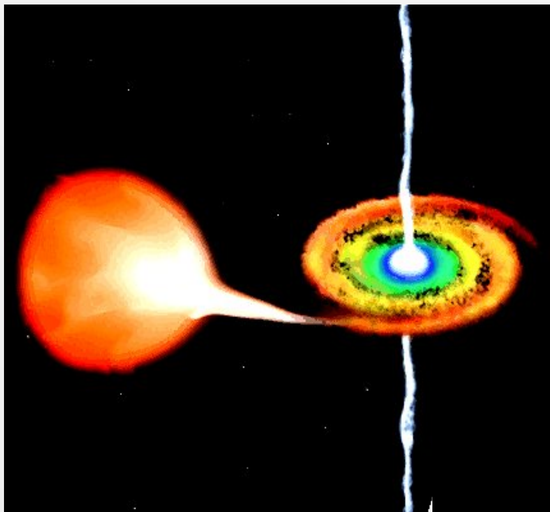
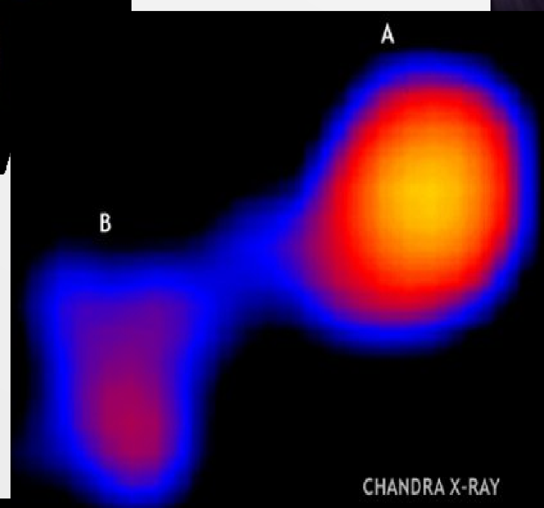
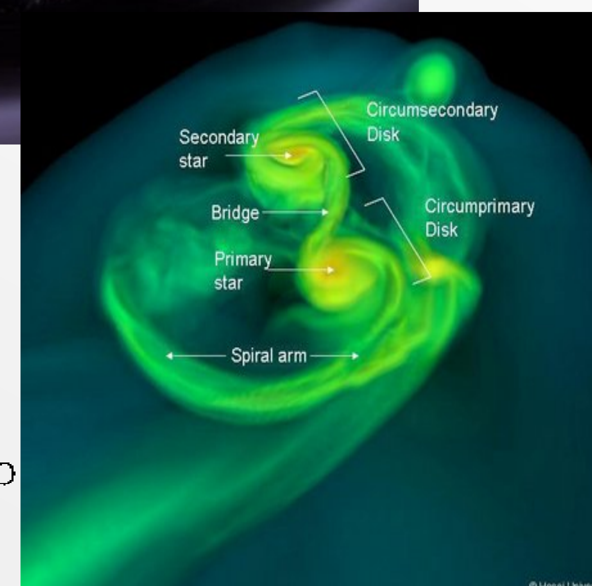
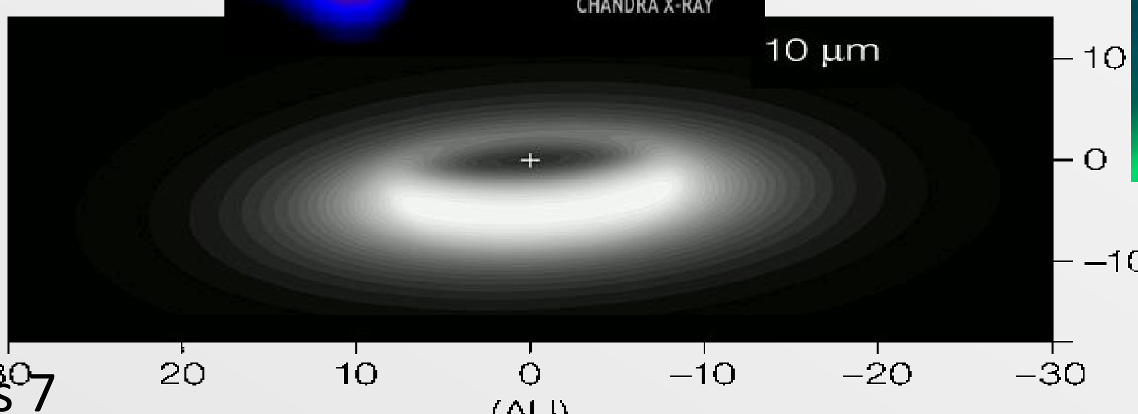
Binary Stars – Lecture 7







