



# seminario

# seminar

**24 de octubre 2007**

Fundación IMDEA Matemáticas  
Módulo C-IX 3ª Planta  
Facultad de Ciencias - UAM  
Ciudad Universitaria de Cantoblanco  
28049 Madrid

**[ Matemáticas, la llave para el conocimiento, el desarrollo y la innovación  
Mathematics, the key for knowledge, development & innovation ]**

## 16:00 On a Lie--Poisson system and its Lie algebra



**Prof. Arie Iserles**

Department of Applied Mathematics and Theoretical Physics  
Centre for Mathematical Sciences  
University of Cambridge

In this talk, based on joint work with Tony Bloch, we describe an unusual-looking isospectral ODE system and demonstrate that it possesses Lie--Poisson structure. Such systems can be reformulated to evolve on a co-adjoint orbit of a Lie algebra defined by the underlying structure constants, but the challenge is to identify a tight faithful representation of this algebra from available information. We develop a numerical algorithm that accomplishes this goal. All necessary concepts (isospectrality, Poisson and Lie--Poisson flows, structure constants, free Lie algebras and faithful representations) will be introduced in the talk.

Time allowing, we'll touch upon more recent work (joint with Tony Bloch, Vasile Brizanescu, Jerry Marsden and Tudor Ratiu) where we prove that our system is integrable, although it is not in the Fomenko--Mischenko class of integrable flows, and describe all its Casimirs.

## 17:00 Coffee break

## 17:15 Chaos and the formation of binary objects in the Kuiper-belt



**David Farrelly**

Department of Chemistry  
Utah State University

The discovery that many trans-Neptunian objects exist as binaries is invaluable for shedding light on the formation, evolution and structure of the outer Solar System, e.g., the nature of the dynamics in debris disks. So far over 20 Kuiper-belt binaries (KBBs) are known. Most KBBs contain partners having similar masses which follow large and eccentric mutual orbits. In this talk a common dynamical explanation is proposed for the unusual compositional and orbital properties of KBBs based on four-body simulations in the Hill approximation.

Chaos is found to play a double role in the stabilization and destabilization of nascent binaries; it provides a mechanism for the formation of transient binaries but selectively destabilizes binaries containing partners having very unequal masses.

Possible extensions of the methods and mechanisms used to problems of current interest in atomic and molecular physics and chemical reaction dynamics will be briefly discussed.