Contribution ID: **211** Type: **Talk in a parallel session**

Multi-Black Hole Gravitational Field

Friday, 12 July 2024 17:00 (20 minutes)

We shall discuss a system consisting of three extremally charged black holes moving in their own gravitational and electromagnetic fields. Based on a method by Ferrell & Eardley for an arbitrary number of holes, we take the exact static Majumdar-Papapetrou spacetime, and perturb it by giving the holes small velocities.

Suprisingly, the complicated equations can be reduced to a classical mechanics problem with a Lagrangian determining the motion of the black hole system, which is given as an integral over the spatial variables. The issue is to evaluate the integral explicitly. This has been done for two holes so far—we extend it by adding a third one. We compare the motion of the third black hole to that of a test particle in the field of the two remaining holes. What remains is the self-force due to the third black hole acting on itself.

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Session Classification: Gravitational instantons and black holes

Track Classification: Black Holes: Classical and Beyond (BH): Gravitational instantons and black holes