Astro 8501
6944



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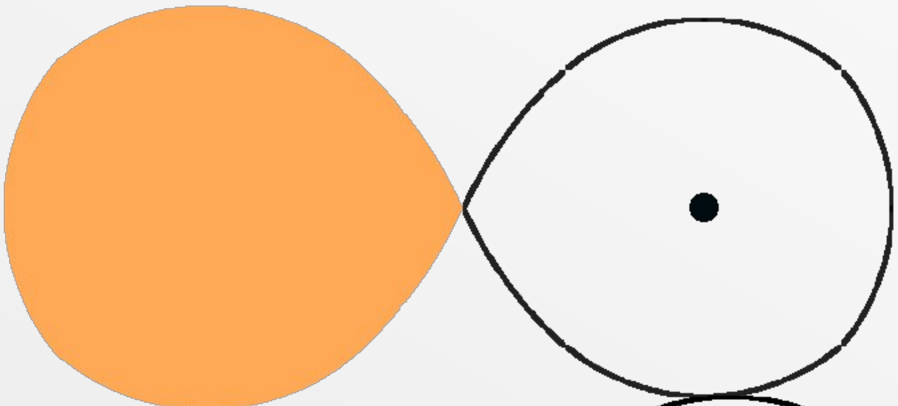
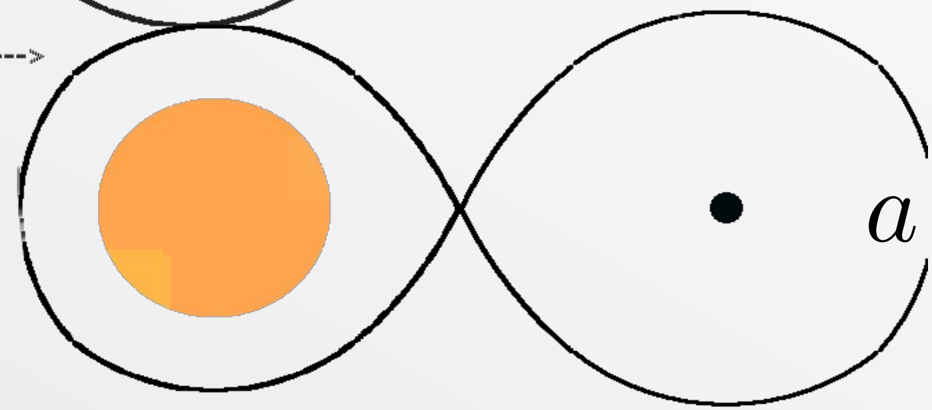
Wide Binary Systems



