THE STRUCTURE OF PULSAR NEBULAE

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ABSTRACT. We have found solutions to the problem of a relativistic pulsar wind interacting with a nebula moving at constant velocity v_n. The wind is assumed to contain a toroidal magnetic field; the ratio of Poynting flux to particle flux in the wind is a constant σ. Under these assumptions, the wind is shocked at a radius r_s that moves out at constant velocity. Solutions for the shocked wind are only possible if $\sigma < \sigma_c = 1/(-1 + c/v_n)$. For a given value of v_n, $r_s \to 0$ as $\sigma \to \sigma_c$. Kennel and Coroniti (1984) have calculated similar models for the Crab Nebula but they assume that r_s is a constant; i.e. they calculate steady-state models. The steady-state approximation is expected to be good close to the shock wave, but it breaks down in the outer parts of the nebula. For $v_n = 2000$ km s^{-1} and $r_n/r_s = 20$, Kennel and Coroniti find $\sigma = 0.003$. For the same Crab Nebula parameters, our time-dependent model yields $\sigma = 0.0016$. There may be times in the evolution of Crab Nebula or of other pulsar nebulae when a model with a shocked relativistic wind and a toroidal magnetic field cannot apply. It appears that a wide variety of structures are possible for pulsar nebulae.

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1. REFERENCE

1.1 Kennel, C. F. and Coroniti, F. V. 1984, Ap. J., 283, 694.

D. J. Helfand and J.-H. Huang (eds.), The Origin and Evolution of Neutron Stars, 122.