

Force-free electrodynamics near rotation axis of a Kerr black hole

Tuesday, January 14, 2020 3:00 PM (15 minutes)

Despite their potential importance for understanding astrophysical jets, physically realistic exact solutions for magnetospheres around Kerr black holes have not been found, even in the force-free approximation. Instead approximate analytical solutions such as the Blandford-Znajek (split-)monopole, as well as numerical solutions, have been constructed. In this talk we consider a new approach to the analysis and construction of such magnetospheres. We consider force-free electrodynamics close to the rotation axis of a magnetosphere surrounding a Kerr black hole assuming axisymmetry. This is the region where the force-free approximation should work the best, and where the jets are located. We perform a systematic study of the asymptotic region with (split-)monopole, paraboloidal and vertical asymptotic behaviors. Imposing asymptotics similar to a (split-)monopole, we find that demanding regularity at the rotation axis and the event horizon restricts solutions of the stream equation so much that it is not possible for a solution to be continuously connected to the static (split-)monopole around the Schwarzschild black hole in the limit where the rotation goes to zero. This provides independent evidence to the issues discovered with the asymptotics of the Blandford-Znajek (split-)monopole in Ref. [1] from which it follows that its perturbative construction is inconsistent.

Primary author: HARMARK, Troels (Niels Bohr Institute)

Presenter: HARMARK, Troels (Niels Bohr Institute)

Session Classification: Afternoon session