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A model for X-ray plateaux following short Gamma-Ray Bursts

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Many short Gamma-Ray Bursts (sGRBs) have a prolonged plateau in the X-ray afterglow lasting up to tens of thousands of seconds. A central engine injecting energy into the remnant may fuel the plateau. We develop a simple analytic model which naturally produces X-ray plateaux using a magnetar as the central engine. Our model leverages well-established descriptions of young supernova remnants and applies the underlying physics to sGRB remnants. We calculate analytically the energy distribution of a bubble of electrons powered by the magnetar wind to obtain both the light curve and the spectrum. Using data from the Swift X-Ray Telescope, we find our model aligns with observed data. We also produce spectra in X-ray plateaux which allow for parameter estimation. The plerion contribution is accompanied by an ejecta contribution which we do not model here. If combined with a gravitational wave signal, our model could provide insight into multimessenger astronomy and neutron star physics.

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