Poster Session #D
Binary sources of Gravitational Waves and cosmology

D07

Topsy-turvy binary black hole spins in numerical relativity

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Spin precession occurs in binary black holes whose spins are misaligned with the orbital angular momentum. Otherwise, the spin configuration is constant, and the subsequent binary dynamics and gravitational-wave emission is much simpler. But, aligned-spin binaries in the 'up-down' configuration are unstable when perturbed; at a critical point in the inspiral the black hole spins begin to tilt wildly as precession takes over. We show for the first time that this prediction, derived with post-Newtonian techniques, holds in full numerical relativity. We perform 12 new simulations of the stable and unstable configurations for different spin perturbations, each lasting about 100 orbits before merger and featuring several precession cycles. Precession induced by the spin instability of up-down black-hole binaries can tilt the spins by as much as 90 degrees from near-alignment and leaves a notable imprint in the emitted gravitational-wave signal.