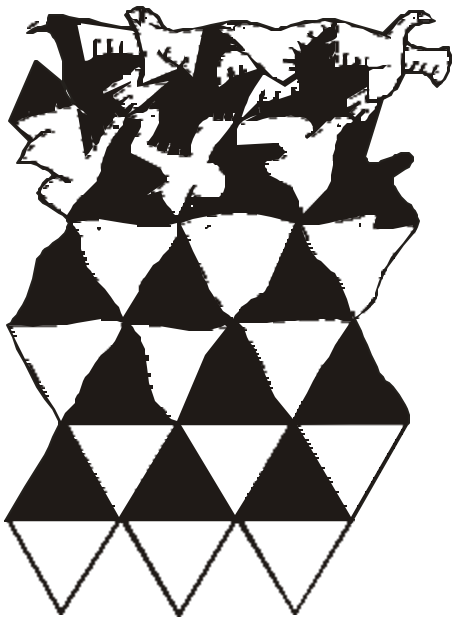
XXVIII ENCONTRO NACIONAL DE FÍSICA DA MATÉRIA CONDENSADA



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Santos, SP

[13/05/05 - P069]
Trabalho útil e dissipação em sistemas fracamente acoplados em diferentes temperaturas, Oswaldo de Medeiros Ritter, Wagner Figueiredo, *Departamento de Física, Universidade Federal de Santa Catarina* • Neste trabalho consideramos um par de sistemas acoplados a uma fonte de trabalho reversível de modo a representar uma máquina térmica. O acoplamento entre esses banhos, inicialmente em diferentes temperaturas, é feito por meio de uma interação fraca. É crença bem estabelecida que qualquer acoplamento direto entre os banhos não traz senão dissipação de energia. No entanto, se as escalas dos tempos de relaxação associadas com esses sistemas são muito diferentes, uma quantidade de trabalho extra pode ser obtida. Este trabalho adicional ganho devido ao acoplamento direto pode ser maior do que a dissipação extra. Mostra-se que, dependendo da natureza dos sistemas que estão interagindo, é necessário considerar a contribuição de segunda ordem ou mesmo de ordem mais alta no parâmetro de acoplamento para observar esse efeito. São feitas aplicações do formalismo analisando o acoplamento entre os dois banhos quando estes são modelados por gases ideais e por osciladores harmônicos com diferentes expressões para o termo de acoplamento.

[13/05/05 - P070]
Pattern Selection in a Phase Field Model for Directional Solidification, T. F. de Alencar Alves, R. N. Costa Filho, *Dep. de Física da UFC, Campus do Pici, C.P. 6030, 60451-970, Fortaleza, CE, Brasil.*, Enzo Granato, *Lab. Associado de Sensores e Materiais, INPE, 12201-970, São José dos Campos, SP, Brasil.*, J. M. Kosterlitz, *Dep. of Physics, Brown University, Providence, RI02912, USA* • The problem of pattern selection is to predict which pattern, out of a number of possible stationary patterns, will be selected under given experimental conditions. This problem has been of great interest for many years in many fields such as biology, chemistry, engineering and physics where a large variety of reproducible patterns can be formed under various external conditions which drive the system away from thermal and mechanical equilibrium. Important examples of pattern selection are directional solidification and eutectic growth where the interface between the ordered and disordered phases can take a periodic cellular pattern[1-3]. From the experimental point of view, the interface seems to have a well defined periodicity in both directed one phase solidification and in directed eutectic solidification. On the theoretical side, there is much disagreement with some researchers claiming that a unique wavelength is selected while others say that the wavelength of the final pattern is accidental. In this piece of work, we use a numerical approach based on the phase field model to study the wavelength selection for the cellular pattern formation in the directional solidification problem.

[1] B. Grossmann, K. R. Elder, M. Grant and J. M. Kosterlitz, Phys. Rev. Lett. **71**, 3323 (1993)
[2] K. R. Elder, F. Drolet, J. M. Kosterlitz and M. Grant, Phys. Rev. Lett. **72**, 677 (1994)
[3] K. R. Elder, F. Drolet, M. Grant and J. M. Kosterlitz, Phys. Rev. E **61**, 6705 (2000)

†Work financed by the brazilian agency CNPq.

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[13/05/05 - P071]
Size limits in the synchronization of chaotic coupled map lattices, Sandro E. de S. Pinto, José.T. Lunardi, Antonio M. Batista, Abdala M. Saleh, *Universidade Estadual de Ponta Grossa* • This communication aims to setup a lower limit for the size N of a coupled map lattice with long-range interaction, where the individual maps are chaotic logistic ones. It is done by means of the Lyapunov dimension D, the distance d to the synchronization subspace $\mathbf{S}$ and the time t_s that the system spends to synchronize. Bellow a limit value of N, and for the synchronized case, D is do not equal to the dimension of $\mathbf{S}$, which is the attractor of the entire system for a especified set of parameters; according to Kaplan-Yorke conjecture this two quantities must be the same. When N is increased, D brings near the dimension of the attractor. Through the examinationof the minimum D values, whithin the synchronized region as a function of N, is possible to find a minimumvalue N_{min} of the lattice size, for which the finite-size effects cease. The behavior of $t_s$corroborates the results of D in the synchronized case. In the nonsynchronized situation the d distribution earmarks also that there is a lower limit of N.

[13/05/05 - P072]
Long-Living Low-Temperature Quasi-Equilibrium States in the Hydrogen Atom, N.M. Oliveira-Neto, E.M.F. Curado, M.A. Rego-Monteiro, *Centro Brasileiro de Pesquisas Físicas*, F.D. Nobre, *Universidade Federal do Rio Grande do Norte* • Obtaining equilibrium properties for the hydrogen atom in free space, through standard Boltzmann-Gibbs statistical mechanics, represents a hard task, since the partition function diverges for any finite temperature. This occurs mostly in systems of composite particles, which are characterized by upper bounds, preceded by a quasi-continuum of energy levels, in their energy spectra. Essentially, this reflects the fact that composite particles always ionize at any finite temperature. Due to these difficulties, such systems are never discussed in standard statistical-mechanics textbooks. However, the presence of long-living nonionized hydrogen atoms in galaxy peripheries and in intergalactic media, at low temperatures, is undeniable. Certainly, their density must be very low in such a media, in order to avoid combination ($H + H \rightarrow H_2$), and they should spend a long time in their nonionized state, before reaching ionization. This is the main point we explore, on theoretical grounds. In the present work the dynamics of the approach to equilibrium of the hydrogen atom is investigated numerically through a Monte Carlo procedure. We show that, before approaching ionization, the hydrogen atom may live in a quasi-equilibrium state, whose duration increases exponentially as the temperatures decreases. By analyzing the quasi-equilibrium state, we compute