



General Relativity and Quantum Cosmology

# Are gravitational waves from giant magnetar flares observable?

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Are giant flares in magnetars viable sources of gravitational radiation? Few theoretical studies have been concerned with this problem, with the small number using either highly idealized models or assuming a magnetic field orders of magnitude beyond what is supported by observations. We perform nonlinear general-relativistic magnetohydrodynamics simulations of large-scale hydromagnetic instabilities in magnetar models. We utilise these models to find gravitational wave emissions over a wide range of energies, from  $10^{40}$  to  $10^{47}$  erg. This allows us to derive a systematic relationship between the surface field strength and the gravitational wave strain, which we find to be highly nonlinear. In particular, for typical magnetar fields of a few times  $10^{15}$  G, we conclude that a direct observation of f-modes excited by global magnetic field reconfigurations is unlikely with present or near-future gravitational wave observatories, though we also discuss the possibility that modes in a low-frequency band up to 100 Hz could be sufficiently excited to be relevant for observation.

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