$a = 1500\mathrm{R}_\odot$



$a = 1700\mathrm{R}_\odot$

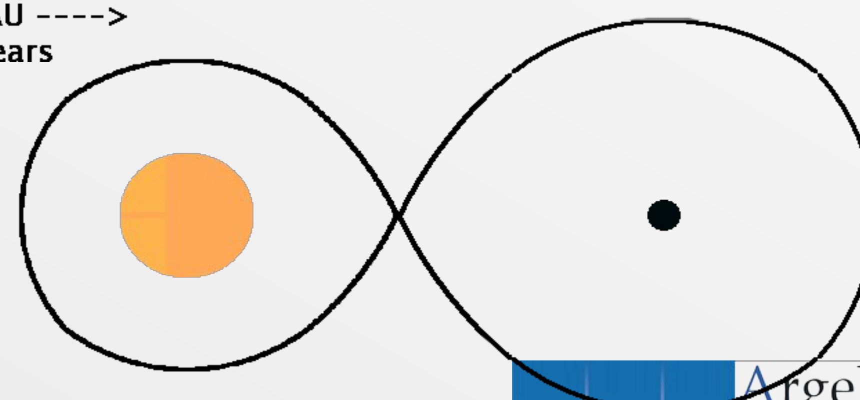
$M_1 = 3\mathrm{M}_\odot$

TPAGB

$M_2 = 1\mathrm{M}_\odot$

Main Sequence Dwarf

$a = 2000\mathrm{R}_\odot$



Stellar Winds/Accretion

- Stars have winds
- Secondary may accrete
- Mass transfer!
- *NOT* RLOF!
- Chemical transfer:

  peculiar abundances
- Luminosity of accretion

  X-ray sources, symbiotic stars ...

