

# Abstracta

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Trabalhos Aceitos para Publicação em Conferências

C002-03 à C004-03

Trabalhos Publicados

P054-03 à P183-03

## Trabalhos Aceitos para Publicação em Conferências

**C 002 - 03 A Questão de "Superestatísticas": Mecânica Estatística Não Convencional.**

Áurea R. Vasconcellos, J. Galvão Ramos, and Roberto Luzzi

Mecânica Estatística Não-Convencional para a qual existem vários enfoques (MENC, que também vem recebendo o nome de Superestatística) é introduzida como um sucedâneo prático da convencional, isto é, a mais geral, bem estabelecida e fisicamente sólida originada nas contribuições dos grandes nomes de Boltzmann e Gibbs (MEBG). Ela vem a ser utilizada - para realizar ajustes de dados experimentais e/ou observações - em situações nas quais o pesquisador tem dificuldades com o uso da MEBG como resultado da sua incapacidade de, no problema em mãos, satisfazer os critérios de eficiência e suficiência em estatística [Fisher, 1922]. Tipicamente uma limitação (por parte do pesquisador e não da MEBG) em incluir na caracterização do sistema aspectos relevantes para a boa descrição da situação física presente no fenômeno observado e teoricamente analisado. MENC oferece um caminho para sanar (em um certo sentido) tal deficiência, devendo ser aplicada com particular cuidado e dependendo de também uma cuidadosa análise de cada situação em mãos.

**Anais da Conferência "Tendências da Física Estatística no Brasil" Simpósio em Homenagem ao prof. Dr. Silvio R. Salinas nos seus 60 anos, São Paulo, SP, Brasil, 2003, accepted on June 2003.**

**C 003 - 03 Unconventional Statistical Mechanics I: General Theory and Derivation of a Nonequilibrium Ensemble in Renyi's Approach.**

Roberto Luzzi, Áurea R. Vasconcellos, and J. Galvão Ramos

Unconventional Statistical Mechanics is introduced as a practical succedaneous to the conventional well established Boltzmann-Gibbs statistical mechanics, when in the use of the latter the researcher is impaired in his/her capacity for satisfying the Criterion of Sufficiency in statistics [Fisher, 1992], that is, a failure in the characterization of the system related to some aspect relevant to the given physical situation [incomplete probabilities]. To patch this limitation on the part of the observer, in order to make calculations of average values of observables and to obtain response functions, are introduced unconventional approaches. We present a detailed description of their construction, for, in continuation, resorting to the use of the particular case of Renyi's unconventional statistics to build a nonequilibrium ensemble formalism. The unconventional distribution functions of fermions and bosons are obtained, and in the follow-up article we describe applications to the study of experimental results in semiconductor physics and in eletro-chemistry involving nanometric scales and fractal-like structures, and some additional theoretical analysis is added.

ArXiv; Cond-Mat/0306217, accepted on June 2003

**C 004- 03 Unconventional Statistical Mechanics II: Comparison of Theory and Experiment and Further Illustrations**

Áurea R. Vasconcellos, J. Galvão Ramos, and Roberto Luzzi

In the presente follow-up article of a previous one [1] we illustrate the use of the Unconventional Statistical Mechanics described and discussed in the latter. This is done via the analysis, resorting to Renyi's approach, of experimental results in the case of so-called "anomalous" luminescence in nanometric quantum wells in semiconductor heterostructures, and the so-called "anomalous" cyclic voltammetry in fractal-like electrodes in microbatteries. Also a purely theoretical analysis is done in the cases of an ideal gas and of radiation comparing the conventional and unconventional approaches. In all of these situations it is discussed which is the failure to satisfy the Criterion of Sufficiency thus requiring to resort to

the unconventional approach, and what determines the value of the infoentropic index in each case, and its dependence on the system characteristics. Moreover, on the basis of the results we obtain, it is conjectured that the infoentropic index may satisfy what we call a law defining a "path to sufficiency".

ArXiv; Cond-Mat/0306217, accepted on June 2003.

