

Abstracta

Ano VII - N. 02

Abr.03



Trabalhos Aceitos para Publicação

A001-03 à A004-03

Trabalho Aceito em Congresso

C001-03

Trabalhos Publicados

P040-03 à P053-03

Trabalhos Aceitos para Publicação em Periódicos

A 001 - 03 "Observing negligible collision trap losses: the case of alkaline-earths."

Reinaldo L. Cavasso-Filho, Artemio Scalabrin, Daniel Pereira and Flavio C. Cruz

We show that when cold collisions account for just a few percent of the total loss in magneto-optical traps, as for alkaline-earths, their contribution can be obtained by comparing the load and decay quasi-exponential curves. We exemplify it by measuring the collision rate coefficient b for calcium atoms at small trap laser detuning, which confirms the role of the long-lived $1P_g$ state at small internuclear separation. Systematic and simpler measurements of b for alkaline-earths are important for cold collision theory, since these elements have nondegenerate ground state and no hyperfine structure. Our method has general applicability and should considerably reduce the experimental challenges associated with these important measurements.

Physical Review A - Rapid Commun. **67**, 02142(R) 2003.

A 002- 03 "Two-Photon Doppler cooling of alkaline-earth-metal and ytterbium atoms."

Victor C. Magno, Reinaldo L. Cavasso Filho and Flavio C. Cruz

A new possibility of laser cooling of alkaline-earth-metal and Ytterbium atoms using a two-photon transition is analyzed. We consider a $1S_0 - 1S_0$ transition, with excitation in near resonance with the $1P_1$ 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 microKelvin. The efficiency of this cooling scheme and the main loss mechanisms are analyzed.

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

A 003- 03 "Deceleration, trapping, and two-photon cooling of calcium atoms."

Reinaldo L. Cavasso Filho, Victor C. Magno, Daniela A. Manoel, Artemio Scalabrin, Daniel Pereira, and Flavio C. Cruz

We report on a system for atomic beam deceleration and magneto-optical trapping of calcium atoms that uses the $1S_0 - 1P_1$ 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 $(4s\ 2)1S_0 - (4s5s)1S_0$ transition. Excitation near resonance with the $1P_1$ level results in an equilibrium temperature seven times smaller than the Doppler limit of the $1S_0 - 1P_1$ transition.

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

A 004 - 03 "Calcium magneto-optical trap loaded from a decelerated atomic beam."

L. Cavasso Filho, D. A. Manoel, D. R. Ortega, A. Scalabrin, D. Pereira and F.C.Cruz,

We describe a new system for laser cooling and trapping of neutral Calcium atoms employing the $1S_0 - 1P_1$ resonant transition at 423 nm. An on-axis magneto-optical trap (MOT) is loaded from a Zeeman decelerated atomic beam. When a single laser is used, in order to avoid perturbation of the trap by the deceleration laser beam, this one has been tightly focused near the MOT center, with a waist size much smaller than the atomic cloud.

In order to test the efficiency of this novel technique, we have then employed a second, independent decelerating laser, with a profile mode matched to the atomic beam. For an oven temperature of 5800C this system can load $1.2(2) \times 10^7$ atoms in 16(1) ms. By the spatial extension of the atomic cloud the one dimension rms velocity was estimated to be 136(12)cm/s, corresponding to a temperature of 9(2) mK. The variation of the number of trapped atoms as a function of laser detuning and intensity, trap magnetic field gradient and oven temperature is analyzed. Spatial structures of the trapped atoms, like stable rings created by vortex forces, have been observed. This is the first time that these structures, already observed in alkali-metal elements, are reported in MOTs of alkaline-earth elements.

Brazilian Journal of Physics **33**[2], 355-362, 2003.

Trabalhos Aceitos para Publicação em Conferências

C 001 -03 "Cooling and Trapping of Atomic Calcium."

Giovana T. Nogueira, Reinaldo L. Cavasso-Filho, Victor C. Magno, Davi R. Ortega, Daniela A. Manoel, David L. Figueira, Luciana C.M.F.Diogenes, Daniel. Pereira, and Flavio. C. Cruz.