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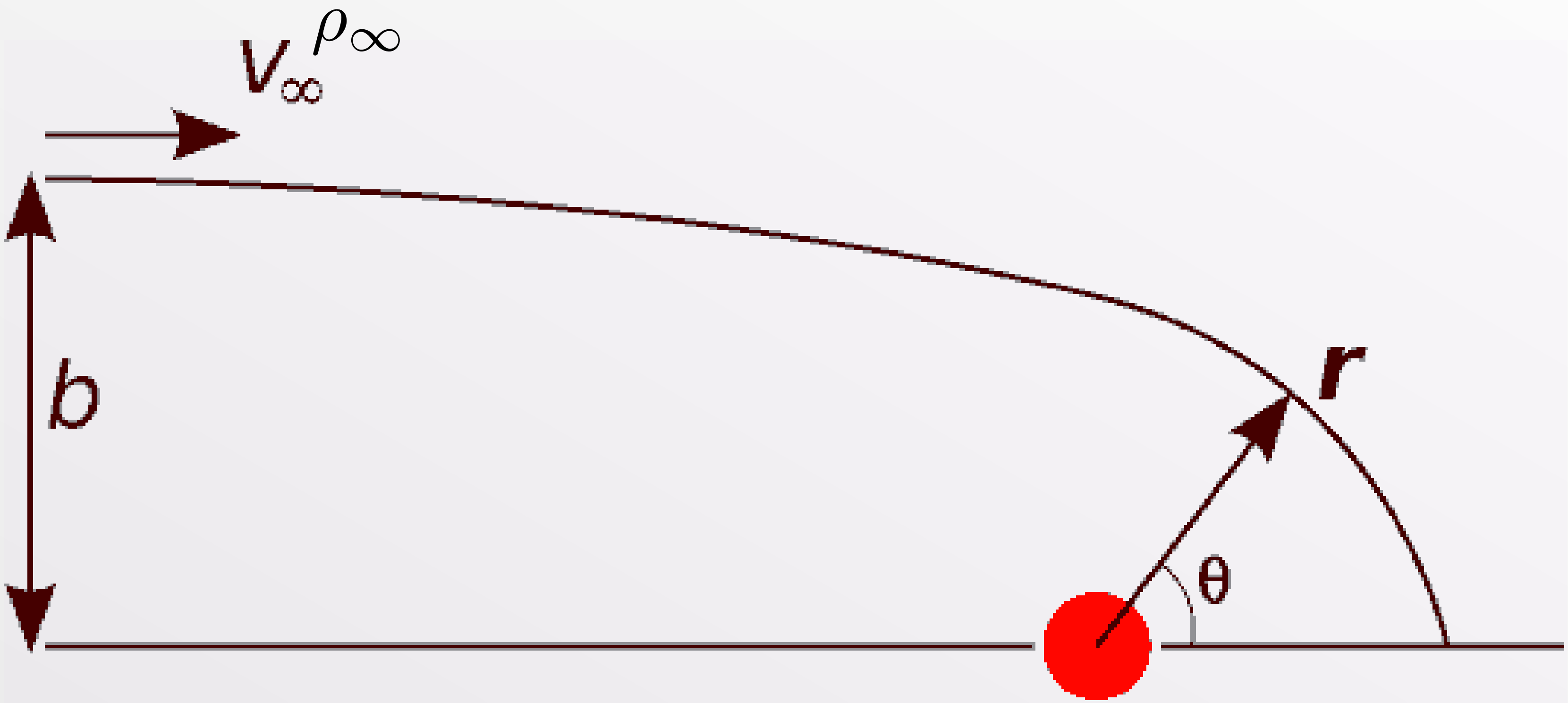
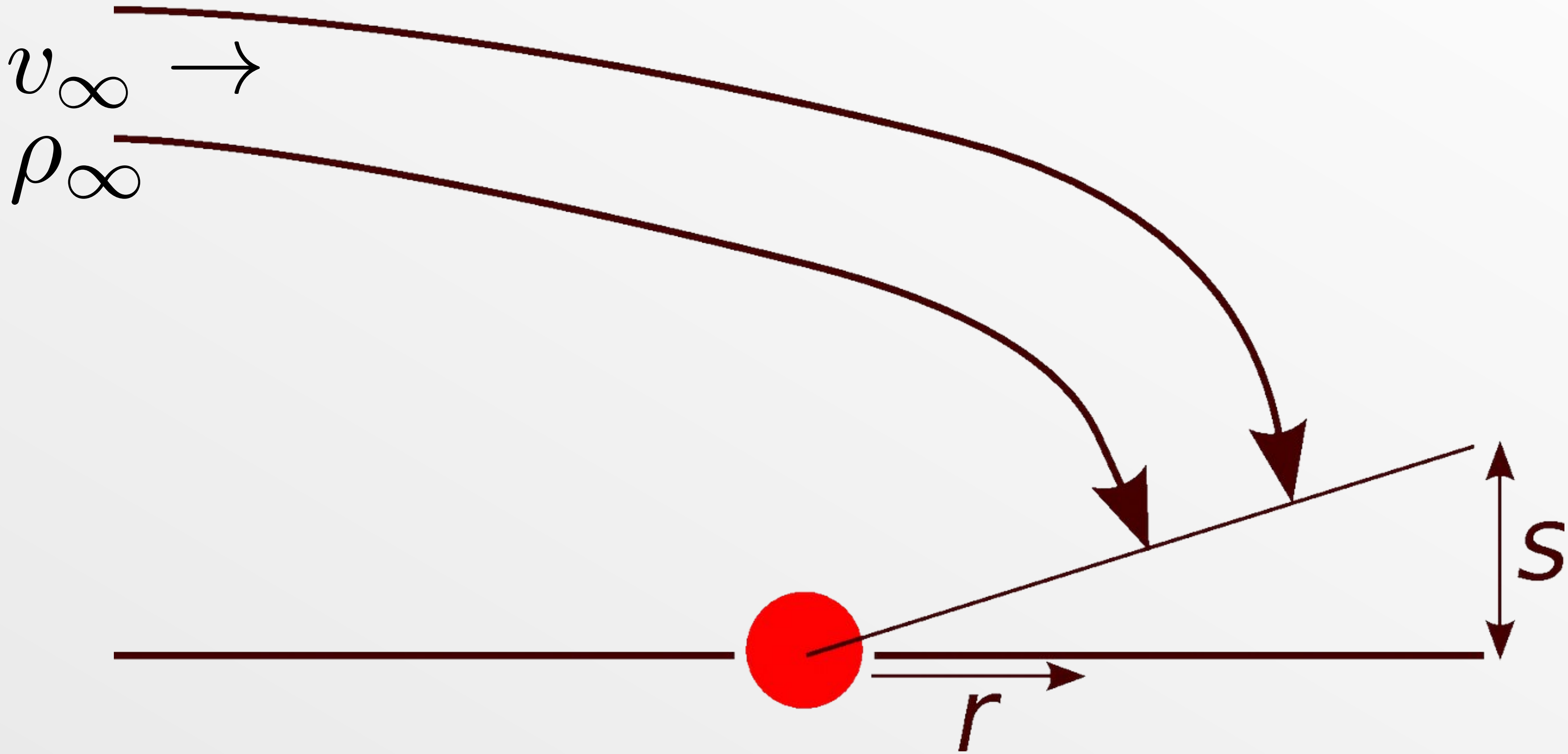
1: Hoyle-Lyttleton Accretion



$$\dot{M}_{\mathrm{HL}} = \frac{4\pi G^2 M^2 \rho_\infty}{v_\infty^3}$$

2: Bondi-Hoyle Accretion



$$\dot{M} = \frac{2\pi G^2 M^2 \rho_\infty}{(c_\infty^2 + v_\infty^2)^{\frac{3}{2}}}$$