## Trabalhos Publicados Maio/Junho 2003

**P 054 - 03 "Analytic models and forward scattering from accelerator to cosmic-ray energies".**

Avila, R. F., Luna, E. G. S., and Menon, M. J

Analytic models for hadron-hadron scattering are characterized by simple analytical parametrizations for the forward amplitudes and the use of dispersion relation techniques to study the total cross section  $\sigma(\text{tot})$  and the rho parameter (the ratio between the real and imaginary parts of the forward amplitude). In this paper we investigate simultaneously four aspects related to the application of the model to pp and (p) over barp scattering, from accelerator to cosmic-ray energies: (1) the effect of different estimations for  $\sigma(\text{tot})$  from cosmic-ray experiments; (2) the differences between individual and global (simultaneous) fits to  $\sigma(\text{tot})$  and rho; (3) the role of the subtraction constant in the dispersion relations; (4) the effect of distinct asymptotic inputs from different analytic models. This is done by using as a framework the single Pomeron and the maximal odderon parametrizations for the total cross section. Our main conclusions are the following: (1) Despite the small influence from different cosmic-ray estimations, the results allow us to extract an upper bound for the soft Pomeron intercept:  $1 + \epsilon = 1.094$ ; (2) although global fits present good statistical results, in general, this procedure constrains the rise of  $\sigma(\text{tot})$ ; (3) the subtraction constant as a free parameter affects the fit results at both low and high energies; (4) independently of the cosmic-ray information used and the subtraction constant, global fits with the odderon parametrization predict that, above roots approximate to 70 GeV,  $\rho(\text{pp})(s)$  becomes greater than  $\rho(\text{p over barp})(s)$ , and this result is in complete agreement with all the data presently available. In particular, we infer  $\rho(\text{pp})=0.134+/-0.005$  at roots = 200 GeV and  $0.151+/- 0.007$  at 500 GeV (BNL RHIC energies). A detailed discussion of the procedures used and all the results obtained is also presented

Physical Review D 67[5], art-054020. 2003.

**P 055- 03 "Critical current density anisotropy of aligned MgB2 crystallites".**

de Lima, O. F. and Cardoso, C. A

We have obtained the induced critical current density,  $J(c)$  proportional to  $\Delta M$ , with  $\Delta M$  taken from hysteretic magnetization loops measured for temperatures between 5 and 35 K, in a sample of aligned MgB2 crystallites. We found an almost temperature independent ratio  $J(c)(ab)/J(c)(c)$  similar to 1.5, between the critical current density parallel and perpendicular to the ab planes. This latter result follows closely the expected dependence of  $J(c)(ab)/J(c)(c)$  approximate to  $\xi(ab)/\xi(c)$  similar to 1.7, where  $\xi(ab)$  and  $\xi(c)$  are the corresponding coherence length values. Uncertainties related to the evaluation of geometric factors and subtraction of a magnetic background are also discussed.

Physica C-Superconductivity and Its Applications 386, 575-577. 2003.

**P 056 - 03 "Deceleration, trapping, and two-photon cooling of calcium atoms".**

Cavasso, R. L., Magno, W. C., Manoel, D. A., Scalabrin, A., Pereira, D., and Cruz, F. C.

We report on a system for atomic beam deceleration and magneto- optical trapping of calcium atoms that uses the  $S-1(0)-P-1(1)$  transition, in which a single laser is used to trap



and slow the atoms. The slower laser beam is focused near the magneto-optical trap's center, which has a waist size much smaller than the atomic cloud such that its influence on the trapped atoms is greatly reduced. We also investigate the theoretical possibility of cooling by use of a two-photon  $(4s(2))S-1(0) \rightarrow (4s5s)S-1(0)$  transition. Excitation near resonance with the  $P-1(1)$  level results in an equilibrium temperature seven times smaller than the Doppler limit of the  $S-1(0) \rightarrow P-1(1)$  transition.

