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The binary-host connection: astrophysics of gravitational wave binaries from their host galaxy properties DANIEL HOLZ, University of Chicago, SUSMITA ADHIKARI, Stanford University, MAYA FISHBACH, University of Chicago, RISA WECHSLER, ZHANPEI FANG, Stanford University — Gravitational waves produced from the merger of binary neutron stars (BNSs) are accompanied by electromagnetic counterparts, making it possible to identify the associated host galaxy. We explore how properties of the host galaxies relate to the astrophysical processes leading to the mergers. It is thought that the BNS merger rate within a galaxy at a given epoch depends primarily on the galaxy's star-formation history as well as the underlying merger time-delay distribution of the binary systems. We find that different time-delay distributions predict different properties of the associated host galaxies, including the distributions of stellar mass, star-formation rate, halo mass, and local and large-scale clustering of hosts. BNSs that merge today with short delay times prefer to be in hosts that have high star-formation rates, while those with long delay times live in dense regions within massive halos that have low star formation. We show that with $\mathcal{O}(10)$ events from current gravitational-wave detector networks, it is possible to make preliminary distinctions between formation channels which trace stellar mass, halo mass, or star-formation rate.

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