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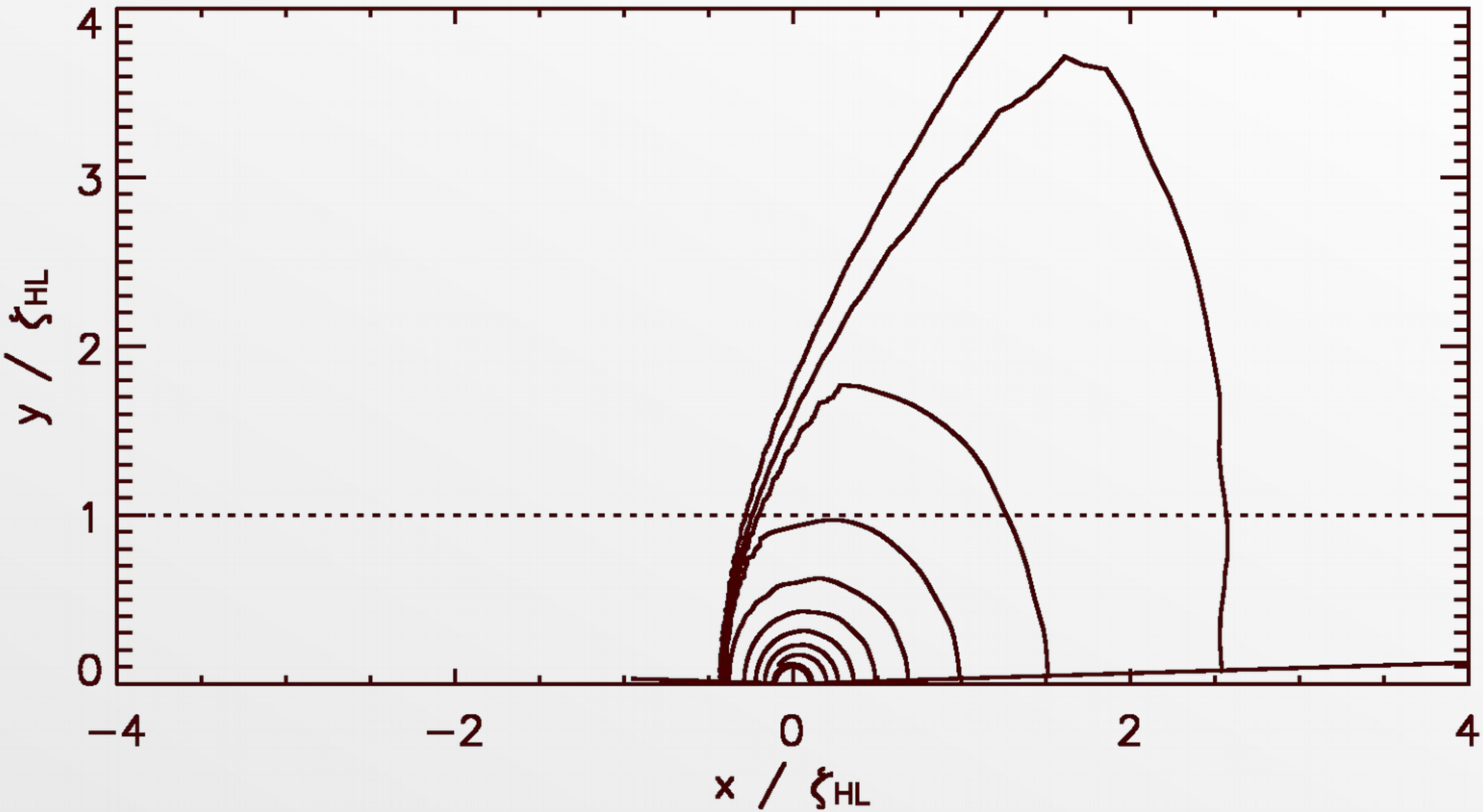
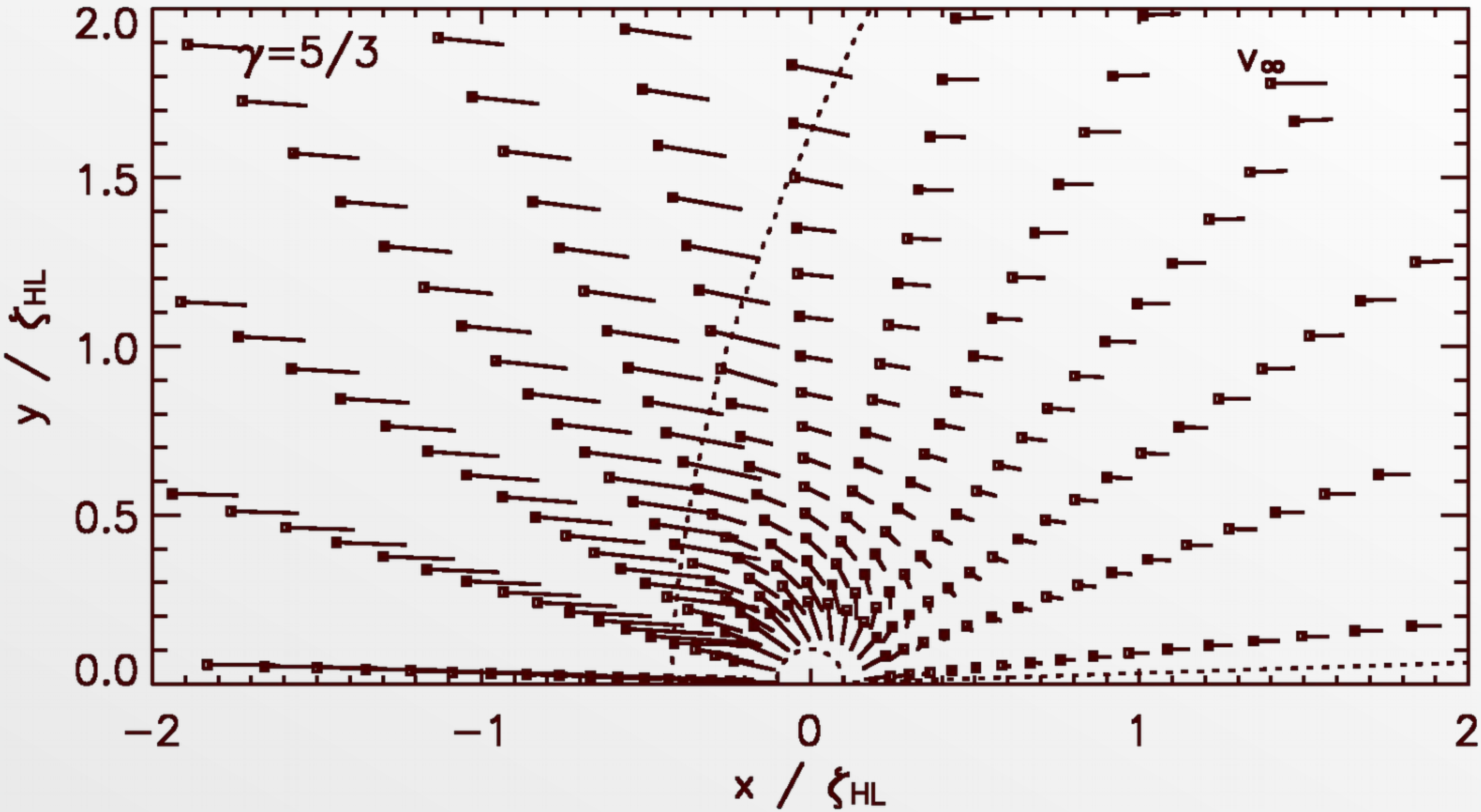
Density Contours



