SOME CHARACTERISTICS OF PULSARS WITH LONG PULSE NULLING

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The phenomenon of pulse nulling was first found by Backer (1970). The fraction of time, we denote it by n(%), for a pulsar in a null state was given by Ritchings (1976) for 32 pulsars. We have found that the average value of n(%) increases with the period of pulsars. It perhaps implies that the pulsars with pulse nulling could constitute a subtype of pulsars. In this paper, the pulsars with pulse nulling are regarded as a subtype to be investigated.

By using the data of 201 pulsars given recently by Taylor and Manchester (1980), we plot the log $\dot{P}$ - log P diagram. Here P is the period of a pulsar, and $\dot{P}$ its time derivative. The triangles, crosses and circles represent different kinds of pulsars as illustrated in the diagram. The pulsars represented by dots have been recently discovered. It is still not clear whether they have nulls or not. But according to our analysis presented in this paper we can predicate that some of the new pulsars may probably have nulls.

It can be seen from the diagram that the pulsars are generally located on the left side of the sloping line, the so-called radio cut-off line. The solid sloping line is obtained for 201 pulsars and the dashed line for 81 pulsars. Their equations are B_c = 1.5 G and B_c = 2 G respectively, where B_c is the magnetic field intensity on the light cylinder. This result means that we cannot observe radio emission if $B_c < 1.5$ G. This argument is supported both by the data of 81 pulsars and that of 201 pulsars. We have also proposed (Wang and Chu) that the radio emission region may be at a distance proportional to that of the light cylinder. This also implies that the magnetic field intensity in the emission region of a radio pulsar must not be less than a certain value. We consider it as the critical value which is proportional to 1.5 G with the same proportional constant for all pulsars.

It should be noted that pulsars with long pulse nulling [n(%) ≥ 6] are located near the radio cut-off line, nearly parallel to it. This result shows that the magnetic field intensity in the radio emission regions of pulsars with long pulse nulling is nearly equal to the

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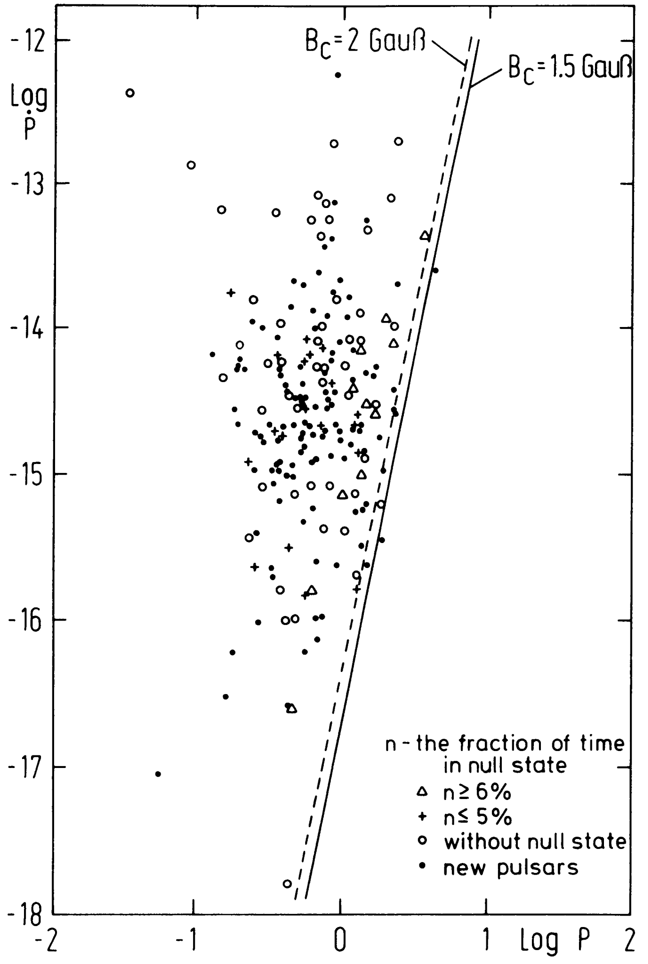

Fig. 1: log Ṗ plotted against log P for 201 pulsars

critical value. If the magnetic field in the emission region falls below the critical value due to some unknown reason, we may miss some radio pulses, and pulse nulling will be present. In other words, the radio emission may depend on the magnetic field in the emission region.

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