

# Analysing the Spin Evolution Pathway of Millisecond Radio Pulsars

**Abstract:** An understanding of spin frequency ( $\nu$ ) evolution of neutron stars in the low-mass X-ray binary (LMXB) phase is essential to explain the observed  $\nu$ -distribution of millisecond radio pulsars. The neutron star spin frequency  $\nu$  can approach one of the two spin equilibrium frequencies: a lower one ( $\nu_{eq,per}$ ) for persistent accretion and a higher one ( $\nu_{eq,eff}$ ) for transient accretion. The former is expected to happen at a higher long-term average accretion rate ( $\dot{M}_{av}$ ) relative to a critical value ( $\dot{M}_{av,crit}$ ), and the latter can happen at a lower  $\dot{M}_{av}$  relative to  $\dot{M}_{av,crit}$ . So there are two modes of spin evolution, and the mode leading to the higher  $\nu$  occurs typically for lower  $\dot{M}_{av}$  values, which is somewhat counter-intuitive.

A special case study performed especially for the Isolated and Binary Millisecond Radio Pulsars, using linear regression for the Frequency vs Age(Time) plot can help predicting the probable Spin Evolution Mechanism and pathway of Isolated and Binary Millisecond Radio Pulsars. The [ATNF](#) (Australia Telescope National Facility), a free open access Archival Database can be good data source for this particular analysis.