

# Master's Thesis Colloquium

## *Planetary Dynamics and Chaos:*

### *A Numerical Stability Study of Resonant Habitable Earth-like Planets in Extrasolar Planetary Systems*

*- A Dynamical Analysis of HD70642 and HD4208 -*

by

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Time: Thursday, 06.04.2006, 14.15 (45. min)  
Location: Auditorium, The Rockefeller Complex, Juliane Maries Vej 30-32, 2100 Copenhagen Ø.  
Language: English  
Note: There will be a reception afterwards in the DARK-Cosmology guest lounge to celebrate this event. A little snack and a glass of something will be served.

#### **Abstract:**

The orbital stability properties of hypothetical terrestrial planets (modelled as test particles) within the habitable zone of the stars HD4208 and HD70642 are investigated. The habitable zone for each system is determined from Kasting et al. (1993) and provides constraints on Kepler parameters within the  $(a, e)$ -space. Independent numerical simulations, using symplectic and interpolation methods, are used to study dynamical characteristics (i.e chaos and dynamical confinement within the system's orbital parameter phase space). The MEGNO indicator is used to measure the chaotic nature of the time evolution of Keplerian orbital parameters. Stability properties are inferred by directly considering the dynamics of  $2 \times 10^3$  test particles. A dynamically "cold" (i.e  $e = 0$ ) distribution of particles with random mean anomalies is used as initial conditions throughout the habitable zone. The presence of mean-motion resonances are capable in eccentricity excitation up to  $e = 0.8$  for the test particles located within the habitable zone. This kind of theoretical dynamical analysis will help future search projects for habitable terrestrial planets, by providing a mission targeting list of exosystems with a high confidence in harbouring terrestrial like planets on dynamically stable orbits confined within the habitable zone.

#### **Literature:**

Master's thesis, T. C. Hinse, Niels Bohr Institute, University of Copenhagen, 2006. A limited number of copies of the thesis are available and will be handed out upon written request: [tobiash@astro.ku.dk](mailto:tobiash@astro.ku.dk).