Non-shallow water waves on a vortex: A model for dispersive fields around rotating black holes

Theo Torres[ab*]

a. School of Mathematical Sciences, University of Nottingham, University Park, Nottingham, NG7 2RD, UK.

b. Centre for the Mathematics and Theoretical Physics of Quantum Non-Equilibrium Systems, University of nottingham, NG7 2RD, UK.

* theo.torresvicente@nottingham.ac.uk

Shallow water waves scattering on a draining and rotating potential flow constitute the analogue of a rotating black hole. In such a spacetime, it has been shown theoretically that, at low frequency, waves can extract energy from black holes. Such a process in known as superradiance. Our recent observation of this effect in an experiment at the University of Nottigham [1] suggests that superradiance persists beyond the shallow water regime. In this talk, I will briefly present the experiment we conducted and I will extend some features of analogue rotating black holes to the dispersive regime. Especially I will focus on light rings and quasi-normal modes. This presentation is based on [2]

[1] T. Torres, S. Patrick, A. Coutant, M. Richartz, E. W. Tedford, and S. Weinfurtner, Nature Phys. 13, 833 (2017), arXiv:1612.06180 [gr-qc].

[2] T. Torres, A. Coutant, S. Dolan, and S. Weinfurtner, (2017), arXiv:1712.04675 [gr-qc].

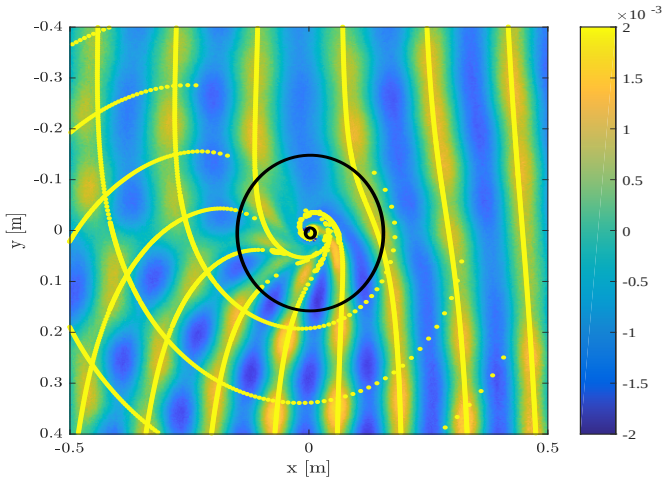

Figure 1: Comparison between eikonal wavefront computed numerically and experimental data from [2]. The bright yellow dots represent the eikonal wavefront reconstructed from the phase along the rays. The two black circles are the unstable orbits. The colorbar represents the amplitude of the wave in metres.