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Probing Neutron Star Physics with Quasi-Periodic Oscillations in Magnetar Bursts[1]

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Neutron stars, the remnants of massive stellar explosions, are prime candidates for studying dense matter physics in conditions not accessible in the laboratory. Among the zoo of neutron star phenomena, magnetars, neutron stars with an extremely high magnetic field, are of particular interest for their spectacular bursting behaviour in X-rays and gamma-rays. They show thousands of recurrent short, bright bursts as well as some of the brightest gamma-ray events, called giant flares, ever observed on earth. The detection of quasi-periodic oscillations (QPOs) in giant flares and, more recently, in small recurrent bursts, is generally interpreted as the observable signature of global oscillations of the neutron star following a star quake. This detection has opened up the potential of neutron star seismology: probing the physical conditions in the interior of the star via the information conveyed in star quakes. In this talk, I will give an overview of observational studies of these sources, focusing on recent detections of QPOs in smaller bursts as well as results from the giant flares. I will then tie these observational results to theoretical models of the star quakes that tie observations to the neutron star interior and crust, and I will finish with an outlook of the future of magnetar seismology.

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