**Journal of the Optical Society of America B-Optical Physics 20[5], 994-1002. 2003.**

**P 057 - 03 "Diffractive production of dijets by double Pomeron exchange processes".**

**Covolan, R. J. M. and Soares, M. S.**

A phenomenological description of diffractive dijet hadroproduction via double Pomeron exchange is presented. This description is based on a modified version of the Ingelman-Schlein model which includes the evolution of the Pomeron structure function and corrections regarding rapidity gap suppression effects. The same quark-dominant Pomeron structure function employed in a previous report to describe diffractive dijet and  $W$  production via single Pomeron processes is shown here to yield results consistent with the available data for double Pomeron processes as well.

**Physical Review D 67[7], art-077504. 2003.**

**P 058- 03 "Dynamics of two atoms coupled to a cavity field".**

**Roversi, J. A., Vidiella-Barranco, A., and Moya-Cessa, H.**

We investigate the interaction of two two-level atoms with a single mode cavity field. One of the atoms is exactly at resonance with the field, while the other is well far from resonance and hence is treated in the dispersive limit. We find that the presence of the non-resonant atom produces a shift in the Rabi frequency of the resonant atom, as if it was detuned from the field. We focus on the discussion of the evolution of the state purity of each atom.

**Modern Physics Letters B 17[5-6], 219-224. 2003.**

**P 059 - 03 "Effects of electron-hole excitations in ion-surface collisions".**

**Pepino, R. T. and Kleiman, G. G**

We investigate effects related to electron-hole pair production and atomic level shift in atom scattering at surfaces by using a recently proposed exactly soluble model. We show that electron-hole pair production weakens Stueckelberg oscillations and enhances loss of memory of the initial atomic charge state for narrow bands because of the diffusion of an electron or hole captured by the band. Wide band materials tend to display memory loss at lower velocities than do narrow band materials. Allowing the atomic energy level to shift above the Fermi energy tends to reduce memory loss. (C) 2003 Elsevier Science Ltd. All rights reserved

**Solid State Communications 126[5], 235-239. 2003.**

**P 060 - 03 "Elastic scattering of low-energy electrons by  $CF_3Cl$ ,  $CF_3Br$  and  $CF_3I$ ".**

**Bettega, M. H. F., Natalense, A. P. P., Lima, M. A. P., and Ferreira, L. G.**

We report integral, differential and momentum transfer cross sections for elastic scattering of low-energy electrons by  $CF_3X$  ( $X = Cl, Br, I$ ) molecules. We use the Schwinger multichannel method with pseudopotentials (Bettega et al 1993 Phys. Rev. A 47 1111) at the static exchange approximation. Our calculations cover the energy range between 5 and 30 eV We compare our results with available theoretical and experimental results for  $CF_3Cl$  and  $CF_3I$ , and in general find good agreement. In particular, our results show the shape

resonances belonging to the  $A(1)$  and  $E$  representations of the  $C-3v$  group that have been reported by previous work.

**Journal of Physics B-Atomic Molecular and Optical Physics 36[6], 1263-1272. 2003.**

**P 061- 03 "Evaluation of magnetorheological suspensions based on carbonyl iron powders".**

**Bombard, A. J. F., Knobel, M., Alcantara, M. R., and Joekes, I.**

The particle size distribution and magnetic susceptibility of some commercial carbonyl iron powders (code names CC, CS, HQ OX and SM) were measured. The particle size of the powders increases as follows:  $HQ < SM < CC$  approximate to  $OX < CS$ . The magnetic susceptibility increases in the order:  $HQ \&AP; OX < SM$ ;  $CC \&AP; CS$ . Magnetorheological suspensions (MRS) with 66% w/w of iron were prepared and their rheological properties were evaluated at no field, 100, 200 and 300 Oe. The yield stress under 300 Oe measured with strain-stress curves increases in the order:  $HQ \&AP; OX < SM < CC < CS$ , showing direct correlation with the susceptibility. The plastic viscosity without field increases in the order:  $CS < CC < OX < SM < HQ$ , an inverse correlation with particle size. These results show that the particle size and/or size distribution can be another important property of the powders, together with magnetic susceptibility on the formulation of improved MRS.

