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Parameter estimation of binary black holes in the endpoint of the up–down instability

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Black-hole binary spin precession admits equilibrium solutions corresponding to systems with (anti-) aligned spins. Among these, binaries in the up–down configuration, where the spin of the heavier (lighter) black hole is co- (counter-) aligned with the orbital angular momentum, might be unstable to small perturbations of the spin directions. The occurrence of the up–down instability leads to gravitational-wave sources that formed with aligned spins but are detected with precessing spins. We present a Bayesian procedure based on the Savage-Dickey density ratio to test the up–down origin of gravitational-wave events. This is applied to both simulated signals, which indicate that achieving strong evidence is within the reach of current experiments, and the LIGO/Virgo events released to date, which indicate that current data are not informative enough.

Primary author: DE RENZIS, Viola (University of Milano-Bicocca)**Presenter:** DE RENZIS, Viola (University of Milano-Bicocca)**Session Classification:** Parallel Session B