Black Holes, Neutron Stars, and Gravitational Waves @ Black Sea



Contribution ID: 67

Type: not specified

Precessing binary black holes and mirror (a)symmetry in the Universe

Wednesday 18 June 2025 14:30 (30 minutes)

Precessing binary black hole mergers can potentially excite photons from the quantum vacuum in such a way that total helicity is not preserved in the process. I will show that precessing binary black hole systems in astrophysics generate a flux of circularly polarized gravitational waves which, in turn, provides the required helical background that triggers this quantum effect. Solving the fully nonlinear Einstein's equations with numerical relativity we explored the parameter space of binary systems and extract the detailed dependence of the quantum effect with the spins of the two black holes. We also introduce a set of diagrammatic techniques that allows us to predict when a binary black hole merger can or cannot emit circularly polarized gravitational radiation, based on mirror-symmetry considerations. According to the cosmological principle, such emission must average to zero across all binary mergers in our Universe to preserve mirror-reflection symmetry at very large scales. I will briefly discuss a new independent gravitational-wave test of this hypothesis.

Author: Dr SANCHIS-GUAL, Nicolas

Co-authors: DEL RIO VEGA, Adrian (Penn State); CALDERON BUSTILLO, Juan; Dr CHANDRA, Koustav; Mr LEONG, Samson (The Chinese University of Hong Kong)

Presenter: Dr SANCHIS-GUAL, Nicolas