MAP-fis Essay Proposal, 2014-2015

(*please write in English*)

Supervisor

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Title

The Boltzmann equation in alternative theories of gravity: f(R)

Area

(*Materials, Optics, Condensed Theory, High Energy Theory,....*);

Gravitation, Cosmology, Statistical Physics

Summary of Proposal

Almost 95% of the Universe is unknown if we rely on General Relativity (GR) and de Lambda CDM standard cosmological model. However, one can admit generalisations of GR, which could account for dark matter and dark energy effects without postulating the existence of exotic particles and/or fluids for that purpose. A well known alternative model for gravity is the so-called f(R) theories [1].

Gravitational systems can be statistically described by the Boltzmann equation, which is a very useful tool for many macroscopic derived equations, such as the Navier-Stokes, the virial theorem, Jeans' equations, etc. Generalisations for the quantum, relativistic and for the general relativistic cases are known [2].

It would be quite interesting to examine how alternative theories of gravity, such as f(R) theories, would affect the Boltzmann equation and its implications for physical systems.

(c*ontinue if necessary*)

References

(t*o allow students first look at topic*)

[1] T. P. Sotiriou and V. Faraoni, f(R) Theories Of Gravity, Rev. Mod. Phys. 82 451
(2010) [arXiv:0805.1726] .

[2] E. W. Kolb and M. S. Turner, The Early Universe, Addinson Wesley, 1990.