

MHD simulation of Supernova Remnants

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Theory

- Blast

- radius
- velocity
- density
- magnetism
- temperature, pressure

Parameters

- E_{ej}
- t_0
- M_{ej}

$$r_c = R_{ej} \left[1 - \frac{x(3-n)M_{ej}}{4\pi\rho_0 R^3} \right]^{1/(3-n)},$$

$$v_0 = E_{ej}^{1/2} \left\{ \frac{2\pi\rho_c r_c^5}{5R_{ej}^2} + \frac{2\pi\rho_{ISM} R_{ej}^3 [1 - (R_{ej}/r_c)^{n-5}]}{5-n} \right\}^{-1/2},$$

$$\rho_{ej}(t, r) = \begin{cases} \rho_c(t)(r/r_c)^{-n} & \text{if } r > r_c, \\ \rho_c(t) & \text{if } r < r_c. \end{cases}$$

$$\rho_c = \frac{3(1-\eta)M_{ej}}{4\pi r_c^3},$$

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Theory

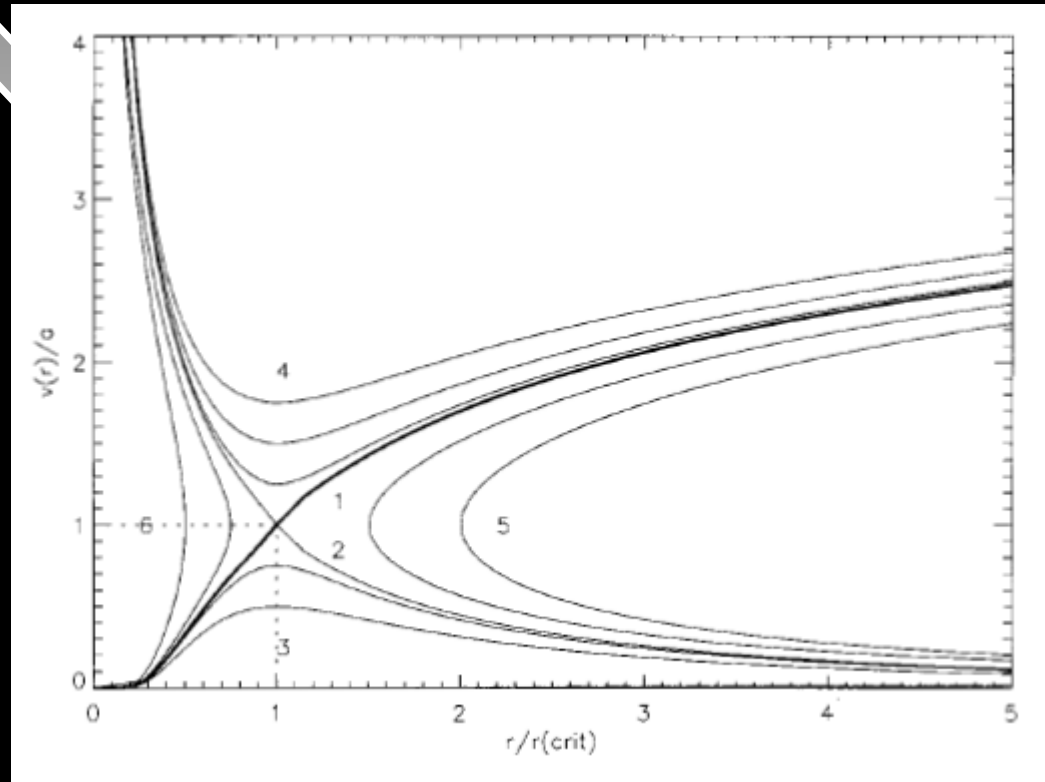
- Stellar Wind

- velocity at boundary
- sonic velocity
- density

- Parameters

- CS_WIND
- RHO_AMB
- S_AMB

$$a^2 \ln(vr^2) + \frac{GM}{r} - \frac{1}{2}v^2 = 0$$



Introduction to
stellar winds.
(Lamers . Cassinelli)



