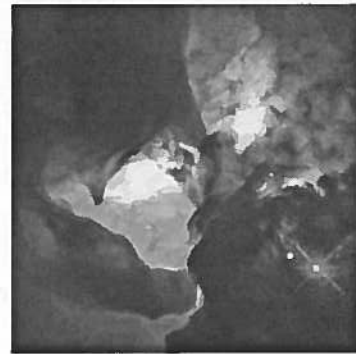




# WEEKLY CALENDAR

12 September 2005

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## General Seminar / Materials Science & Engineering Seminar Series

3:40PM / Thursday, 15 September 2005 / Room 109, Nicholson Hall

Host: Dr. Ilya Vekhter

[Refreshments served at 3:15PM in Room 229, Nicholson Hall]

### "Intermediate Symmetries and Dimensional Reduction"

Cristian Batista, PhD  
Los Alamos National Laboratory

#### Abstract

Symmetry occupies a central and indispensable role in physics. Amongst others, it is the key concept behind the theory of phase transitions and critical phenomena. Most of the known phase transitions break one or more symmetries. When symmetry breaking occurs, the mean value of a quantity which is not invariant under the symmetry group of the theory becomes "spontaneously" non-zero in the broken symmetry phase. Such a quantity is called the order parameter. As well appreciated, the dimension  $D$  of the system and the nature of the *order parameter* characterize different universality classes and play a pivotal role in determining whether a particular phase transition may or may not exist. In particular, zero or one-dimensional theories with short range interactions cannot exhibit a phase transition at any finite temperature. Additionally, the Mermin-Wagner theorem states that a continuous symmetry cannot be spontaneously broken at any finite temperature for two-dimensional theories with finite range interactions. On the other hand, Elitzur demonstrated that a spontaneous breaking of a *local* symmetry is not possible.

Different physical systems of current interest exhibit symmetries which are intermediate between local and global. I will show in this talk that the main consequence of this property is a *dimensional reduction* for fields which are not invariant under the symmetry transformations. In other words, these fields live in a  $d < D$ -dimensional world, where  $d$  is a property of the symmetry group.

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## Publications

"Fundamental Decoherence in Quantum Gravity." Rodolfo A. Gambini (Republica U., Montevideo), Rafael Porto (Carnegie Mellon U.), Jorge Pullin. *Braz. J. Phys.* **35**, 266-270 (2005).

"Characteristic Initial Data for a Star Orbiting a Black Hole." N. Bishop, R. Gomez, L. Lehner, M. Maharaj and J. Winicour. *Phys. Rev. D.* **72**, 024002 (2005).

"Fluctuations and Noise: A General Model with Applications." R.F. O'Connell. Invited Paper. *In: Fluctuations and Noise in Photonics and Quantum Optics III*. Proc. of SPIE Vol. 5842, 206 (2005).

"A Note on Frame Dragging." R.F. O'Connell. *Class. Quantum Grav.* **22**, 1-2 (2005).