

Investigations of the Ohmic decay and the soft X-ray emission of high-braking index pulsar PSR J1640–4631

Tuesday 11 September 2018 09:30 (20 minutes)

In this work, we investigate the Ohmic decay of surface dipole magnetic field of high-braking index pulsar PSR J1640–4631, and interpret the observed soft X-ray flux $F_x^\infty [2-10\text{keV}]$ from *Chandra* + *NuStar* telescopes. We obtain the ohmic decay timescale $\tau_{\text{ohm}} \sim 3.23 \times 10^6$ yr. Observations indicate that magnetic multipole fields could exist in a neutron star and the toroidal component of multipole fields at and near the pulsar cap is thought to be responsible for the star's unique pulse profile. A possible application of ohmic decay timescale to thermoplastic wave (TPW) heating due to toroidal fields dissipation is studied for interpreting the observed soft x-ray emission of PSR J1640–4631, and other heating mechanisms for the star's surface thermal emission are also investigated.

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