

Dipole magnetic field of magnetars: the effect of magnetar wind

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Considering recent observations challenging the traditional magnetar model, we explore the wind braking of magnetars. In the wind braking scenario, magnetars are neutron stars with strong multipole field. A strong dipole field is no longer necessary. Recent challenging observations of magnetars may be explained naturally in the wind braking scenario: (1) The supernova energies of magnetars are of normal value; (2) The non-detection in Fermi observations of magnetars; (3) The problem posed by the low-magnetic field soft gamma-ray repeaters; (4) The relation between magnetars and high magnetic field pulsars; (5) A decreasing period derivative during magnetar outbursts. For low luminosity transient magnetars, they may still be magnetic dipole braking. This may explain why low luminosity magnetars are more likely to have radio emissions. A magnetism-powered pulsar wind nebula and a braking index smaller than three are the two predictions of the wind braking model. Current observations are consistent with the predictions of wind braking of magnetars.

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