**Journal of Intelligent Material Systems and Structures 13[7-8], 471-478. 2002.**

**P 062 -03 "Fast quantum logic gates with trapped ions interacting with. external laser and quantized cavity field beyond the Lamb-Dicke regime".**

**Sharma, S. S. and Vidiella-Barranco, A.**

A scheme to implement quantum logic gates by manipulating trapped ions through interaction with monochromatic external laser field and quantized cavity field, beyond the Lamb-Dicke regime, is presented. Characteristic times, for implementing ionic state transitions using non-resonant laser pulse or quantized cavity field, show a sharp decline for a relatively large Lamb-Dicke parameter value  $\eta(L) = \eta(c) = 0.2$ , and are seen to decrease further with increase in number of initial state vibrational quanta  $m$ . (C) 2003 Elsevier Science B.V. All rights reserved

**Physics Letters A 309[5-6], 345-350. 2003.**

**P 063 - 03 "Fractionation of cellulose acetate for the investigation of molecular weight influences on the morphology of membranes".**

**Loske, S., Goncalves, M. D. C., and Wolf, B. A.**

Cellulose acetate (CA) with an apparent weight average molar mass,  $M-w^*$ , of 150 kg/mol was fractionated with respect to  $M$  by means of the mixed solvent methyl acetate (MeAc)/2-propanol (2-POH) applying a new method that uses spinning nozzles to promote the rapid attainment of phase equilibria. Two of the fractions obtained in this manner were employed to prepare membranes from solutions in methyl acetate with 2-propanol as coagulating agent. Electron n-dcographs demonstrate that the molar mass of CA influences the morphology of the membranes markedly under otherwise identical conditions. For  $M-w^* = 128$  kg/mol, one obtains considerably denser structures than for  $M-w^* = 263$  kg/mol; furthermore, the pores are considerably less interconnected in the former than in the latter case. The efficiency of the fractionation process and the reasons for the differences in membrane structure are discussed. (C) 2002 Elsevier Science B.V. All rights reserved

**Journal of Membrane Science 214[2], 223-228. 2003**

**P 064 - 03 Giant Hall effect in superparamagnetic granular films".**

Denardin, J. C., Knobel, M., Zhang, X. X., and Pakhomov, A. B.

A comprehensive review of the giant Hall effect (GHE) is presented, with emphasis on novel experimental data obtained in Ni-SiO<sub>2</sub> and Co-SiO<sub>2</sub> films prepared by co-sputtering. GHE is observed close to and on both sides of the metal-insulator transition. From the point of view of microscopic conduction mechanisms, this means a crossover from metallic conductivity with weak localization to tunneling, or hopping, between separate granules across insulating barriers. Magnetic percolation is also interrupted at this concentration of metal, leading to superparamagnetic behavior of the composite and blocking phenomena. Temperature dependencies of magnetization and extraordinary Hall coefficient in the composites near the critical concentration are compared. In single phase magnetic metals and alloys, the extraordinary Hall is believed to be directly proportional to the total magnetization, due to side jumps or skew scattering. In a metal-insulator composite, only those electrons traveling in conduction critical paths can contribute to the Hall signal, thus only magnetization of the material belonging to these paths is important in the Hall measurements. Comparison with the magnetic results leads to new possibilities in understanding both the electronic and magnetic properties of granular nanocomposites.

*Journal of Magnetism and Magnetic Materials* 262[1], 15-22. 2003.

P 065 - 03 "Hot-phonon bottleneck in the photoinjected plasma in GaN".

Vasconcellos, A. R., Luzzi, R., Rodrigues, C. G., and Freire, V. N

The evolution on the picosecond scale of the macroscopic (nonequilibrium thermodynamic) state of a highly excited photoinjected plasma in bulk GaN is analyzed. We present the equations of evolution for the quasitemperature (level of excitation) of the hot carriers and of the optical phonons. A hot-phonon temperature overshoot is evidenced, as well as a preferential production of phonons in excess of equilibrium in a reduced off-center region of the Brillouin zone. A comparative analysis of the influence of the length of the exciting laser pulse is also performed.

