Contributed Talk

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Title: Gravitomagnetism in the Lewis cylindrical metrics

Abstract: 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: the Komar mass and angular momentum per unit length, plus the angle deficit. This new form of the metric 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 the Sagnac and gravitomagnetic clock effects. This perfectly 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.