SS 433 - THE ULTIMATE CATACLYSMIC VARIABLE?

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Several authors (Begelman et al. 1979; Martin and Rees 1979; Bandwagon 1979) suggest that the precessing relativistic gas jets observed in SS 433 (Abell and Margon 1979) arise from de Sitter and/or Lense-Thirring precession of one member of a close binary system. For a semi-detached system of a few solar masses, we find the mean density of the lobe-filling secondary, $\bar{\rho}_2 \sim 3 \times 10^4$ gm cm^{-3}. The secondary may thus be a low mass white dwarf, transferring material to the vicinity of its companion at a supercritical rate because of gravitational radiation losses.

For the illustrative choices $M_2 = 0.5\ M_\odot$, $M_1 = 5\ M_\odot$, we find the separation, $D \sim 9.5 \times 10^9$ cm, and Kepler orbital period, $P_K \sim 3.6$ min. An important consequence of the model is a change in the precession period, P_{prec} (currently ~164 days), which should be readily detectable within a few years. In fact $\omega_{prec} \propto (1 + 3M_2/4M_1)\ J_{orb}/D^3$; with a degenerate secondary, all variable factors conspire cooperatively to increase P_{prec}. The conservative assumption that transferred mass leaves the system with no more than the specific orbital angular momentum of the primary leads to an increase in P_{prec} of 1 day in ~44 years, or ~33 min. per annum. The data of Abell and Margon, and of Gottlieb and Liller (1979), taken literally, may support a rate of increase of this order.

There is no firm reason to expect optical variations on the timescale of P_K. Nevertheless, we recently observed SS 433 spectroscopically with 15 sec time resolution, using the Lick 120" IDS system. On timescales from ~1 min. to ~1 hr., we can rule out velocity variations in the so-called rest Hα exceeding ~20 km s^{-1}. There is a tantalizing suggestion of low amplitude variability in the 3.6 - 4 min. range, which may however be instrumental in origin.

References

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