MAP-fis Essay Proposal, 2013-2014

Supervisor

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Title

Stellar and Orbital evolution during the Red-giant phase

Area

Theoretical Astrophysics

Summary of Proposal

In the next 5 billion years, the Sun will start to cool and expand, becoming a Red-giant star. During this process, the Sun radii will increase hundreds of times, and will engulf the orbits of the inner planets. However, during this process the orbits of the planets will also expand, and there is a possibility that they are never cached by the solar envelope. Nevertheless, the orbital scattering may also give rise to close encounters between the planets, which will cause collisions between them or ejections from the Solar System. During this Ph.D we want to study the simultaneous solar and orbital evolution of the Solar System during the last stages of the solar life. In particular, we wonder what will be the fate of the inner planets, and, in particular, the final destiny of the Earth. We will also apply our model to the already detected extra-solar planets around Red-giant stars.

References

Rasio, F. A., Tout, C. A., Lubow, S. H. & Livio, M. (1996), "Tidal Decay of Close Planetary Orbits", Astrophysical Journal 470, 1187-1191.

Rybicki, K. R. & Denis, C. (2001), "On the Final Destiny of the Earth and the Solar System", Icarus 151, 130-137.

Schroder K.-P., Smith R. C. & Apps K. (2001), "Solar evolution and the distant future of Earth", Astronomy & Geophysics 42, 6.26-6.29.

Veras, D. & Wyatt, M. C. (2012), "The Solar system's post-main-sequence escape boundary", Monthly Notices of the Royal Astronomical Society, 421, 2969-2981.