

Ph.D. thesis position

Dark matter chaos in the solar system and related areas

Host laboratory

Institut UTINAM - UMR CNRS 6213 - Equipe PhAs - Physique et Astrophysique

Supervisors

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Research project

One of the most challenging task of the nowadays physics is the understanding of dark matter. The count of all the baryonic matter (the visible matter) in the Universe does not allow to understand the cosmic ballet played by the galaxies. Thus, ninety percent of the matter (dark matter) is lacking in order to explain the movements of the galaxy clusters. The study of this unknown type of matter is at the heart of an outstanding international effort gathering thousands of researchers (astrophysicists, theoretical physicists, high energy physicists, ...) around several international space missions. One of the tasks of these missions will be to determine the spatial distribution of dark matter in our galaxy and especially in the neighborhood of the solar system. In order to probe efficiently the dark matter it is highly desirable to know where to look at in the Universe and as a consequence to understand the capture mechanism of dark matter particles. The work done this year jointly at the Institut UTINAM (Besançon) and at the Laboratoire de Physique Théorique (Toulouse) has confirmed the importance of chaos in the capture process of dark matter by the solar system. This capture is due to the three body interaction (chaos paradigm) between the dark matter particle, the Sun and the Jovian planets. This Ph.D. thesis work will deepen the understanding of the dark matter capture mechanism and will establish a reliable distribution of dark matter around the solar system and around our galaxy. Besides the dark matter theme, this Ph.D. work will also focus on the understanding of mechanisms of synchronization in the solar system. The candidate will be hosted by the Institut UTINAM but the work will be done in close collaboration with the Laboratoire de Physique Théorique, UMR CNRS 5152 (Toulouse, France).

Required skills

The candidate should possess an academic degree equivalent to the French Master 2 degree in Physics or in Astrophysics, solid theoretical background, and solid knowledge of at least a programming language such as FORTRAN, C++, ... Additional knowledge in chaos theory would be appreciated.

Keywords

Classical Chaos, Quantum Chaos, Synchronization.

References

1. I.B. Khriplovich and D.L. Shepelyansky, "Capture of dark matter by the Solar System", International Journal of Modern Physics D (IJMPD) v.18(12), pp.1903-1912 (2009) [arxiv:0906.2480](https://arxiv.org/abs/0906.2480) [astro-ph]
2. D.L. Shepelyansky, A.S. Pikovsky, J. Schmidt, F. Spahn "Synchronization mechanism of sharp edges in rings of Saturn", Mon. Not. R. Astron. Soc. v.395, pp.1934-1940 (2009) [arxiv:0812.4372](https://arxiv.org/abs/0812.4372) [astro-ph]
3. J. Lages and D.L. Shepelyansky, "Chaos of dark matter in the Solar system", in preparation.

Modalities

This is a three year position leading to a Ph.D. degree in theoretical physics. The position start ideally in october 2012, but no later than december 2012. The before taxes monthly income is 1685€ or 2025€ with teaching duties (64 hours per year). To apply, please send a curriculum vitæ, a copy of the relevant academic diplomas with the corresponding marks, and a letter of reference.