Arnaud Beth | Curriculum vitae

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Education

Université Paul Sabatier **Toulouse, France**
PhD in Planetary Sciences *2011–2014*

Université Paul Sabatier **Toulouse, France**
Bachelor & Master in Science *2007–2011*
Major in Fundamental Physics (Bachelor in Science) and in Astrophysics, Space and Planetary Sciences (Master)

Master thesis

Title: *Dynamics of radiative layers of massive stars*

Supervisors: M. Rieutord

Description: Stars lose, during their life, a huge amount of matter through the stellar wind. This induces a spin-down and a retroacting effect on the circulation of matter in the radiative layers of the star. We investigated the coupling between the spin-down and the baroclinic torque. The method is based on the resolution of the Navier-Stokes equations, based on a development on Spherical Harmonics.

PhD thesis

Title: *Analytical modeling of terrestrial planets' upper atmospheres*

Supervisors: D. Toublanc & P. Garnier

Abstract: The external part of the atmosphere, the exosphere, is not a well-known region. The densities are too low for many instruments compared with their detection capabilities, and the modeling of the particles dynamics can be complex. During my PhD thesis, I focused on two problems: the production of "satellite" particles from the scarce collisions in the lower exosphere and the influence of the radiation pressure on the exosphere structure.
In the first part of my thesis, we modeled the influence of the scarce collisions near the exobase on the density profiles at higher altitudes for the Earth, Titan and Mars, through the production of "satellite" particles, that are neglected in the collisionless models. In a second part, I studied the effect of the radiation pressure on the structure of the exosphere with a semi-analytical approach. The radiation pressure changes the ballistic particle density profiles and implies strong asymmetries at high altitudes. It increases also the thermal escaping flux, which we determined analytically at the subsolar point. Finally, we studied its influence on the Three-Body problem and on the stability of the atmospheres, in particular for hot Jupiter exoplanets.

Languages

French: Mother tongue

English: Fluent

Computer skills

Computation language: C, Matlab, Maple

Publications

A. Beth, P. Garnier, D. Toublanc, I. Dandouras, and C. Mazelle. **Theory for planetary exospheres: I. Radiation pressure effect on dynamical trajectories of Hydrogen**. *Icarus*. (in review).

A. Beth, P. Garnier, D. Toublanc, I. Dandouras, and C. Mazelle. **Theory for planetary exospheres: II. Radiation pressure effect on neutral species density profiles**. *Icarus*. (accepted).

A. Beth, P. Garnier, D. Toublanc, I. Dandouras, and C. Mazelle. **Theory for planetary exospheres: III. Radiation pressure effect on thermal escape flux**. *Icarus*. (in review).

A. Beth, P. Garnier, D. Toublanc, I. Dandouras, C. Mazelle, and A. Kotova. **Modeling the satellite particle population in the planetary exospheres: Application to Earth, Titan and Mars**. *Icarus*, 227(0):21 – 36, 2014.

M. Rieutord and A. Beth. **Dynamics of the radiative envelope of rapidly rotating stars: Effects of spin-down driven by mass loss**. *A&A*.

International communications

Orals

2013: EGU, ***Modeling the satellite particles in planetary exospheres : application to Titan, Earth and Mars***, Vienna.

2014: EPSC, ***Influence of the radiation pressure on the planetary exospheres : analytical modeling of density profiles and escape flux, implication for the Three-Body problem and the Roche lobe location***, Lisbon.

2015: EGU, ***Analysis of the effect of the radiation pressure on planetary exospheres : application to Earth, Mars, Titan and hot Jupiters***, Vienna.

2015: EPSC, ***Influence of the radiation pressure on the planetary exospheres: density profiles, escape flux and atmospheric stability***, Nantes.

Posters

2012: EGU, ***Modeling the satellite particles in planetary exospheres : application to Titan, Earth and Mars***, Vienna.

2012: AGU, ***Modeling the satellite particles in planetary exospheres : application to Titan, Earth and Mars***, San Francisco.

2013: AGU, ***The analytical modeling of planetary exospheres: a) the satellite particles at Earth, Titan and Mars, b) the influence of the radiation pressure on the ballistic and escaping particles density profiles***, San Francisco.

2014: EGU, ***Influence of the radiation pressure on the planetary exospheres : analytical modeling of density profiles and escape flux***, Vienna.

2014: AGU, ***Analytical Analysis of the Effect of the Radiation Pressure on Planetary Exospheres: Application to Earth, Mars, Titan and Hot Jupiters***, San Francisco.

Internal communications

I attended two meetings and took part in different scientific groups linked to MAVEN (January 2012 and November 2013 before MAVEN launch) and I also participated and presented my work during the Heliosares meetings (June 2013 and February 2014), organized by F. Leblanc.

Teaching

200 hours of tutorials and practical work in Mathematics applied to Physics, Instrumentation, Optics, Fluid Mechanics, etc... to Bachelor students at the Paul Sabatier University in Toulouse during my PhD.

Outreach

Each Summer from 2013, I participated to the organization of the Astronomical Festival in Fleurance (France), the biggest French and European astronomical festival, supervising children (4-17 years old, beyond 150 children each morning) to teach about Astronomy for a week with several activities.