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Modeling the Magnetospheres of Luminous Stars: Interactions Between Supersonic Radiation-Driven Winds and Stellar Magnetic Fields[1]

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Hot, luminous stars (spectral types O and B) lack the hydrogen recombination convection zones that drive magnetic dynamo generation in the sun and other cool stars. Nonetheless observed rotational modulation of spectral lines formed in the strong, radiatively driven winds of hot-stars suggest magnetic perturbations analogous to those that induce "corotating interaction regions" in the solar wind. Indeed, recent advances in spectropolarimetric techniques have now led to direct detection of moderate to strong (100-10,000 G), tilted dipole magnetic fields in several hot stars. Using a combination of analytic and numerical MHD models, this talk will focus on the role of such magnetic fields in channelling, and sometimes confining, the radiatively driven mass outflows from such stars. In particular, I discuss how the resulting "magnetically confined wind shocks" can explain the moderately hard X-ray emission seen from the O7V star Theta-1 Ori C, and how the trapping of material in a "rigidly rotating magnetosphere" can explain the periodically modulated Balmer line emission seen from the magnetic B2pV star sigma Ori E. I also discuss how magnetic reconnection heating from episodic centrifugal breakout events might explain the occasional very hard X-ray flares seen from the latter star. I conclude with a brief discussion on the generation of hot-star fields and the broader relationship to other types of magnetospheres.

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