Open Internship in the ESA Advanced Concepts Team in 2015
on

Time Transfer Problem

Topic description

With current advances in both science and technology, it has become imperative that we are able to determine some of the relativistic effects in the propagation of light. This is necessary for global navigation satellite systems which we depend on for up to date location determination but also for modern day telescopes such as the GAIA (Global Astrometric Interferometer for Astrophysics). Several methods have been used to date: post-Minkowskian expansions [1-3], using the analytical solution of the geodesic equation[4], numerical integration of Synge world function[5], etc. This project is to investigate these previous methods but also to develop new methods and give an overall analysis.

Candidate's tasks

The candidate will join an existing project in collaboration with researchers from the Technical University of Lisbon. The candidate's tasks will be to:

- Re-produce previous results using post-Minkowskian and post-Newtonian expansion methods
- Explore possibility of producing higher orders
- Implement new expansion methods
- Assist in overall analysis and comparison of different methods

The ideal candidate

Mandatory:

- Strong background in mathematics/applied mathematics/mathematical physics/theoretical physics;
- Background knowledge of General Relativity.

Desirable:

- Working knowledge of Mathematica or other symbolic solver
- Programming skills

References

[1] B. Linet, P. Teyssandier ,New method for determining the light travel time in static, spherically symmetric spacetimes. Calculation of the terms of order G^3, Class. Quantum Grav. 30 (2013) 17500

[2] P. Teyssandier, C. Le Poincin-Lafitte, General post-Minskoskian expansion of time transfer functions, Class. Quantum Grav. 25 (2008) 145020

[3] C. Le Poincin-Lafitte, B. Linet, P. Teussandier, World function and time transfer: general post-Minkowskian expansions

[4] A. Cadez, U. Kostic, Optics in the Schwarzschild spacetime, Phys Rev D 72 (10):104024 (2005)

[5] A. San Miguel, Numerical determination of time transfer in general relativity, General Relativity and Gravitation, 39:2025-2037 (2007)