We present our recent results on atomic beam deceleration and magneto-optical trapping of atomic Calcium, using its $1S_0 - 1P_1$ transition at 423 nm. In order to avoid any perturbation to the atomic cloud, we employed a slower laser beam tightly focused near the on-axis MOT. This allowed us to detect cold collisions trap losses, which contribute to only 3% of the total losses, by comparing trap load and decay curves. We also analyze the theoretical possibility of Doppler cooling using the two-photon $(4s^2)1S_0 - (4s5s)1S_0$ transition, excited in near resonance with the $1P_1$ level by laser beams at 423 and 1030 nm. An equilibrium temperature limit of 123 microKelvin is obtained. This scheme should be used as a second cooling stage, allowing 100% transfer efficiency for atoms pre-cooled with the 423-nm transition. Finally we report our progress towards the development of an optical clock based on the $1S_0 - 3P_1$ intercombination transition at 657 nm.

Meeting of the Atomic Molecular and Optical Physics (DAMOP) of The American physical Society, Boulder, Accepted on May 2003.

Trabalhos Publicados

P 040- 03 "Diffractive hadroproduction of dijets and W's at the Fermilab Tevatron collider and the Pomeron structure function"

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

Results from a phenomenological analysis of dijet and W hard diffractive hadroproduction at Fermilab Tevatron energies are reported. The theoretical framework employed here is a modified version of the Ingelman-Schlein approach which includes Dokshitzer-Gribov-Lipatov-Altarelli-Parisi evolved structure functions. Different from what has been achieved by the DESY ep HERA reactions, a reasonable overall description of such diffractive hadron processes is obtained only when a complex, quark-rich Pomeron structure function is employed in the calculation.

Physical Review D **67**[1], art-017503. 2003.

P 041-03 'Electrostatic response of hydrophobic surface measured by atomic force microscopy'

Teschke, O. and de Souza, E. F.

The arrangement of water molecules at aqueous interfaces is an important question in material and biological sciences. We have measured the force acting on neutral tips as a function of the distance to hydrophobic silicon surfaces and cetyltrimethylammonium bromide monolayers covering mica surfaces in aqueous solutions. The unusually large magnitude of this force is attributed to an electrostatic response of the aqueous fluid structure (hydration layer) which is generated by the reorientation of water molecular dipoles. The exchange of a volume of this region with a dielectric permittivity (ϵ_{int}) by the tip with a dielectric permittivity (ϵ_{tip}) is responsible for the tip attraction when it is immersed in the polarization (hydration) layer. Variable permittivity profiles starting at $\epsilon_{\text{int}} \approx 11$ at the interface and increasing to $\epsilon_{\text{tip}} = 80$ about 10 nm from hydrophobic silicon surfaces and about 50 nm from cetyltrimethylammonium bromide monolayer covering mica surfaces were measured. (C) 2003 American Institute of Physics.

Applied Physics Letters 82[7], 1126-1128. 2003.

P 042 - 03 "Influence of illumination on the quantum mobility of a two-dimensional electron gas in Si delta-doped GaAs/In_{0.15}Ga_{0.85}As quantum wells"

Cavalheiro, A., da Silva, E. C. F., Quivy, A. A., Takahashi, E. K., Martini, S., da Silva, M. J., Meneses, E. A., and Leite, J. R.

A series of GaAs/InGaAs quantum wells with a silicon delta-doped layer in the top barrier was investigated by Shubnikov-de Haas measurements as a function of the illumination time of the samples. During the illumination process strong modifications of the electronic density and the quantum mobility of each occupied subband were observed. Based on self-consistent calculations, the dominant mechanism which caused the changes in the subband quantum mobilities with illumination was elucidated.

Journal of Physics-Condensed Matter 15[2], 121-132. 2003.

P 043 - 03 "Influence of the coupling between center of mass and internal degrees of freedom on the binding energy of magnetotriions"

Dacal, L. C. O. and Brum, J. A.

