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Detection of Gravitational Waves from Repetitive Magnetar Bursts Using Autoencoder-Based Denoising and Stacking

Friday, July 12, 2024 6:00 PM (20 minutes)

Unmodeled gravitational-wave signals from magnetars are expected to be weak and challenging to detect in LIGO-Virgo-KAGRA data. We introduce a new method to denoise and stack signals from repetitive magnetar bursts, such as the 2020 SGR 1935+2154 burst storm which produced 217 bursts in 1120 seconds. Our method involves identifying bursts in electromagnetic data and searching for corresponding gravitational signals in time-frequency (TF) maps. We use autoencoders to denoise the gravitational data for each burst and stack the denoised TF-maps to increase the significance of a potential repetitive signal. Results on simulated data showed that the detection statistic of both stacked synthetic signals and background noise both evolve logarithmically with the number of stacked TF-maps, signals detection statistic evolving 54% faster, demonstrating the method's effectiveness. We will present the method for denoising and stacking, and the detection performances on both simulated and real data based on synthetic signals.

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Session Classification: Machine learning in astronomy: AGN, transient events, cosmology and others

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