UNIVERSITY OF CRETE
PHYSICS DEPARTMENT

CRETE CENTER FOR QUANTUM COMPLEXITY AND NANOTECHNOLOGY

ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

Thursday, 10 October 2013
17:00 -18:00
3rd Floor Seminar Room

"Star formation through the chemical lens"

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Abstract

Star formation is the process that connects the physical and the observable universe, that lights up the stars and creates planets. Yet to this day our understanding of it remains highly uncertain: the mechanism that is responsible for the fragmentation of star-forming interstellar clouds and that regulates the contraction of gas to form proto-stars remains the subject of intense debate. At the heart of the problem lies the difficulty in observing star-forming sites and obtaining directly the initial conditions of star formation. Observations of star-forming sites rely heavily on the use of molecular tracers. However, the abundance of these tracers is not constant: it is a result of a complex network of chemical reactions, and it depends on many factors. I will discuss how the coupling between chemistry and dynamics can help us probe the initial conditions of star formation. To this end, we have studied a variety of dynamical models describing the evolution of pre-stellar molecular cloud cores that cover the entire spectrum of proposed mechanisms, including pure hydrodynamic collapse and magnetically mediated collapse. These models have been coupled to a network of chemical reactions that follow the relative abundances for ~100 molecules, by solving the non-equilibrium chemical reactions for the first time simultaneously with the dynamical equations. I will present highlights from the results of this work, including newly proposed observables with maximal potential for discrimination between different models of cloud evolution and star formation. These results are especially timely as current and future facilities, such as ALMA and SKA, will be able to measure these quantities and contribute to the resolution of long-standing questions in star formation.