



# Obliquely rotating pulsars: screening of the inductive electric field

D. B. Melrose, Rai Yuen

(Submitted on 1 Jul 2011 (v1), last revised 23 Dec 2011 (this version, v2))

Pulsar electrodynamics has been built up by taking ingredients from two models, the vacuum-dipole model, which ignores the magnetosphere but includes the inductive electric field due to the obliquely rotating magnetic dipole, and the corotating-magnetosphere model, which neglects the vacuum inductive electric field and assumes a corotating magnetosphere. We argue that the inductive field can be neglected only if it is screened by a current,  $\mathbf{J}_{\text{sc}}$ , which we calculate for a rigidly rotating magnetosphere. Screening of the parallel component of the inductive field can be effective, but the perpendicular component cannot be screened in a pulsar magnetosphere. The incompletely screened inductive electric field has not been included in any model for a pulsar magnetosphere, and taking it into account has important implications. One effect is that it implies that the magnetosphere cannot be corotating, and we suggest that drift relative to corotation offers a natural explanation for the drifting of subpulses. A second effect is that this screening of the parallel inductive electric field must break down in the outer magnetosphere, and this offers a natural explanation for the acceleration of the electrons that produce pulsed gamma-ray emission.

Comments: 26 pages, 5 figures

Subjects: **Solar and Stellar Astrophysics (astro-ph.SR)**

Cite as: [arXiv:1107.0100](#) [astro-ph.SR]

(or [arXiv:1107.0100v2](#) [astro-ph.SR] for this version)

## Submission history

From: Rai Yuen [[view email](#)]

[v1] Fri, 1 Jul 2011 04:11:19 GMT (185kb)

[v2] Fri, 23 Dec 2011 21:10:46 GMT (47kb)

*[Which authors of this paper are endorsers?](#)*

## Download:

- [PDF](#)
- [PostScript](#)
- [Other formats](#)

Current browse context:

astro-ph.SR

[< prev](#) | [next >](#)

[new](#) | [recent](#) | [1107](#)

Change to browse by:

[astro-ph](#)

## References & Citations

- [INSPIRE HEP](#)  
([refers to](#) | [cited by](#))
- [NASA ADS](#)

Bookmark([what is this?](#))

