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Gravitational Wave Data Processing with Open-Source Tools: Glitch Mitigation and Matched Filtering

The analysis of gravitational wave data requires precise methods for identifying and extracting astrophysical signals from instrumental noise. In this work, we employ open-source tools such as GWpy and PyCBC to process real data from the LIGO–Virgo collaboration. For the GW170817 event, associated with the merger of two neutron stars, we applied the Q-transform for time–frequency characterization and used a Planck Inverse window to mitigate the effects of the glitch while preserving the astrophysical signal. For the GW150914 event, the first direct detection of gravitational waves, we used the matched filtering technique to identify the signal. The results demonstrate the effectiveness of open-source tools in reproducing advanced analyses, reinforcing their potential for both education and research in gravitational wave data analysis.

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