Theory

- Radiation

- magnetism
- frequency
- shock velocity
- density
- index
- no LoS

- Parameters

- r
- B
- V
- a

$$i(\nu) = C_1 K B_{\perp}^{\alpha+1} \nu^{-\alpha},$$

$$I(\nu_0) = \int i(\nu_0) dl,$$

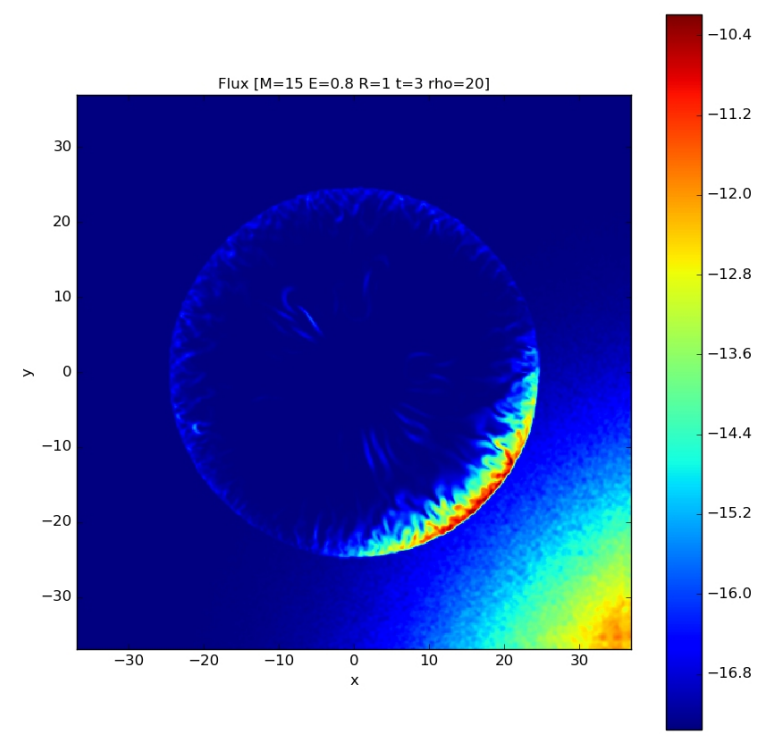
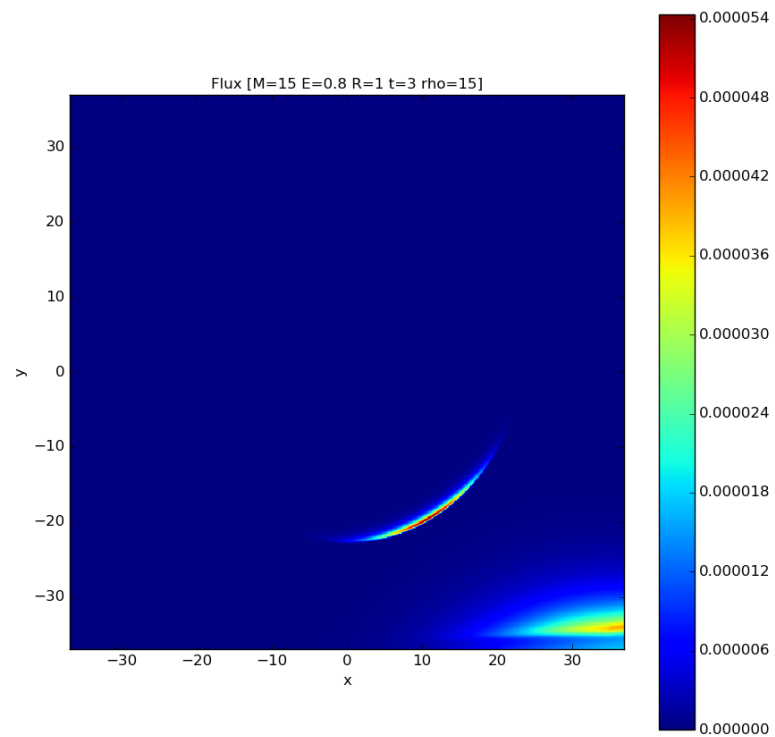
$$K_s \propto \rho_s V_{sh}(t)^{-b}.$$

A&A 470, 927-939
(2007)



