Exploring LIGO/Virgo Sensitivity Evolution through Parameter Estimation of Compact Binary Mergers

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Gravitational-wave astronomy has advanced rapidly as detector sensitivity has improved across successive observing runs. In this project, we analyze select events from O1 to O3 to explore how these upgrades affect both signal recovery and parameter estimation. Strain data around selected mergers are filtered with theoretical templates to extract quantities such as signal-to-noise ratio(SNR), chirp mass, and component masses. The comparison highlights how higher sensitivity reduces uncertainty in recovered parameters and strengthens confidence through clearer residual checks after waveform subtraction. To connect detector performance with astrophysical implications, We also examine the change in detection horizon for compact binaries across runs. This demonstrates how improvements in noise reduction not only yield sharper parameter recovery but also extend the observable volume of the universe accessible to gravitational-wave detectors. The study provides a concise and easy to understand perspective on the link between instrument development, parameter inference, and the expanding reach of gravitational-wave observations. We discuss some aspects of GW astronomy as well.