Pulsed emission from a rotating off-centred dipole in vacuum

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Studying electromagnetic field around neutron stars is one of the vital methods to understand the physics of the pulsars. From the very beginning of the efforts made to understand these objects, most of the works have been based on the assumption of a standard centred dipolar electromagnetic field. However, lately there have been some studies which focus on including higher multipolar field components while considering the electromagnetic field studies and explain how it modifies our current ideas about these objects [1].

Also, another prevalent standard assumption is that the magnetic moment lies at the geometrical centre of the star. Possibilities of deviation from this standard centred case have been seen to be existing for stars and even, planets. Apart from the simplicity, there is no special reason to consider such centred case. In [2] a more generalized picture has been put forward for pulsars in which the magnetic dipole moment is shifted off from the centre of the star showing how a rotating off-centred dipole can be expanded into multipolar components.

I will talk about the effects of such off-centred rotating dipole on various characteristic features of pulsars in vacuum. Showing how the magnetic field line structure is different for the two geometries, the reliability of the off-centred geometry will be analyzed. I will be discussing the consequences of this approach on the shape of the polar caps, radio and high energy emission phase plots and light curves presenting a comparison with the standard centred case [3]. I will conclude with a summary of possible future investigations for improvement along with a small highlight on the next steps involving force free environment.

References

[1] Jérôme Pétri, *Multipolar electromagnetic fields around neutron stars: exact vacuum solutions and related properties, MNRAS* 2015; 450 (1): 714-742

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