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Binary black holes and their echoes in the Universe

PABLO LAGUNA, The Pennsylvania State University

A new window in astronomy will open once gravitational-wave interferometers detect “first light.” These detectors will give us a revolutionary view of the Universe, complementary to the electromagnetic perspective. The detection and characterization of gravitational waves is a formidable undertaking, requiring innovative engineering, powerful data analysis tools as well as careful theoretical and numerical modeling. Binary black holes are expected to be one of the primary sources of gravitational radiation. I will discuss aspects of numerical simulations of binary black holes in connection with spins, gravitational recoil and eccentricities that have been recently obtained and have direct relevance to gravitational wave data analysis and astrophysics.