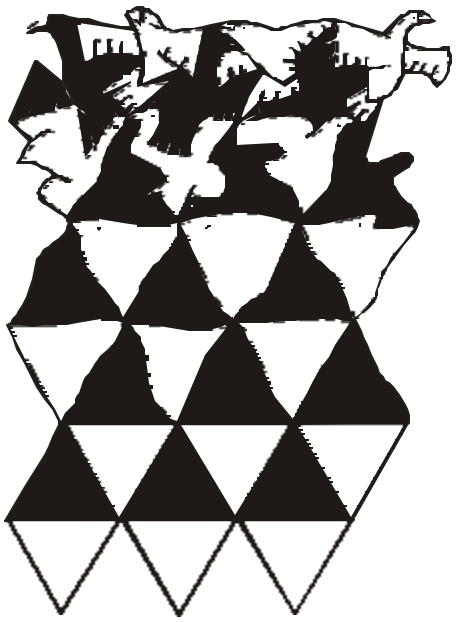
XXVIII ENCONTRO NACIONAL DE FÍSICA DA MATÉRIA CONDENSADA



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[12/05/05 - P329]
Excitons em Poços Quânticos Tipo I-Tipo II usando Cálculos da Função Variacional 2D e 3D, J. Costa e Silva, A. Chaves, J. A. K. Freire, V. N. Freire e G. A. Farias, *Universidade Federal do Ceará* • Sistemas semicondutores $Si/Si_{1-x}Ge_x$ tem atraído grande interesse devido seu potencial de aplicações em circuitos eletrônicos de alta velocidade. Recentemente, métodos alternativos foram propostos baseado na aproximação do potencial Coulombiano efetivo [1] criado pelo portador confinado. Cálculos numéricos do potencial de confinamento do outro portador neste potencial resultam na energia de ligação e em uma forma razoável da função de onda total usando um parâmetro [2]. Neste trabalho nos usamos a função de onda bi-dimensional (2D) e tri-dimensional (3D) e comparamos estas aproximações. Usamos o método variacional para calcular a energia do exciton em poços quânticos $Si_{1-x}Ge_x$ com alinhamento de banda tipo I e (tipo II), onde os portadores de carga estão confinados espacialmente no mesmo material (materiais diferentes) [3,4]. Nestes sistemas, nós consideramos a existência de interfaces graduais entre os materiais e propomos um Hamiltoniano que descreve o confinamento dos portadores levando em conta a massa efetiva dependendo das variáveis espaciais [5]. Calculamos a energia do exciton variando o comprimento do poço e a espessura da interface para um poço de Si1-xGex com barreira de Si. Nossos resultados mostram que as flutuações interfaciais podem mudar consideravelmente os valores da energia de ligação e da energia total do exciton, e que quando usamos a aproximação tri-dimensional (3D) a energia de ligação aumenta em aproximadamente 54%. [1] J. W. Wu, Solid State Commum., 67, 911 (1988); [2] A. Bellabchara, P. Lefebre, P. Christol, and H. Mathieu, Phys. Rev. B 50, 11840 (1994); [3] T. D. Harris, R. Sauer, and W. T. Tsang, Appl. Phys. Lett., 50, 1077 (1987); [4] M. Matsuura and Y. Shinozuka, Phys. Rev. B 38, 9830 (1988). [5] C. L. N. Oliveira et al., Applied Surface Science, 234, 38 (2004);

