Evolution of a Pulsar's Braking Index

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A neutron star is modeled by a spherically symmetric Pulsars are believed to be magnetized neutron stars which on account of the rotation emit magnetic dipole radiation whose detection reveals their presence. The radiation is balanced by a loss of rotational energy and causes the pulsar frequency to decrease slowly. The rate of change of rotational energy is proportional to a power of the frequency, $n+1$, where n is called the braking index. For magnetic dipole radiation the index is $n = 3$, while for gravitational radiation, expected to be present only briefly at the birth of the star, it is 5. For the three pulsars for which the index has been measured it is less than 3. This has been interpreted as indicating the presence of some other form of energy-loss obeying a different frequency dependance. However, taking account of the trivial effects of the change of the moment of inertia with rotational frequency computed for three model constitutions of neutron stars and for several masses, we find that the braking index for *pure* dipole radiation evolves slowly over the life of the pulsar, attaining the value of 3 only for very low frequencies. During any observational era it will appear to be constant with value in the range $0 < n \leq 3$ [1].

References

[1] N. K. Glendenning, S. Pei, and F. Weber, "Evolution of a Pulsar's Braking Index", November 17, 1995, (LBNL–37952), submitted for publication

Nonradial Vibrations of Neutron Stars

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Nonradial oscillations of a nonrotating neutron star are studied [1]. A neutron star is modeled by a spherically symmetric distribution of nuclear matter possessing properties of an elastic solid bounded by Newtonian gravity. The analytic formalism describing the spheroidal gravitation-elastic vibrations is developed. Emphasis is placed on calculation of the eigenfrequencies of nonradial vibrations. First numerical estimates are presented and compared with those obtained in earlier calculations on the basis of Kelvin's hydrodynamic model.

References

[1] S. Bastrukov, I. Molodtsova, V. Papoyan, and F. Weber, "Nonradial Vibrations of Neutron Stars", to appear in the Journal of Physics G (preprint, September 1995)