SECONDARY COMPONENTS OF BINARY PULSARS & MAGNETIC FIELD DECAY IN NEUTRON STARS

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ABSTRACT. We report the discovery of white dwarf secondaries in 0655+64 and 0820+02 systems. In the 2303+46 system, we do *not* find any optical counterpart suggesting that the companion is another neutron star. The existence of a *cool* and therefore *old* white dwarf in the 0655+64 system implies that the surface magnetic field of neutron stars stops decaying beyond some value(s) of field strength.

a)**0655+64:** Coincident with the timing position (Damashek *et al.* 1982) we find a $m_R \sim 22^m$, cool ($T \sim 8000$ K) white dwarf. The cooling age of the white dwarf ($\sim 2 \times 10^9$ y) is comparable to the spin-down age, $\frac{P}{2\dot{P}}$. In any evolutionary scenario, the white dwarf is formed *after* the primary. This suggests that in weak field pulsars such as PSR 0655+64 ($B_s \sim 10^{10}$ G) the magnetic field does not decay as rapidly as in the isolated, strong field pulsars (see Kulkarni (1986) for more details).

b)**0820+02:** A faint ($m_R \sim 22.8^m$), blue (V−R $\sim -0.2^m$) star is coincident with the position given by Manchester *et al.* 1983. A preliminary U−B determination by Liebert and Spinrad (*pers. comm.*) suggests the candidate is a *hot* white dwarf. Unlike the secondary in 0655+64, the white dwarf cooling age is much smaller than $\frac{P}{2\dot{P}} \sim 10^8$y (see Kulkarni (1986) for further details). Consistent with this young age the field strength of the pulsar is $\sim 3.3 \times 10^{11}$ G – not too different from that of a typical single pulsar.

c)**2303+46:** The large eccentricity of this system immediately suggests that the secondary is another neutron star (Stokes *et al.* 1985) – consistent with the lack of optical detection ($m_R \gtrsim 23^m$). These limits will be improved during the coming Fall season.

d)**1855+09:** In collaboration with S. Djorgovski we tentatively report a faint ($m_V \sim 23^m$) star which is within 3σ of the best timing position (Segelstein *et al.* 1986). Pending further optical data all we can say at this point is that the candidate (if not a chance background source) is consistent with the low-mass, old white dwarf.

References

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