[12/05/05 - P330]
ESTUDO DE PROPRIEDADES ÓPTICAS DE SUPER-REDES GaAs/AlAs ULTRA-FINAS, Edson Laureto, José Leonil Duarte, Ivan Frederico Lupiano Dias, *Departamento de Física, Centro de Ciências Exatas, Universidade Estadual de Londrina, Londrina, PR*, Euclydes Marega Jr., *Instituto de Física de São Carlos, Universidade de São Paulo, São Carlos, SP*, Márcio Daldin Teodoro, Pedro Pablo González-Borrero, *Departamento de Física, Universidade Estadual do Centro-Oeste, Guarapuava, PR* • Neste trabalho são investigadas propriedades ópticas de super-redes (GaAs)5/(AlAs)5 obtidas sobre diferentes planos cristalográficas do GaAs. São analisadas três amostras crescidas simultaneamente sobre substratos de GaAs orientados nas direções [100], [311]A e [111]A. As amostras têm a seguinte estrutura: dez repetições de uma super-rede GaAs/AlAs com período de 60 Å, uma camada "buffer"de GaAs com espessura de 600 nm, 40 repetições da super-rede (GaAs)5/(AlAs)5, e uma camada tampão de GaAs de 50 Å. As espessuras nominais foram determinadas a partir das oscilações de RHEED no GaAs-(100). As técnicas de fotorefletância (PR) e de fotoluminescência (PL) são empregadas, em função da temperatura da amostra, para a caracterização óptica das heteroestruturas. Previsões teóricas das energias das mini-bandas das super-redes são confrontadas com a posição em energia dos picos existentes nas curvas experimentais. Desta análise obtém-se que as estruturas observadas nos espectros de PR vêm das transições diretas entre os níveis fundamentais das super-redes, enquanto que a banda de PL origina-se da transição pseudo-direta da super-rede (GaAs)5/(AlAs)5, envolvendo elétrons no vale X do AlAs e buracos pesados confinados nas camadas de GaAs. Expressões teóricas são utilizadas para ajustar a dependência com a temperatura tanto da energia quanto da meia-largura destas transições, e os parâmetros obtidos dos melhores ajustes são avaliados em função da orientação dos substratos.

[12/05/05 - P331]
Dynamics of two interacting electrons in a one-dimensional crystal with impurities, Paulo E. de Brito, Eduardo S. Rodrigues, *Universidade Católica de Brasília*, Hugo N. Nazareno, *Centro Internacional de Física da Matéria Condensada - UnB* • We investigated the role that the electron-electron interaction plays on the propagating properties of wave packets in a one-dimensional crystal with impurities. We considered two interacting particles with opposite spins in a band, where we treated their interaction along the Hubbard model. We have obtained the density of states of the crystal for different values of the interaction term, as well as solved the dynamical Schrödinger equation by varying the initial conditions. We have introduced a method through which we were able to follow the time evolution of the wave packets for both spins showed in three-dimensional plots, and have evaluated, for each particle, the corresponding $MSD's$ and the centroids as function of time . These measurements allow us to determine the influence of the interaction on dynamical properties. We discussed the combined effect that the extension of the initial wave packets and the interaction strength have on propagating properties. Under certain conditions we obtained an entanglement of the two packets associated with both spins that takes place in a small region of the lattice.

[12/05/05 - P332]
Electrical characterization of p-type $Pb_{1-x}Eu_xTe$, Marcelos L. Peres, V. A. Chitta, Nei F. Oliveira Jr., *Instituto de Física, Universidade de São Paulo*, P. H. O. Rappl, A. Y. Ueta, E. Abramof, *Instituto Nacional de Pesquisas Espaciais, Laboratório Associado de Sensores e Materiais* • Diluted magnetic semiconductors of group IV-VI have attracted considerable interest in recent years. One of the most important ternary alloys is obtained with the incorporation of the magnetic ion Eu^{2+} into the PbTe compound. The increase of the Eu content yields the possibility of having an alloy with energy gap varying from 0.31 to 2 eV, covering continuously the optical spectrum from the infrared to the visible region. Besides this important property, the exchange interaction between the spin of the mobile carriers

and the localized magnetic moments can significantly modify the electrical and optical properties of these alloys. In this work we investigate the electrical properties of $Pb_{1-x}Eu_xTe$ layers grown by molecular beam epitaxy, as a function of Eu content x, the carrier concentration, temperature and magnetic field. When this alloy is grown under Te rich condition, it shows p-type conductivity. We have been able to show that the low-temperature hole mobility suffers a drastic reduction when the Eu concentration is increased from 0 to 10%, while the hole concentration is kept almost constant. The reduction of the hole mobility indicates a metal-to-insulator transition, which is probably induced by the disorder caused by the introduction of Eu. A negative magnetoresistance has also been observed at low magnetic fields. These results will be discussed and a comparison with a non-magnetic IV-VI alloy will be presented.