*Applied Physics Letters* 82[15], 2455-2457. 2003.

P 066 -03 "Introduction to bosonization".

Miranda, E.

This is a pedagogical introduction to the general technique of bosonization of one-dimensional systems starting from scratch and assuming very little besides basic quantum mechanics and second quantization. The formalism is developed in a self-contained fashion and applied to the spinless and spin-1/2 Luttinger models, working out both single and two particle correlation functions. The implications of these results for the specific cases of the (anisotropic) Heisenberg and the Hubbard models are discussed. Although everything in these notes can be found in the published literature, detailed and explicit calculations of most of the results are given, which may prove useful to beginning graduate students or researchers in this area.

*Brazilian Journal of Physics* 33[1], 3-35. 2003.

P 067 - 03 "Localized non-linear solutions in multiply-charged dusty plasmas".

Sakanaka, P. H. and Spassovska, I.

Finite amplitude localized electrostatic solitons in a multi-component unmagnetized dusty plasma are presented. Assuming that the constituents of dusty plasmas are warm electrons, warm positive ions, and an admixture of cold dust grains with negative and positive charges, it is shown that stationary solutions of the fluid equations combined with Poisson's equation can be expressed in terms of the energy

integral of a classical particle with a modified Sagdeev potential. The latter is analyzed both analytically and numerically to demonstrate the coexistence of rarefactive and compressive electric potential pulses which travel faster than the effective dust-acoustic velocity. Compressive dust-acoustic solitons exist only when there is a significant fraction of positively charged dust grains. Furthermore, the four-fluid dusty plasma system, with both negative and positively charged dust grains, also provides the possibility of double layers. Conditions under which solitons and double layers arise are given, and their profiles are displayed graphically. The results of investigation should be helpful in identifying the salient features of nonlinear structures in low-temperature space and laboratory dusty plasmas in which positive and negatively charged dust grains coexist. In particular, we have applied the theory in the laboratory plasma and we can predict that a double layer might be possible to be launched if a trace ions component is added.

*Brazilian Journal of Physics* 33[1], 158-165. 2003.

P 068 - 03 "Magnetic properties of the U(Ge<sub>1-x</sub>Ni<sub>x</sub>)(<sub>2</sub>) system".

Rojas, D. P., Medina, A. N., Gandra, F. G., and Cardoso, L. P.

Magnetic results for the U(Ge<sub>1-x</sub>Ni<sub>x</sub>)(<sub>2</sub>) series of compounds with x=0.1, 0.2, 0.3, and 0.4 are reported. For x less than or equal to 0.2 the system is ferromagnetic with T<sub>c</sub> close to 52 K. For the remaining samples we found a spin-glass ground state with T<sub>f</sub> around 30 K. The specific heat for the x=0.3 sample present an anomaly at 50 K, which does not seem to be of magnetic origin. We discuss the results in terms of the possible formation of the compound U<sub>2</sub>NiGe<sub>3</sub>.

*Journal of Applied Physics* 93[10], 7825-7827. 2003.

P 069- 03 "Magnetic susceptibility and saturation magnetization of some carbonyl iron powders used in magnetorheological fluids".

Bombard, A. J. F., Joekes, I., Alcantara, M. R., and Knobel, M.

Some commercial carbonyl iron powders, from BASF AG, were characterized through their magnetic susceptibility and saturation magnetization. The saturation magnetization increases in the order: HQ < OX < CS < CC < CL approximate to SM. Although all the powders have 96% minimum of iron content, this result suggests that an investigation at higher magnetic fields, under simultaneous shear is very important. The reversibility and the reproducibility of the MR effect were satisfactory, confirming that carbonyl iron powders are good ferromagnetic materials to prepare magnetorheological fluids.

*Advanced Powder Technology* 14 416-4, 753-758. 2003.

