Sixteenth Marcel Grossmann Meeting



Contribution ID: 295

Type: Invited talk in the parallel session

Gravitomagnetism in the Lewis cylindrical metrics

Monday, 5 July 2021 18:19 (18 minutes)

The Lewis solutions describe the exterior gravitational field produced by infinitely long rotating cylinders, and are useful models for global gravitational effects. When the metric parameters are real (Weyl class), the metrics of rotating and static cylinders are locally indistinguishable, but known to globally differ. The significance of this difference, both in terms of concrete physical effects and of the mathematical invariants where the rotation imprints itself, remained however an open problem. In this talk we will address these issues. We show that the Weyl class metric can be put into a 'canonical' form which depends explicitly only on three parameters with a clear physical significance, and reveals that the two settings differ only at the level of the gravitomagnetic vector potential which, for a rotating cylinder, cannot be eliminated by any global coordinate transformation. It manifests itself in frame-dragging effects such as the Sagnac and gravitomagnetic clock effects. This mirrors the electromagnetic field of a rotating charged cylinder, which likewise differs from the static case only in the vector potential, responsible for the Aharonov-Bohm effect (formally analogous to the Sagnac effect). The notions of local and global staticity are also revisited.

Primary author: COSTA, Filipe (CAMGSD - Instituto Superior Técnico, Universidade de Lisboa)

Co-authors: Prof. NATÁRIO, José (CAMGSD - Instituto Superior Técnico, Universidade de Lisboa); Dr SANTOS, Nilton O. (Sorbonne Universite, UPMC Universite Paris 06, LERMA, UMRS8112 CNRS, Observatoire de Paris-Meudon)

Presenter: COSTA, Filipe (CAMGSD - Instituto Superior Técnico, Universidade de Lisboa)

Session Classification: Dragging is Never Draggy: MAss and CHarge Flows in GR

Track Classification: Precision Tests: Dragging is never draggy: MAss and CHarge flows in GR