Bull. Astr. Soc. India (2002) **30**, 695–696

Radio pulsar emission altitudes

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Abstract. By attributing the often seen longitude offsets between the core and conal component centres of pulsar radio pulses to different emission altitudes, we present a new method for investigating these altitudes. Our method can explain these offsets and also sheds light on them.

Different altitudes of emission, due to contributions from aberration and the magnetic field line sweepback (*mfs*), will lead to longitude offsets between radio pulse components of pulsars, like the core and conal components. This offers a new method to study pulsar emission altitudes.

Comparison of offsets calculated with our method with those seen in observations provides ample indication that the observed offsets come into play due to the emission mechanism selecting different altitudes of emission. Our method further leads to the following conclusions :

(i) The combined offset due to aberration and *mfs* always advances the arrival time for all altitudes and α the inclination angle between rotation and magnetic axes.

(ii) Core emission does not necessarily come from the stellar surface.

(iii) Core emission altitudes, r_{core} may be smaller, larger than or same as r_{cone}, the conal ones.

(iv) For most pulsars $|r_{core} - r_{cone}|$ is small compared to r_L the light cylinder radius but not necessarily compared to R_* the stellar radius. Indeed $|r_{core} - r_{cone}|$ is usually much larger than the individual altitudes so far ascribed to core and conal components by other authors.

(v) For some pulsars $|r_{core} - r_{cone}|$ could be comparable to r_L. This may resolve the mystery of main pulse-interpulse separations being much different from the expected 180^o as in the Crab pulsar.

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(vi) Both core and conal emissions do not come from the full available part of the polar flux tube and their filling factors vary with the altitudes.

Details of this work can be found in Kapoor and Shukre (2002)

References

Kapoor R.C., Shukre C.S., 2002, arXiv:astro_ph/0205429.