P 070- 03 "Mean-field approximation to a spatial host-pathogen model".

de Aguiar, M. A. M., Rauch, E. M., and Bar-Yam, Y

We study the mean-field approximation to a simple spatial host-pathogen model that has been shown to display interesting evolutionary properties. We show that previous derivations of the mean-field equations for this model are actually only low-density approximations to the true mean-field limit. We derive the correct equations and the corresponding equations including pair correlations. The process of invasion by a mutant type of pathogen is also discussed.

*Physical Review E* 67[4], art-047102. 2003.

P 071- 03 "Measurement of phase differences between the diffracted orders of deep relief gratings".

Cordeiro, C. M. B., Cescato, L., Freschi, A. A., and Li, L. F

Measurement of the phase difference between the 0th and the 1st transmitted diffraction orders of a symmetrical surface-

relief grating recorded on a photoresist film is carried out by replacement of the grating in the same setup with which it was recorded. The measurement does not depend on lateral shifts of the replaced grating relative to the interference pattern, on environmental phase perturbations or on the wave-front quality of the interfering beams. The experimental data agree rather well with theoretical results calculated for sinusoidal profiled gratings. (C) 2003 Optical Society of America

**Optics Letters 28[9], 683-685. 2003.**

**P 072- 03 "Performance of a two-pump fiber optical parametric amplifier in a 10 Gb/s x 64 channel dense wavelength division multiplexing system".**

**Boggio, J. M. C., Dainese, P., and Fragnito, H. L.**

We analyze the performance of two-pump fiber optical parametric amplifiers (2P-FOPA) as preamplifiers for wavelength division multiplexing transmission systems. We simulate the propagation of 10 Gb/s x 64 channels over 120 km of non-zero dispersion shifted fiber and amplify them by a 2P-FOPA before detection. We demonstrate that a careful design of the FOPA parameters leads to high system performance, comparable to those obtained with erbium and Raman amplifiers. For signal powers of -32.5 dBm at the FOPA input we observe clear eye openings for all the amplified signal lasers, with an average gain of 22 dB and low ripple (6 dB) over 25 nm bandwidth. We study the influence of fluctuations of the zero dispersion wavelength of the FOPA fiber. These fluctuations in realistic fibers tend to reduce the average gain and degrade the noise figure and spectral gain ripple. (C) 2003 Elsevier Science B.V. All rights reserved

**Optics Communications 218[4-6], 303-310. 2003.**

**P 073 - 03 "Photoreflectance studies of optical transitions in cubic GaN grown on GaAs(001) substrates".**

**Noriega, O. C., Tabata, A., Soares, J. A. N. T., Rodrigues, S. C. P., Leite, J. R., Ribeiro, E., Fernandez, J. R. L., Meneses, E. A., Cerdeira, F., As, D. J., Schikora, D., and Lischka, K.**

The optical properties of cubic GaN epitaxial layers were investigated by modulated photoreflectance (PR) and photoluminescence in the temperature interval from 5 to 300 K. The epilayers were grown on GaAs(001) substrates by molecular beam epitaxy using a nitrogen RIF-activated plasma source. The PR spectra show a transition which is well fitted using the third-derivative functional form of the unperturbed dielectric function, which we interpret as band-to-band transition. Our results allow determination of the temperature dependence of the main gap of c-GaN and give insights into the residual strain in the film, as well as allow us to estimate the binding energy of the complex formed by an exciton bound to a neutral acceptor.

**Journal of Crystal Growth 252[1-3], 208-212. 2003.**

**P 074- 03 "Reentrant metallic behavior of graphite in the quantum limit".**

**Kopelevich, Y., Torres, J. H. S., da Silva, R. R., Mrowka, F., Kempa, H., and Esquinazi, P.**

Magnetotransport measurements performed on several well-characterized highly oriented pyrolytic graphite and single crystalline Kish graphite samples reveal a reentrant metallic behavior in the basal-plane resistance at high magnetic fields, when only the lowest Landau levels are occupied. The results suggest that the quantum Hall effect and Landau-level-quantization-induced superconducting correlations are relevant to understand the metallic-like state(s) in graphite in the quantum limit.