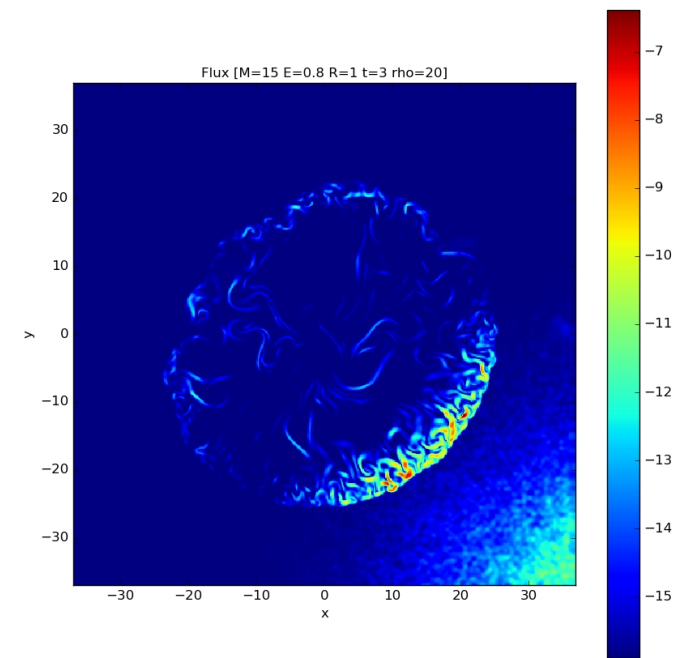
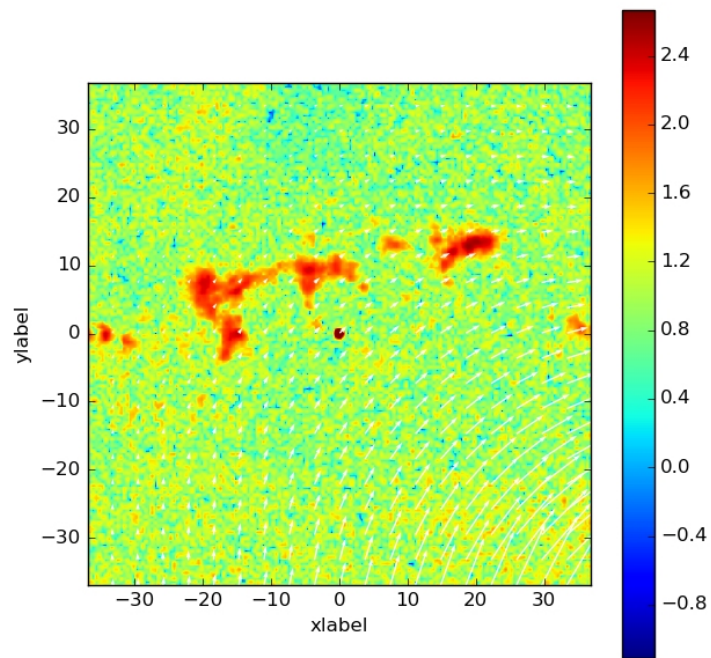
Simulation

