Spin-perturbed orbits near black holes

Vojtěch Witzany

vojtech.witzany@asu.cas.cz,
Astronomical Institute of the Czech Academy of Sciences,
Boční II 1401/1a, CZ-141 00 Prague, Czech Republic

A compact stellar mass object inspiralling onto a massive black hole deviates from geodesic motion due to radiation-reaction forces as well as finite-size effects. Such post-geodesic deviations need to be included with sufficient precision into wave-form models for the upcoming space-based gravitational-wave detector LISA.

In this talk, I present the formulation and solution of the Hamilton-Jacobi equation for the motion of test bodies near Kerr black holes perturbed by the so-called spin-curvature coupling, the leading order finite-size effect. The formulation is based on the recently derived Hamiltonian formalism for spinning particles [1]. An important property used in the construction of the solution is the separability of parallel transport with respect to a specially adapted tetrad in Kerr space-time, which makes the Hamilton-Jacobi equation "almost separable". In return, this solution allows to compute a number of observables such as the turning points of the orbits as well as the fundamental frequencies of motion. I finish with discussing how this contributes to the post-geodesic (or "self-force") program of modeling extreme mass ratio inspirals.

References

[1] V. Witzany, J. Steinhoff, and G. Lukes-Gerakopoulos. Hamiltonians and canonical coordinates for spinning particles in curved space-time. *Class. Quant. Grav.*, 2018. In print.