**Physical Review Letters 90[15], art-156402. 2003.**

**P 075- 03 "Residual carbon and carrier concentration in InGaP layers grown by chemical beam epitaxy".**

**Bettini, J., de Carvalho, M. M. G., Pudenzi, M. A. A., Laureto, E., and Meneses, E. A.**

In this work we present a study on the carbon incorporation in InGaP layers grown by Chemical Beam Epitaxy as a function of growth temperature. Hall measurements show that the electron concentration increased from  $2.3 \times 10^{14}$  to  $8.9 \times 10^{16}$  cm<sup>-3</sup> as the growth temperature increased from 500 degreesC to 560 degreesC. Lower growth temperature InGaP layers are more resistive. Using photoluminescence and a carbon-implanted sample, we identify an acceptor level at nearly 45 meV from the top of the valence band. Part of incorporated carbon acts as an acceptor and part as a donor. The electrical and photoluminescence measurements show that the ratio between acceptors and donors increase as the growth temperature decreases. Due to this compensation, samples grown at lower temperatures (500 degreesC) present a resistivity  $10^4$  times higher than those grown at high temperature (560 degreesC).

**Thin Solid Films 429[1-2], 91-95. 2003.**

**P 076 - 03 "Resonant magnetotunneling of photogenerated holes in double barrier structures".**

**Vercik, A., Gobato, Y. G., Bittencourt, A. C. R., Marques, G. E., Brasil, M. J. S. P., and Trallero Giner, C.**

In this work, we report on a technique-namely, the photoinduced magnetotunneling technique-which allows the direct experimental observation of tunneling of holes through valence-band Landau levels in n-i-n double-barrier resonant tunneling structures. Photocurrent-voltage curves exhibit several peaks associated with the complex nature of the dispersion of holes under parallel electric and magnetic fields applied to the sample.

**Journal of Applied Physics 93[9], 5830-5832. 2003.**

**P 077- 03 "Silicon nitride etching in high- and low-density plasmas using SF6/O-2/N-2 mixtures".**

**Reyes-Betanzo, C., Mohshkalyov, S. A., Swart, J. W., and Ramos, A. C. S.**

Results of a comparative study of SiNx SiO2 and Si etching in high- and low-density O-2-N-2 based plasmas with small additions of SF6 are presented. Higher selectivities of SiNx etching over both SiO2 (up to 50-70) and Si (up to 20) are obtained in a high-density reactor as compared with low-density reactive ion etching. Plasma and surface processes responsible for etching are analyzed. Kinetics of NO molecules responsible for enhanced nitride etching is shown to be distinctly different for low- and high-density plasma conditions. Possible ways of further optimization of the process are discussed.

**Journal of Vacuum Science & Technology A 21[2], 461-469. 2003.**

**P 078 - 03 "Spatial ordering in InP/InGaP nanostructures".**

**Bortoleto, J. R. R., Gutierrez, H. R., Cotta, M. A., Bettini, J., Cardoso, L. P., and de Carvalho, M. M. G.**

We report the observation of a spatially-ordered bidimensional array of self-assembled InP quantum dots grown on slightly In-rich InGaP layers. The alignment of InP dots is observed along [100] and [010] directions. This effect is enhanced when 2degrees off vicinal substrates are used; it is also strongly dependent on growth temperature. Our results suggest that the density and size of CuPt-type atomically ordered regions as well as compositional modulation of InGaP layers play an important role on the spatial alignment of InP/InGaP quantum dots.

**Applied Physics Letters 82[20], 3523-3525. 2003.**

**P 079 -03 "Spontaneous U-238 fission half-life measurements based on fission-track techniques".**



Hadler, J. C., Bigazzi, G., Guedes, S., Iunes, P. J., Oddone, M., Tello, C. A., and Paulo, S. R.

In the last recommendation of the International Union of Pure and Applied Chemistry (I.U.P.A.C.) on spontaneous fission half-lives for ground-state nuclides, a number of measurements of U-238 based on fission-track techniques were discarded. The arguments given by the authors are not clear. In this work a more detailed discussion of these determinations is given, considering the possible systematical errors inherent in fission-track approaches.

