Corona of Magnetars

A.M. Beloborodov (1), C. Thompson (2)

(1) Columbia University, (2) CITA

The discovery of persistent high-energy emission from magnetars has revealed the presence of a hot plasma corona. The output of the corona even exceeds the surface luminosity of the star. Such a corona should form as a result of starquakes that twist the magnetosphere of the star and lead to particle acceleration along the magnetic lines by an induced electric field. The electric field grows until e+/- breakdown occurs and the magnetosphere gets filled with e+/- plasma. Thus formed, the corona persists in dynamic equilibrium: it is continually lost to the stellar surface and replenished with new particles. It is maintained in the state of self-organized criticality by stochastic e+/- discharges. The energy output of the corona, $10ˆ{36}-10ˆ{37}$ erg/s, is regulated by the threshold for discharge. The source of energy for this persistent dissipation is provided by the twist in the magnetic field. The particles accelerated in the corona impact the solid crust and knock out protons, which form a cool hydrostatic atmosphere atop the star's surface. The transition layer between the cool atmosphere and the hot corona is the likely source of the observed 100-keV emission from magnetars. The corona also emits curvature radiation that can supply the observed IR-optical luminosity.