Gravitational waves from long-time evolution of tilted thick disc around a rotating black hole

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Abstract

The tilted thick disc around a rotating black hole scenario can be formed from BH-NS binary mergers when the BH spin is misaligned with orbital plane of the binary. The numerical relativity simulations from [1] have shown that the Papaloizou-Pringle Instabilities [2] developed during the evolution can produce potentially detectable gravitational waves. In this talk, we will show a 3D numerical relativity simulations of tilted thick torus around a rotating black hole after long-time evolution, around one hundred orbital periods of the disc. We perform this simulation using the public Einstein Toolkit [3,9] code to evolve the Einstein equations written in BSSN formulation [4,6] implemented in McLachlan thorn [7,8], while the matter part was evolved using the GRHydro thorn [9,11] that solves the general relativistic hydrodynamics equations written in Valencia formulation, using the well known high-resolution shock-capturing methods with Marquina’s flux formula and PPM cell reconstructor. The initial data for the thick disc is a self-gravitating solution provided by Stergioulas [11], i. e., satisfy the Einstein equations at $t = 0$. We will present the morphology of the torus and waveform generated from the non-linear dynamics of the tilted disc-black hole system.

References