SEMICONDUTORES / MAGNETISMO (Spintrônica)

[12/05/05 - P333]
Analyzing the dimensionality of contacts in semiconductor quantum wires through the electronic wave function phase shift, Luis C. O. Dacal, *Instituto de Estudos Avançados - IEAv - CTA, C. P. 6044, 12231-970, São José dos Campos - SP, Brazil*, Erasmo A. de Andrada e Silva, *Instituto Nacional de Pesquisas Espaciais - INPE, C. P. 515, 12201-970, São José dos Campos - SP, Brazil* • The Rashba spin-orbit coupling is expected to be one of the main mechanisms for spintronic devices operation [1]. It is known that this term couples the spatial and spin coordinates [2] requiring a full three-dimensional description of the device properties. In this work we show that even the wave functions of Fermi electrons confined in a semiconductor quantum wire are not equivalent when one considers quasi-2D and 3D contacts. This geometric effect is shown through a simple phase shift calculation and the respective plot of the density of probability. We introduce a single effective phase-shift ϕ described by the usual constructive interference condition, namely $\frac{2\pi}{\lambda_F}L + \phi = n\pi$, where λ_F is the de Broglie wavelength of the Fermi electrons at conductance resonance, L is the quantum wire length and n is the corresponding resonance index. Alternatively, by setting $\phi = \frac{2\pi}{\lambda_F}\delta L$, we can use the simpler resonance condition $\frac{2\pi}{\lambda_F}L_{eff} = n\pi$ with an effective wire length $L_{eff} = L + \delta L$. Our results show that the 3D contacts exhibits effective phase-shifts, ϕ, twice bigger than the quasi-2D ones. At the same time, $\delta L/L$ is shown to decrease with increasing contact dimensionality and quantum wire length. These effective length analysis is corroborated by the plot of the density of probability.
This work is supported by CNPq and FAPESP.
[1] S. Datta and B. Das, Appl. Phys. Lett. **56**, 665 (1990)
[2] E. A. de Andrada e Silva and G. C. La Rocca, Phys. Rev. B **67**, 165318 (2003)

[12/05/05 - P334]
Electron Spin Resonance studies of Mn-doped GaAs and GaN amorphous thin films, W. A. Iwamoto, R. R. Urbano, C. Rettori, P. G. Pagliuso, *Instituto de Física Gleb Wataghin - Unicamp - Campinas - SP-Brazil*, J. H. D. da Silva, André L.J. Pereira, *Laboratório de Filmes Semicondutores-Departamento de Física Unesp-Bauru-SP-Brazil*, S. B. Oseroff, *San Diego State University, San Diego, California 92182, U.S.A* • Ferromagnetic semiconductors have become compounds of great interest due magnetic ions doped semiconductors where the free degree of spin could be utilized for producing electronic devices. In this work, experiments of magnetic susceptibility and Electron Spin Resonance (ESR) of Mn^{2+} ion in amorphous thin films of Mn-doped GaAs and GaN are reported. We have studied specimens of films doped with different concentrations of Mn (0.5 - 10%) and hydrogenated films with the same Mn concentration. In contrast to the ferromagnetic ordering observed in crystalline films for at $T_c \sim 110$ K, measurements show the absence of the ferromagnetic ordering for all measured films in the $300 < T < 2$ K temperature range. A single nearly temperature independent g ~ 2 line is observed for the Mn-doped films. The ESR intensity of this line roughly follows the paramagnetic Curie-law measured in the magnetic susceptibility for a given film. For GaAsMn hydrogenated films, the presence of hydrogen is also verified in the ESR spectra by three narrows g ~ 2 lines presumably due to s=$\frac{1}{2}$ centers with and without hyperfine splitting, whereas the hydrogen has no effect in ESR spectra for the GaMnN hydrogenated films. The origin of these s=$\frac{1}{2}$ centers is unclear. However, the ESR intensity of the three narrows lines is temperature independent suggesting that their origin may be associated with itinerant carriers.

[12/05/05 - P335]
A selfconsistent treatmet for a spin filter, Sergio S. Makler, Carlos F. Ritter, *Instituto de Física, Universidade Federal Fluminense*, Ivan C. da Cunha Lima, *Instituto de Física, Universidade do Estado do Rio de Janeiro* • A double barrier resonant tunneling device in which the well is made of a semimagnetic material can work as a spin filter. Neglecting the Rashba effect, the magnetization of the well produces totally polarized narrow resonant peaks separated by approximately $0.15eV$. These splittings are bigger than those produced by the highest stationary magnetic field obtained in a laboratory. As a consequence we get a spin polarized current when one of these peaks is below the Fermi level and above the bottom of the band.
Today is possible to make semiconductors that are ferromagnetic at room temperature. Therefore the device described here could be used as a spin polarizer, analyzer and other spintronic applications.
In this work we consider a $Ga_{1-x}Mn_xAs/Ga_{1-y}Al_yAs$ system that has a Curie temperature less than $110K$. However this system has the advantage that it can be easily integrated into the well known $GaAl/GaAs$ tech-