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Magnetars and Fundamental QED Physics in the MeV Band ZORAWAR WADIASINGH, NASA Goddard Space Flight Center, MATTHEW BARING, Rice University, ALICE HARDING, NASA Goddard Space Flight Center, KUN HU, Rice University, PETER GONTHIER, Hope College — Magnetars are young neutron stars with high surface magnetic fields, exceeding 10^9 Tesla, and probe the high magnetic field domain of QED. Pulsed non-thermal quiescent X-ray emission extending between 10 keV to > 150 keV has been observed in about 10 magnetars. For inner magnetospheric models of such hard X-ray signals, resonant Compton upscattering of soft thermal photons from the neutron star surface is the most efficient process for generating the continuum radiation in high magnetic fields. Such upscattering emission is anticipated to exhibit strong polarization above around 30 keV that is pulse phase dependent. These signatures define science agendas for future hard X-ray polarimeters and Compton telescopes. We present detailed model predictions of emission spectra and polarization signals, addressing prospects for measuring the spectral cutoffs with a future Compton telescope such as AMEGO. Polarization measurements can probe fundamental strong-field QED processes operating in the magnetar magnetospheres, potentially distinguishing between spectral cutoffs due to magnetic pair production or photon splitting. Thus, magnetars can provide insights into Nature that are currently beyond the reach of current terrestrial experiments.

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