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The Loudest Gravitational Wave Events HSIN-YU CHEN, DANIEL HOLZ, University of Chicago — Compact binary coalescences are likely to be the source of the first gravitational wave (GW) detections. While most Advanced LIGO-Virgo detections are expected to have signal-to-noise ratios (SNR) near the detection threshold, there will be a distribution of events to higher SNR. Assuming the space density of the sources is uniform in the nearby Universe, we derive the universal distribution of SNR in an arbitrary GW network, as well as the SNR distribution of the loudest event. These distributions only depend on the detection threshold and the number of detections; they are independent of the detector network, sensitivity, and the distribution of source variables such as the binary masses and spins. We also derive the SNR distribution for each individual detector within a network as a function of the detector orientation. We find that, in 90% of cases, the loudest event out of the first four Advanced LIGO-Virgo detections should be louder than SNR of 15.8 (for a threshold of 12), increasing to an SNR of 31 for 40 detections. We expect these loudest events to provide the best constraints on their source parameters, and therefore play an important role in extracting astrophysics from GW sources.

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