- Magnetism



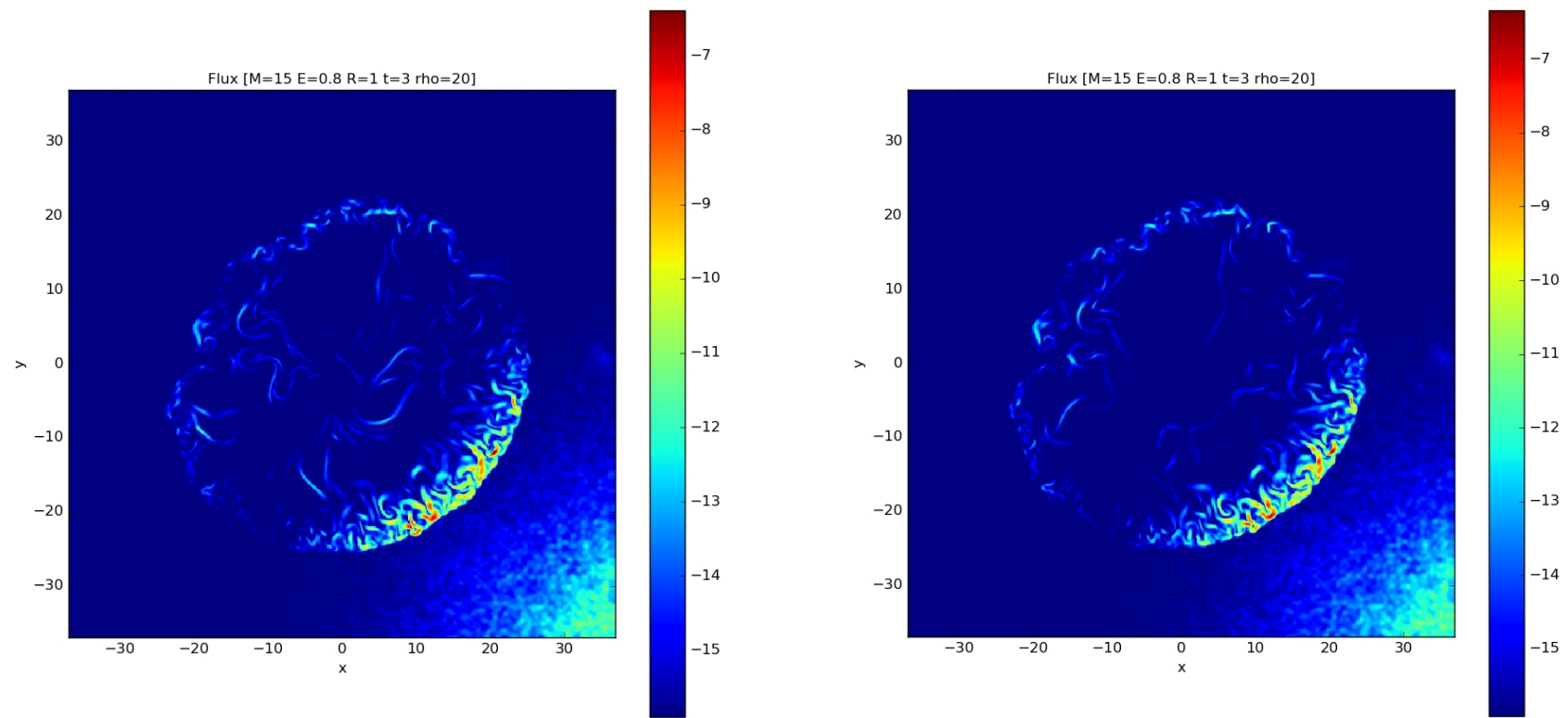
Simulation

- Background Density



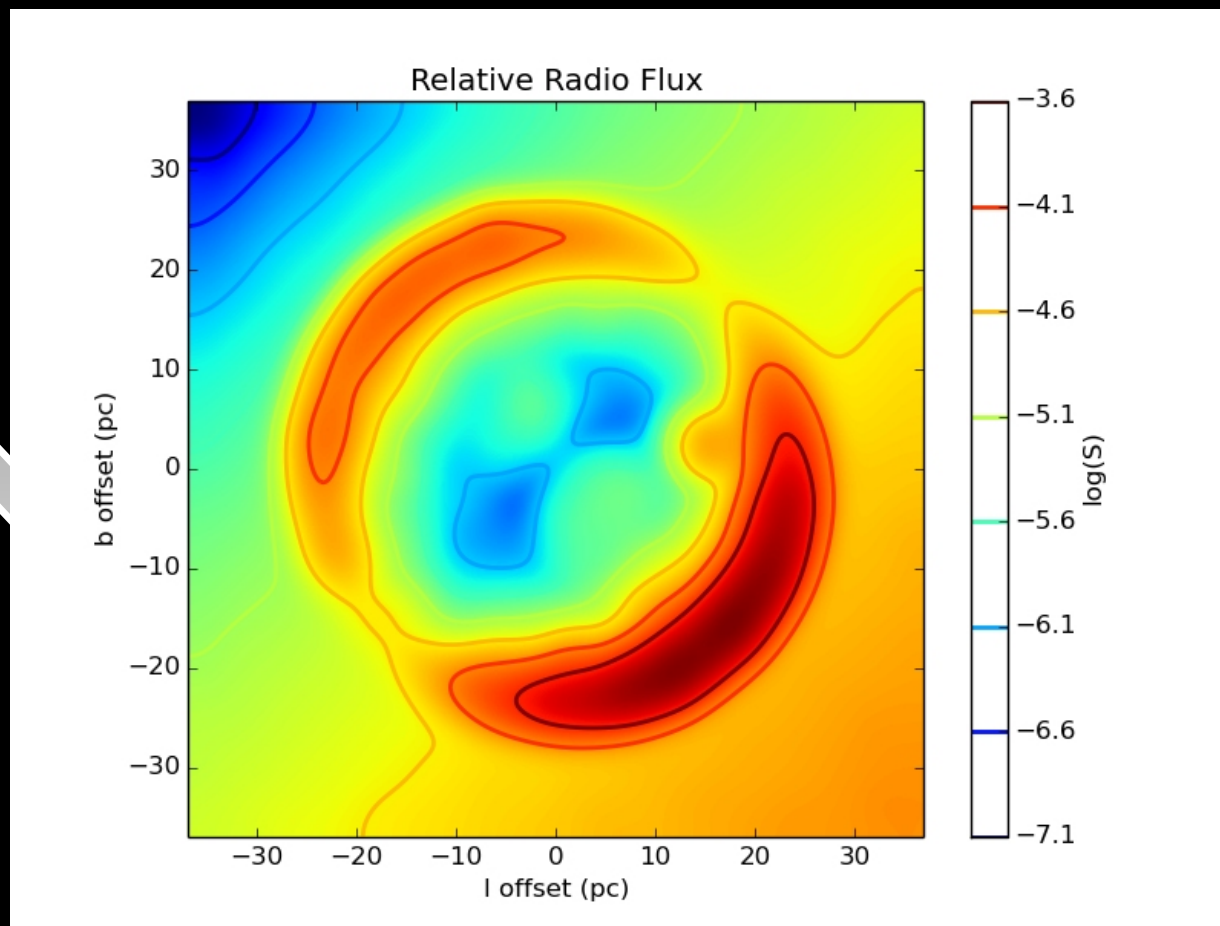
Simulation

- Stellar Wind



Simulation

- For a SNR after smoothing



Thanks