Low-level accretion onto highly magnetized neutron stars

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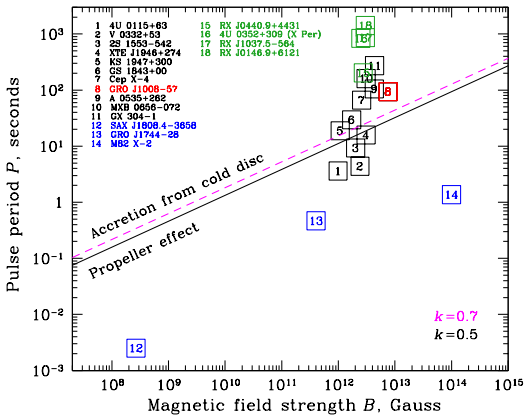

Figure 1: Collection of some known BeXRPs (shown with black color), as well as millisecond accreting pulsar SAX J1808.4−3658, intermediate pulsar GRO J1744−28 and accreting magnetar M82 X-2 (all three shown with blue color) on the $B - P$ plane. Solid and dashed lines divide all sources into two groups: (i) with propeller regime onset at low mass accretion rate (below the line), and (ii) with stable accretion from the cold disc (above the line). Solid and dashed lines correspond to magnetospheric radius of 0.5 and 0.7 from the Alfvén radius, respectively. Persistent low-luminous BeXRPs are shown with green color.

In my talk I will consider the case of transient highly magnetized neutron stars accreting in a broad range of rates, focusing on their behaviour in the very end of the outbursts. At low mass accretion rates the centrifugal inhibition of the accretion (aka "propeller effect" [1], one of the most direct evidence of the ultra-strong magnetic field presented in the vicinity of the neutron stars) was discovered in a few systems. I will review observational manifestations of the propeller effect in X-ray pulsars with broad range of the magnetic fields from 10^8 to 10^{14} G with main focus on our recent discoveries [2-4].

In the second part of my talk I will introduce a model explaining the existence in some X-ray pulsars of an unexpected quasi-stable state characterized by the accretion rate of $\sim 10^{14} - 10^{15}$ g s^{-1}. We associate this state with the accretion from cold (non-ionised) disc with temperature below $\sim$ 6500 K (Tsygankov et al., submitted). We argue that a transition to such accretion regime should be observed in all X-ray pulsars with certain combination of the rotation frequency and magnetic field strength (see Fig. 1). Moreover, the propeller effect should never be observed in such sources even for very low mass accretion rates.

References

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