Emission mode transition dynamics in the pulsar B0943+10

S. A. Suleymanova[1], J. M. Rankin[2]

[1]PRAO

[2]Univ. of Vermont

The pulsar B0943+10 is well known for its 'B' (burst) mode, characterized by accurately drifting subpulses, in contrast to its chaotic 'Q' (quiet) mode. Six new Arecibo observations at 327 MHz with a duration nearly 2+ hours each have shed considerable light on the modal dynamics in this pulsar. Of these six, three were found to be exclusively in the 'B' mode, while other three were discovered to exhibit transitions from the 'Q' to the 'B' mode. One of these observations has permitted us to determine the circulation time of the sub-beam carrousel in the 'Q' mode for the first time, at some 35.5 stellar rotation periods. The onset of the 'B' mode is then observed to commence similarly in all three observations. The initial circular time is around 35.5 periods and relaxes to perhaps 38 periods in an near exponential fashion with a characteristic time of nearly 1 hour. This is the longest characteristic time ever found in the 'switching' pulsars. Moreover, just after the 'B' mode onset the pulsar exhibits a resolved double profile form with a somewhat larger trailing component, but this trailing component slowly dies away leaving the usual single 'B' mode profile with the longitude of the magnetic axis falling at about its trailing half power point. There are some indications that 'Q' to 'B' and 'B' to 'Q' transitions have different characteristic times.

Additional longer observations are still needed to learn how long each of the modes sequences can persist. Some speculations are given on the nature of the slow modal alternations.

Portions of this work were carried out with support from NSF (grants AST 99-87654 and 00-98685).