We present the effects of the center-of-mass dynamics on the negatively charged exciton bound states in the presence of longitudinal magnetic and electric fields. We consider an idealized GaAs/Al_{0.3}Ga_{0.7}As quantum well in the low-field limit and use the configuration interaction method to build up the two-particle basis set. Our results show that the dynamics of the charged exciton center of mass has to be taken into account for a realistic description of the bound states

Physical Review B 67[3], art-033306. 2003.

P 044 - 03 "Isothermal aggregation of Bi atoms embedded in a soda borate glass: Coarsening of liquid nanodroplets and atomic diffusion"

Kellermann, G. and Craievich, A. F.

The process of nucleation and growth of liquid Bi nanodroplets embedded in a soda borate glass submitted to isothermal annealing at different temperatures was studied by small-angle x-ray scattering (SAXS) and transmission-electron microscopy. The experimental results indicate that the formation and growth of Bi droplets occur in two successive stages after a short incubation period. The first is characterized by the nucleation and growth of spherical droplets promoted by atomic diffusion and aggregation of isolated Bi atoms and the second one by a subsequent droplet coarsening. The experimental functions describing the time variation of the droplet average radius and density number at advanced stages of the growth process agree with the classical Lifshitz-Slyozov-Wagner (LSW) theory. However, the radius distribution was demonstrated to be well described by a log-normal function thus differing from the prediction of the LSW

model. The atomic diffusion coefficient of Bi was determined from SAXS results for several annealing temperatures and, from it, the activation energy for the diffusion process was inferred

Physical Review B 67[8], art-085405. 2003.

P 045 - 03 "Measuring the spectra of high energy neutrinos with a kilometer-scale neutrino telescope"

Hooper, D., Nunokawa, H., Peres, O. L. G., and Funchal, R. Z.

We investigate the potential of a future kilometer-scale neutrino telescope, such as the proposed IceCube detector in the South Pole, to measure and disentangle the yet unknown components of the cosmic neutrino flux, the prompt atmospheric neutrinos coming from the decay of charmed particles and the extra-galactic neutrinos in the 10 TeV to 1 EeV energy range. Assuming a power law type spectra, $d\phi(\nu)/dE(\nu) \sim \text{toal}\alpha E(\nu)^\beta$, we quantify the discriminating power of the IceCube detector and discuss how well we can determine magnitude (α) as well as slope (β) of these two components of the high energy neutrino spectrum, taking into account the background coming from the conventional atmospheric neutrinos.

Physical Review D 67[1], art-013001. 2003.

P046 - 03 "Molecular-dynamics simulations of carbon nanotubes as gigahertz oscillators"

Legoas, S. B., Coluci, V. R., Braga, S. F., Coura, P. Z., Dantas, S. O., and Galvao, D. S.

Recently, Zheng and Jiang [Phys. Rev. Lett. 88, 045503 (2002)] have proposed that multiwalled carbon nanotubes could be the basis for a new generation of nano-oscillators in the several gigahertz range. In this Letter, we present the first molecular dynamics simulation for these systems. Different nanotube types were considered in order to verify the reliability of such devices as gigahertz oscillators. Our results show that these nano-oscillators are dynamically stable when the radii difference values between inner and outer tubes are of similar to 3.4 Angstrom. Frequencies as large as 38 GHz were observed, and the calculated force values are in good agreement with recent experimental investigations.

Physical Review Letters 90[5], art-055504. 2003.

P 047 - 03 "Observing negligible collision trap losses: The case of alkaline-earth metals"

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

We show that when cold collisions account for just a few percent of the total loss in magneto-optical traps, as for alkaline-earth metals, their contribution can be obtained by comparing the load and decay quasiexponential curves. We exemplify it by measuring the collision rate coefficient beta for calcium atoms at small trap laser detuning, which confirms the role of the long-lived ($^1\Pi(g)$) state at small internuclear separation. Systematic and simpler measurements of beta for alkaline-earth metals are important for cold collision theory, since these elements have nondegenerate ground state and no hyperfine structure. Our method has general applicability and should considerably reduce the experimental challenges associated with these important measurements.

