

The pulsar magnetic field oscillation model and the verification method

Z.X. Liang (1), Y. Liang (2)

(1) KPT lab, Shijiazhuang, China, (2) College of Physics, Jilin University, China

(kpt01@heinfo.net / Phone: +86-311-87704264)

The characteristics of pulsar have been most commonly explained using lighthouse model. However, our research has demonstrated that the characteristics of pulsar can be better described using a magnetic oscillating model (hereafter MO model) built by analogising the reversing phenomenon of the solar magnetic field to pulsar. Although the mechanism why the magnetic field can oscillate has not been known yet, no observed oppositions to it (MO model) have been found either. After comparing with the lighthouse model, the MO model has the following advantages:

1. The prediction of the MO model differs significantly from the prediction of the lighthouse model. The MO model predicts that the geodetic precession of the spin axis in binary pulsar system may result in some slight changes of the amplitude and shape of profile, but it is impossible that they disappear from our line of sight. The observed results of PSR B1913+16, PSR J0737-3039 and other binary pulsar system have shown obviously such tendency.
2. The lighthouse model can be ruled out by the result from calculating the micropulse of PSR B1133+16. The wheel-axis structure of the image of Crab Nebula taken by Chandra X-ray Observatory correlates precisely with the prediction of the MO model.
3. The MO model is more appropriate to explain the polarization characteristics, glitch, the interpulse and the generation rate of the pulsar than the lighthouse model.

The MO model also gives satisfactory results to explain the other characteristics, eg, the spin-down, the pulse nulling, the beat and pulse drift, the rate of the rotating energy loss and the accuracy of the magnetic field oscillation, and so on.

It is popularly believed that the accuracy of the solar magnetic field oscillation period is lower, the accuracy of the period of the pulsar is higher. However, up till today, we only have the records of 24 solar periods (22 years per period). If 24 periods are arbitrarily selected out from the single pulse data of the pulsar, its period accuracy is roughly equivalent to the accuracy of the solar period. Therefore, the period accuracy cannot be used for the argument to negate the MO model.

In addition, we recommend the study of Sweep Delay Effect of pulsar in order to determine the correct model between Lighthouse and Magnetic Field Oscillating.