d(23)$ and $d(25)$ piezoelectric coefficients by applying the electric field along the [010] crystallographic direction.

Journal of Applied Crystallography 36, 1348-1351. 2003.

P 170-03 “Possible Fulde-Ferrell-Larkin Ovchinnikov superconducting state in CeCoIn₅”.

Bianchi, A., Movshovich, R., Capan, C., Pagliuso, P. G., and Sarrao, J. L.

We report specific heat measurements of the heavy fermion superconductor CeCoIn₅ in the vicinity of the superconducting critical field H_{c2} , with magnetic fields in the [110], [100], and [001] directions, and at temperatures down to 50 mK. The superconducting phase transition changes from second to first order for fields above 10 T for H_{parallel} to [110] and H_{parallel} to [100]. In the same range of magnetic fields, we observe a second specific heat anomaly within the superconducting state. We interpret this anomaly as a signature of a Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) inhomogeneous superconducting state. We obtain similar results for H_{parallel} to [001], with the FFLO state occupying a smaller part of the phase diagram.

Physical Review Letters 91[18]. 187004. 2003.

P 171-03 “Preheating in quintessential inflation”.

Campos, A. H., Reis, H. C., and Rosenfeld, R.

We perform a numerical study of the preheating mechanism of particle production in models of quintessential inflation and compare it with the usual gravitational production mechanism. We find that even for a very small coupling between the inflaton field and a massless scalar field, g greater than or similar to 10^{-6} , preheating dominates over gravitational particle production. Reheating temperatures in the range 10^4 less than or similar to T_{rh} less than or similar to 10^{15} GeV can be easily obtained.

Physics Letters B 575[3-4], 151-156. 2003.

P 172- 03 “Spin and charge gaps of the half-filled N-leg Kondo ladders”.

Xavier, J. C.

In this work, we study N-leg Kondo ladders at half-filling through the density matrix renormalization group. We found nonzero spin and charge gaps for any finite number of legs and Kondo coupling $J > 0$. We also show evidence of the existence of a quantum critical point in the two-dimensional Kondo lattice model, in agreement with previous works. Based on the binding energy of two holes, we did not find evidence of superconductivity in the two-dimensional Kondo lattice model close to half filling.

Physical Review B 68[13]. 134422. 2003.

P 173- 03 “Spontaneous-fission decay constant of U-238 measured by nuclear track techniques without neutron irradiation”.

Guedes, S., Hadler, J. C., Sarkis, J. E. S., Oliveira, K. M. G., Kakazu, M. H., Iunes, P. J., Saiki, M., Tello, C. A., and Paulo, S. R.

A value of the decay constant for spontaneous fission of U-238, $\lambda(f)$ determined by particle-track detector techniques, is presented. The main source of systematic error in fission-track measurements of $\lambda(f)$ the so called “neutron dosimetry”, has been avoided. Instead of calibrating the neutron source and the usual mica detector through tracks of U-235 fission induced by thermal neutrons, spontaneous-fission tracks and alpha-particle tracks of U-238 and Pu-242 were used. A value of $\lambda(f) = (8.66 \pm 0.38) \cdot 10^{-17} \text{ y}^{-1}$ has been obtained.

Journal of Radioanalytical and Nuclear Chemistry 258[1], 117-122. 2003.

P 174- 03 “Thermal scanning studies of percolated Fe-Cu granular alloys”.

Socolovsky, L. M. and Sanchez, F. H.

Fe-Cu alloys produced by mechanical alloying were studied with Mossbauer thermal scanning spectroscopy (NITS). This technique consists in recording Mossbauer effect absorption at a fixed energy while the temperature of the sample is changed. Hyperfine magnetic field behavior can be closely followed. Four mechanically alloyed samples $\text{Fe}_x\text{Cu}_{100-x}$ with iron concentration $x=30, 35, 40,$ and 45 at.% were studied. Absorption graphs (intensity vs. temperature) are similar for all samples: intensity sharply falls with the increase of the temperature, following the collapse of the sextet lines. This collapse occurs at a very precise temperature, which coincides with a magnetic-nonmagnetic transition line in a former magnetic phase diagram. Conventional Mossbauer spectroscopy confirms the appointed phase change, displaying a doublet at temperatures above the critical.

Materials Characterization 50[2-3], 123-125. 2003.

Abstracta

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