Synthesis of Observables from Numerical Simulations of Magnetized Hot-Star Winds

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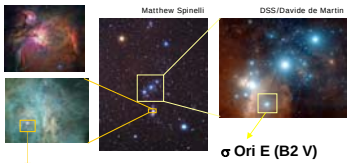
Some - young, chemically peculiar, pulsating - OB stars have magnetic fields: θ^1 Ori C (O7 V), σ Ori E (B2 V), τ Sco (B0 V), β Cep (B1 III)

What do you get when you combine a strong, radiation-driven stellar wind with a large-scale magnetic field?

- Flows channeled along field lines, very strong shock heating at the top of magnetic loops
- A magnetosphere filled with quasi-stationary plasma - periodic infall and also centrifugally driven breakout, which can be accompanied by magnetic reconnection

Misalignment of the magnetic and rotation axes leads to rotational modulation and complex circumstellar geometries



θ^1 Ori C (O7 V)

- Strong B field (~1 kG)
- Strong wind (~10^{-7} M_{sun} yr^{-1})
- Slow rotation

Unusually hard x-rays, rotationally modulated x-rays, UV winds lines, and Hα

σ Ori E (B2 V)

- Very strong magnetic field (~5 kG)
- Weak wind
- Rapid rotation

Hα emission with rotational modulation; x-ray flares

The nature of the MHD flows depends on the relative strength of the wind (~ρv^2) to the magnetic field (~B^2)

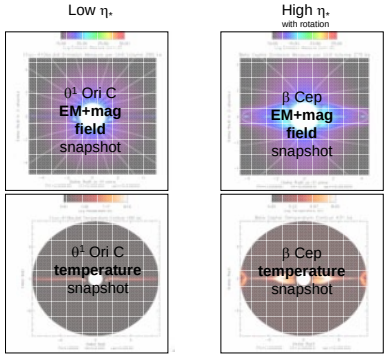
For a dipole field this ratio can be characterized as

$\eta \ldots \eta_*$ ( )

For θ^1 Ori C, $\eta_* \sim 10$
while for σ Ori E, $\eta_* \sim 10^7$

Numerical MHD up to $\eta_* \sim 1000$

For the very strong field regime, we have developed a rigidly rotating magnetosphere (RRM) model (Townsend, Owocki, Groote 2006, ApJL, 630, L81)



θ^1 Ori C - successful modeling viz. the **x-rays** (Gagne et al. 2005)