Institut de recherche sur les lois fondamentales de l'univers
SOUTENANCE DE THÈSE

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Mercredi 15 décembre 14h00

CEA Saclay, Orme des Merisiers Bât 774, amphithéâtre Claude Bloch

Gamma-ray pulsar physics: gap model populations and light-curve analyses in the FERMI era

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This thesis research focuses on the study of the young and energetic normal pulsar population detected by the Fermi gamma-ray space Telescope. We compared the model expectation of four emission model population and the LAT data. We found that all the models fail to reproduce the LAT detections and are not able to predict the observed high spin-down power (hereafter Edot) object number. This inconsistency is not model dependent and could be explained on the basis of magnetic alignment, non dipole magnetic field Edot evolution or bias effects due to a different magnetic field structure, as force free of split monopole configuration. A different magnetic field layout implies different emission beams and could even explain the inconsistency between the radio-loud/radio-quiet objects ratio observed and predicted. The L proportional to Edot relation is robustly confirmed by all the assumed models with particular agreement in the slot gap (SG) case. On luminosity bases, the intermediate altitude emission of the two pole caustic SG model favored. The beaming factor shows an Edot dependency that is slightly visible in the SG case. The pulsar orientation estimate has been implemented to find solutions able to explain the simultaneous gamma and radio emission. Through the solutions analysis we found a relation between the energy cutoff and the width of the emission slot gap. This relation has been theoretically predicted but it does not appear in the simulations. A possible magnetic obliquity alpha alignment is systematically rejected , for all the models, on timescale of the order of a million years. Anyway it could occurs on a shorter timescale. The morphology study shows that the outer magnetosphere gap emission mechanism (OGs) are favorite to explain the observed radio lag. Since the OGs are one pole caustic models, their agreement with structural observed characteristics suggests a different magnetic field structure. The light curve moment studies (symmetry and sharpness) are anyway in favor of a two pole caustic SG emission. All the model predictions suggest a different magnetic field layout with an hybrid two pole caustic and intermediate altitude emission to explain both the pulsar luminosity and light curve morphology.The low magnetosphere emission mechanism of the polar cap model, is systematically rejected on the bases of all the tests done.

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