TOWARD AN EMPIRICAL THEORY OF PULSAR EMISSION

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ABSTRACT. Polarized, pulsar profiles consist of two distinct types of emission units, core and conal components. Various configurations of these two basic units then underlie the 5 principal species of profile: conal and core single, conal double, triple, and multiple (5 comp.) profiles. Conal single profiles typically evolve through bifurcation into conal double forms at low frequency; whereas core single profiles evolve into triple forms at high frequency by adding pairs of conal "outriders". Conal components and outrider pairs exhibit polarization properties compatible with a hollow-conical emission zone which spreads weakly at low frequency. The central core components in each profile species, by contrast, often exhibit circular polarization of symmetrically alternating sense. The triple profile is then most generally prototypical of pulsar emission, and the physical distinction between its outriding conal components and its central core emission feature are primary--implying two distinct corresponding radiation mechanism. (Ap. J. 274, 333/359).

The isolated core components of stars with core single profiles exhibit little ordered modulation, nor do they null or evince of any sort of mode changing; many have featureless fluctuation spectra, while others exhibit low-frequency (P_3=15-50 periods/cycle) features with which no orderly "drift" is apparently associated. The core components in triple, double ("saddle" region), and multiple profiles also exhibit these stationary, low-frequency fluctuations. "Drifting" subpulses are then an exclusively conal phenomenon. Systematic subpulse modulation (P_3=2-15 periods/cycle) is associated with the conal components of stars with double, triple, and multiple profiles, but progressive, orderly drifting is observed only in conal single stars. The ensemble P_3 values associated with the conal components of the various profile species seem indistinguishable, again suggesting that these species are geometry-specific manifestations of a single physical configuration. Mode changing and pulse nulling are exclusively associated with neither core nor conal emission, but rather connect the two. Mode changing is typically manifest as a reorganization of the conal constituents of emission about the profile's core component. Finally, pulse nulling is not so closely associated with spindown age as has been thought. Pulsars which null are members of older profile species to be sure, but within a given species, those stars which null are no older than those that do not. (1986 Ap. J. 301, 901)

D. J. Helfand and J.-H. Huang (eds.), The Origin and Evolution of Neutron Stars, 53.