Abstract Submitted
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Mapping spacetime geometry with gravitational wave observatories CHAO LI, GEOFFREY LOVELACE, Caltech — We consider the gravitational waves emitted from an extreme mass ratio inspiral (EMRI) system that consists of a small object (the "moon") orbiting a massive body whose metric is stationary, axisymmetric, reflectional symmetric and asymptotically flat (SARSAF). Numerical experiments suggest that the moon moves in a multi-periodic orbit; this may be due to the KAM theorem. We show that the emitted waves can be expanded into a discrete Fourier series with three fundamental frequencies that evolve slowly due to radiation reaction. A previous study (*Ryan's theorem* Phys. Rev. D **52** 5707 (1995)) showed how to extract the spacetime metric from these evolving frequencies, assuming a nearly circular, nearly equatorial orbit. We generalize this theorem in two ways: We show that (i) for nearly circular, nearly equatorial orbits the moon's evolving orbital elements and its tidal coupling to the central body can be extracted along with the metric (joint work with Geoffrey Lovelace), and (ii) if the orbit has substantial eccentricity, the metric can still be extracted. We also argue that generalizing Ryan's theorem to generic orbits will require details of wave generation theory.

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