Physical Review A 67[2], art-021402. 2003.

P048 - 03 "Optimization problems in the estimation of parameters of thin films and the elimination of the influence of the substrate"

Birgin, E. G., Chambouleyron, I. E., and Martinez, J. M.

In a recent paper, the authors introduced a method to estimate optical parameters of thin films using transmission data. The associated model assumes that the film is deposited on a completely transparent substrate. It has been observed,

however, that small absorption of substrates affect in a nonnegligible way the transmitted energy. The question arises of the reliability of the estimation method to retrieve optical parameters in the presence of substrates of different thicknesses and absorption degrees. In this paper, transmission spectra of thin films deposited on non-transparent substrates are generated and, as a first approximation, the method based on transparent substrates is used to estimate the optical parameters. As expected, the method is good when the absorption of the substrate is very small, but fails when one deals with less transparent substrates. To overcome this drawback, an iterative procedure is introduced, that allows one to approximate the transmittance with transparent substrate, given the transmittance with absorbent substrate. The updated method turns out to be almost as efficient in the case of absorbent substrates as it was in the case of transparent ones. (C) 2002 Elsevier Science B.V. All rights reserved.

Journal of Computational and Applied Mathematics 152[1-2], 35-50. 2003.

P 049 - 03 Physical and chemical analysis of dielectric properties and differential scanning calorimetry techniques on buriti oil"

Garcia-Quiroz, A., Moreira, S. G. C., de Moraes, A. V., Silva, A. S., da Rocha, G. N., and Alcantara, P.

Dielectric constant (DC) analysis has been carried out on buriti oil (*Mauritia flexuosa*), in a scan temperature range of -100-40degreesC. Fatty acid characterization was performed by gas crystallography and differential scanning calorimetry (DSC). Interesting physical characteristics were noted in a DC analysis on buriti oil. It revealed five different temperature anomalies, which were studied for the chemical properties of the oil components. On the basis of the classical polarizability model and the oil composition, the temperature DC anomalies were studied during the process of its solid- liquid transition phase.

Instrumentation Science & Technology 31[1], 93-101. 2003.

P 050- 03 "Polarization dependent effects in photo-fragmentation dynamics of free molecules"

Mocellin, A., Marinho, R. R. T., Coutinho, L. H., Burmeister, F., Wiesner, K., and de Brito, A. N.

We present multicoincidence spectra of nitrogen, formic acid and methyl methacrylate. We demonstrate how to probe the local symmetry of molecular orbitals from molecules core excited with linearly polarized synchrotron radiation. The intensity distribution of the photoelectron photo-ion photo-ion coincidence (PEPIICO) spectrum reflects the selectivity and localization of core excitation by polarized light. By simulating the spectra the angular dependence of the fragmentation is determined. (C) 2003 Elsevier Science B.V. All rights reserved

Chemical Physics 289[1], 163-174. 2003.

P 051- 03 "Recognition of Cretaceous, Paleocene, and Neogene tectonic reactivation through apatite fission-track analysis in Precambrian areas of southeast Brazil: association with the opening of the south Atlantic Ocean"

Saenz, C. A. T., Hackspacher, P. C., Neto, J. C. H., Iunes, P. J., Guedes, S., Ribeiro, L. F. B., and Paulo, S. R.