*Journal of Radioanalytical and Nuclear Chemistry* 256[1], 155-157. 2003.

P 080 -03 "Structural and magnetic properties of TM-SiO<sub>2</sub> (TM = Fe, Co, Ni) films".

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

TM<sub>x</sub>-(SiO<sub>2</sub>)<sub>(1-x)</sub> (TM = Fe, Co, Ni) thin films were prepared in a wide concentration range (0.35 less than or equal to x less than or equal to 1). Structure was studied with transmission electron microscopy (TEM), X-ray diffraction (XRD) and small angle X-ray scattering (SAXS). Magnetic and magnetotransport properties were investigated by means of magnetization and Hall effect measurements. TEM images display nanometric spherical structures embedded in a SiO<sub>2</sub> amorphous matrix, with typical sizes increasing from 3 to 5 nm when TM volume concentration x is increased. SAXS measurements indicate a complex structure formed by nanosized objects. XRD measurements show that the structure is composed by amorphous SiO<sub>2</sub> and TM crystallites. Slightly above the percolation threshold all samples display giant Hall effect. The observed magnetic properties are dependent on x, and display an evolution resulting from the progressive increase of the mean particle size.

*Journal of Magnetism and Magnetic Materials* 262[1], 102-106. 2003.

P 081- 03 "Tungsten oxide films of high electrochromic efficiencies obtained by deposition".

Scarminio, J., de Moraes, M. A. B., Dias, R. C. E., Rouxinol, F. P., and Durrant, S. F.

Amorphous tungsten oxide films of high electrochromic efficiency were produced by a chemical vapor deposition technique in which the precursors of film formation are generated at the surface of a heated tungsten filament by reactions of tungsten with oxygen. The film deposition rate was determined as a function of the filament temperature and oxygen pressure. Molecular structure investigations using X-ray photoelectron spectroscopy revealed that the tungsten oxide was in the WO<sub>3</sub> stoichiometry. The electrochromic properties of the films were studied for Li<sup>+</sup> intercalation. Optical efficiencies as high as 78 and 125 cm<sup>2</sup>/C at 632.8 and 950 nm, respectively, and absorbance changes from 0.07 to 1.1 were measured between the bleached and the colored states at 632.8 nm. (C) 2003 The Electrochemical Society

*Electrochemical and Solid State Letters* 6[6], H9-H12. 2003.

P 082 - 03 "Two-photon Doppler cooling of alkaline-earth-metal and ytterbium atoms".

Magno, W. C., Cavasso, R. L., and Cruz, F. C.

The possibility of laser cooling of alkaline-earth-metal atoms and ytterbium atoms using a two-photon transition is analyzed. We consider a S-1(0)-S-1(0) transition with excitation in near resonance with the P-1(1) level. This greatly increases the two-photon transition rate, allowing an effective transfer of momentum. The experimental implementation of this technique is discussed and we show that for calcium, for example, two-photon cooling can be used to achieve a Doppler limit of 123 μK. The efficiency of this cooling scheme and the main loss mechanisms are analyzed.

*Physical Review A* 67[4], art-043407. 2003.

P 083 - 03 "Z(2)-gradings of Clifford algebras and multivector structures".

Mosna, R. A., Miralles, D., and Vaz, J.

Let Cl(V, g) be the real Clifford algebra associated with the real vector space V, endowed with a nondegenerate metric g. In this paper, we study the class of Z(2)-gradings of Cl(V, g) which are somehow compatible with the multivector structure of the Grassmann algebra over V. A complete characterization for such Z(2)-gradings is obtained by classifying all the even subalgebras coming from them. An expression relating such subalgebras to the usual even part of Cl(V, g) is also obtained. Finally, we employ this framework to define spinor spaces, and to parametrize all the possible signature changes on Cl(V, g) by Z(2)-gradings of this algebra.

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# Abstracta

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