Vacuum birefringence and X-ray polarimetry in transient magnetars

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Recent optical polarimetry observations of an X-ray dim isolated neutron star, RX J1856.5−3754, showed a first evidence for QED vacuum birefringence induced by a strong magnetic field. This important result can be confirmed by performing systematically polarimetry observations in the X-ray band for other strongly magnetized neutron stars, such as transient or persistent magnetars. We computed the phase averaged polarization fraction (PF) and polarization angle (PA) expected in the thermal emission from transient magnetars in the soft X-ray energy band. We found that the detection of a PF higher than 40% is a strong evidence for vacuum birefringence. We also found that a steady change in the PA measured from transient magnetars during their outburst decay (up to 16 degrees for a magnetospheric untwisting of 0.5 rad) is a strong evidence for vacuum birefringence. This latter detection would also provide an independent strengthening of the magnetospheric untwisting model for these sources. Simulations show that these measurements are achievable by future polarimetry missions such as XIPE and eXTP, with observations of 10 - 700 ksec.

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