Apatite fission-track analysis was used for the determination of thermal histories and ages in Precambrian areas of southeast Brazil. Together with geological and geomorphologic information, these ages enable us to quantify the thermal histories and timing of Mesozoic and Cenozoic epirogenic and tectonic processes. The collected samples are from different geomorphologic blocks: the high Mantiqueira mountain range (HMMR) with altitude above 1000 m, the low Mantiqueira mountain range (LMMR) under 1000 m, the Serra do Mar mountain range (SMMR), the Jundiá and Atlantic Plateaus, and the coastline, all of which have distinct thermal histories. During the Aptian (similar to120 Ma), there was an uplift of the HMMR, coincident with opening of the south Atlantic

Ocean. Its thermal history indicates heating (from similar to60 to similar to80 degreesC) until the Paleocene, when rocks currently exposed in the LMMR reached temperatures of similar to100 degreesC. In this period, the Serra do Mar rift system and the Japi erosion surface were formed. The relief records the latter. During the Late Cretaceous, the SMMR was uplifted and probably linked to its origin; in the Tertiary, it experienced heating from similar to60 to similar to90 degreesC, then cooling that extends to the present. The SMMR, LMMR, and HMMR were reactivated mainly in the Paleocene, and the coastline during the Paleogene. These processes are reflected in the sedimentary sequences and discordances of the interior and continental margin basins.

Journal of South American Earth Sciences 15[7], 765-774.2003

P 052 - 03 "Role of the E-2g phonon in the superconductivity of MgB2: a Raman scattering study"

Martinho, H., Rettori, C., Pagliuso, P. G., Martin, A. A., Moreno, N. O., and Sarrao, J. L.

Temperature-dependent Raman scattering studies in polycrystalline MgB₂ (10 < T < 300 K) reveal that the E-2g phonon does not experience any self-energy renormalization effect across the superconducting critical temperature T_C approximate to 39 K, in contrast with most of the current theoretical models. In the presence of our results, those models must be reviewed. The analysis of the temperature dependence of the E-2g phonon frequency yields an isobaric Grüneisen parameter of $\gamma(E_{2g})$ less than or equal to 1, smaller than the value of 3.9 obtained from isothermal Raman experiments under pressure. It is suggested that this apparent disagreement can be explained in terms of pressure-induced changes of the topology of the Fermi surface. (C) 2003 Elsevier Science Ltd. All rights reserved

Solid State Communications 125[9], 499-502. 2003.

P053 - 03 "Spin glass behavior in RuSr₂Gd_{1.5}Ce_{0.5}Cu₂O₁₀-delta"

Cardoso, C. A., Araujo-Moreira, F. M., Awana, V. P. S., Takayama-Muromachi, E., de Lima, O. F., Yamauchi, H., and Karpinen, M.

The dynamics of the magnetic properties of polycrystalline RuSr₂Gd_{1.5}Ce_{0.5}Cu₂O₁₀-delta (Ru-1222) have been studied by ac susceptibility and dc magnetization measurements, including relaxation and ageing studies. Ru-1222 is a reported magnetosuperconductor with Ru spins magnetic ordering at temperatures near 100 K and superconductivity in Cu-O-2 planes below T_c similar to40 K. The exact nature of Ru spins magnetic ordering is still being debated, and no conclusion has been reached yet. In this work, a frequency-dependent cusp was observed in $\chi''(ac)$ vs T measurements, which is interpreted as a spin glass transition. The change in the cusp position with frequency follows the Vogel-Fulcher law, which is commonly accepted to describe a spin-glass with magnetically interacting clusters. Such an interpretation is supported by thermoremanent magnetization (TRM) measurements at T=60 K. TRM relaxations are well described by a stretched exponential relation, and present significant aging effects

Physical Review B 67[2], art-020407. 2003.

Abstracta

Instituto de Física

Diretor: Prof. Dr. Daniel Pereira

Universidade Estadual de Campinas - UNICAMP

Cidade Universitária Zeferino Vaz

CEP: 13083-859 - Campinas - SP - Brasil

e-mail: secdir@ifi.unicamp.br

Fone: 0XX 19 3521 - 5300

Publicação

Biblioteca do Instituto de Física Gleb Wataghin

<http://webbif.ifi.unicamp.br>

Diretora Técnica: Rita Aparecida Sponchiado

Elaboração

Tânia Macedo Folegatti

abstract@ifi.unicamp.br

Projeto Gráfico

ÍgneaDesign

Impressão

Gráfica Central - Unicamp