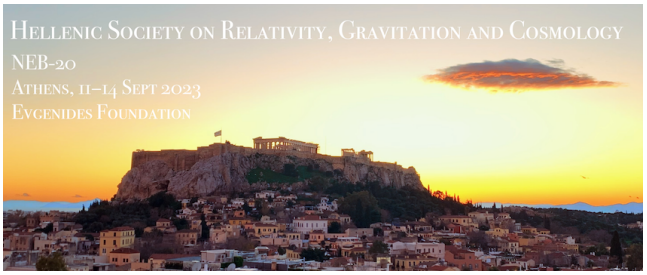

Contribution ID: **43** Type: **not specified**

Resonant orbits and chaos of rotating black holes beyond circularity

Monday, 11 September 2023 15:30 (20 minutes)

According to General Relativity, an isolated black hole in vacuum shall be described by the Kerr metric, whose geodesic equations are integrable. The violation of integrability leads to chaos for particles moving around the black hole. This chaotic dynamics could leave imprints on the associated gravitational waveform and could be tested with upcoming observations. In this talk, we discuss the chaotic orbital dynamics induced by the violation of a certain spacetime symmetry, the circularity. Specifically, we focus on the resonant orbits of a particular noncircular spacetime as an example and find that they form chains of Birkhoff islands on Poincaré surfaces of section. We compare the island structures with those generated in typical nonintegrable but circular spacetimes. The islands of stability induced by noncircularity appear asymmetric on the most common Poincaré surface of section at the equatorial plane. The asymmetric patterns of islands vary discontinuously when the spacetime parameters transit through integrable regions. Possible observational implications about testing circularity through gravitational wave detection are discussed.

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Session Classification: Parallel Session B