

Is magnetar a fact or fiction to us?

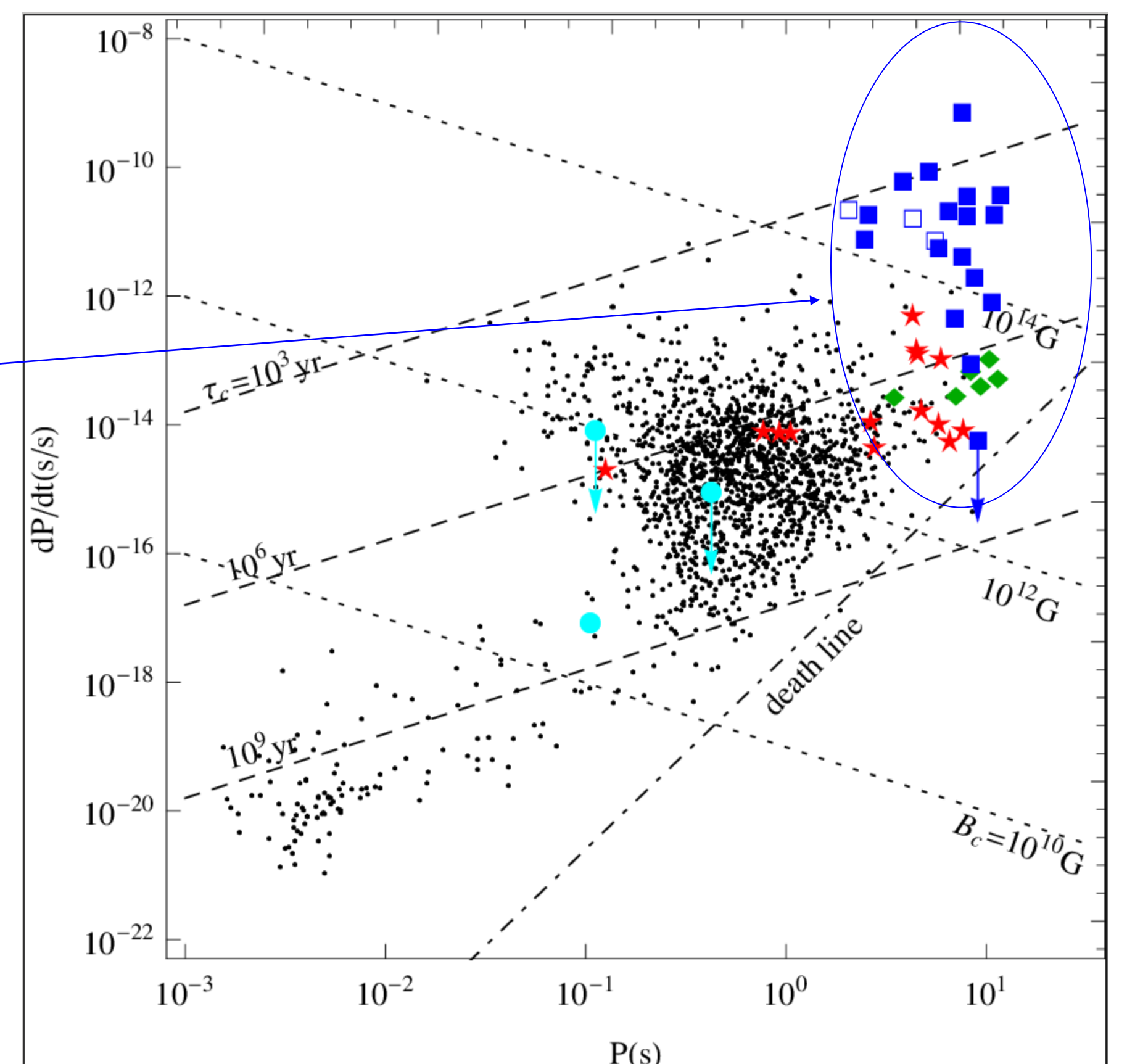
H. Tong (tonghao@xao.ac.cn, Xinjiang Astronomical Observatory)

R. X. Xu (r.x.xu@pku.edu.cn, Peking University)

The key point of studying AXPs/SGRs (anomalous X-ray pulsars/soft gamma-ray repeaters) is relevant to the energy budget. Historically, rotation was thought to be the only free energy of pulsar until the discovery of accretion power in X-ray binaries. AXPs/SGRs could be magnetars if they are magnetism-powered, but would alternatively be quark-star/fallback-disk system.

Observations for the magnetar model:

1. Dipole magnetic field through P and $\dot{P}$ measurement: assuming magnetic dipole braking
2. Total field through spectral lines: assuming proton origin
3. Magnetic confinement of the giant flare pulsating tails: assuming sudden release of magnetic energy
4. Magnetic suppression account for the super-Eddington luminosity: assuming other force terms are unimportant
5. SGR bursts from the high magnetic field PSR J1846-0258: what about the low-B SGRs?
6. Energy of persistent emissions, energy of bursts, spectral modeling etc: more model dependent than the above points



magnetars on the P - $\dot{P}$ diagram

Failed predictions: challenges to the magnetar model

1. Energetic supernovae associated with magnetars: NO!
2. A larger kick velocity: NO!
3. No radio emissions: Detected! (transient radio emissions are observed)
4. High energy gamma-rays detectable by *Fermi*-LAT: NO!
5. Discovery of low-B SGRs
6. Existence of transient magnetars and HBPSRs
7. Precession of magnetars: NO!

Alternatives:

1. Alternative origin of magnetic field
2. Alternative radiation mechanism in the magnetar domain
3. Alternative free energy to power AXPs/SGRs:

magnetars vs. quark star/fallback disk systems
↑ ↑
(*B-field decay* vs. *star-quake induced energy release*)

References:

1. Tong, H., Xu, R. X., 2011, “Magnetars: fact or fiction?” Int. Jour. Mod. Phys. E, 20, 15 (and references therein) (arXiv:1110.1975)
2. Xu, R. X., 2007, “AXPs/SGRs: Magnetars or quark-stars?” Adv. Sp. Res. 40, 1453