From Edgar (2004) $\mathcal{M} = 1.4 \;\; \gamma = 5/3$

$$R_{\rm acc} = 0.1 b_{\rm HL}$$

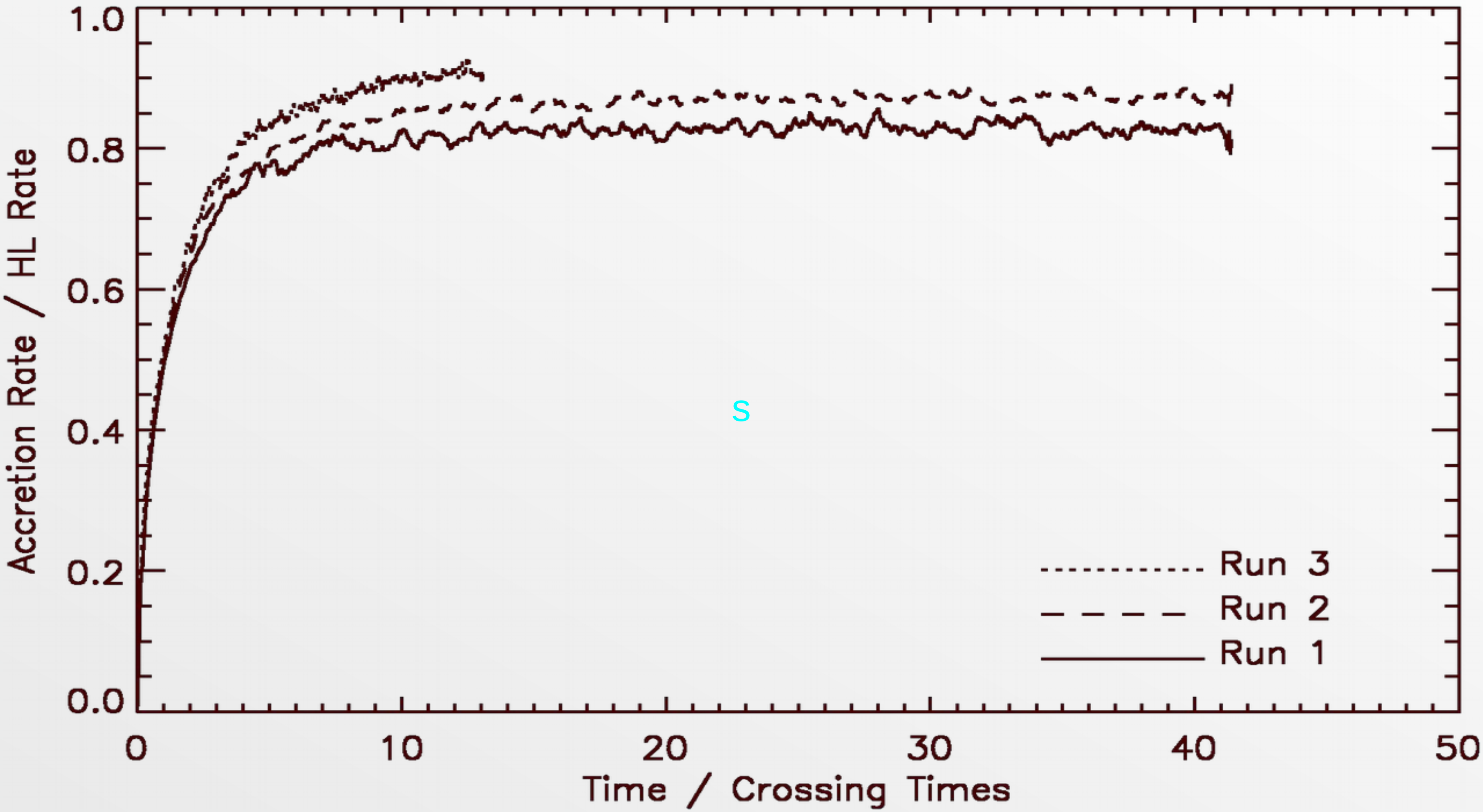
Velocity Vectors



From Edgar (2004) $\mathcal{M} = 1.4 \;\; \gamma = 5/3$

$$R_{\mathrm{acc}} = 0.1 b_{\mathrm{HL}}$$

Accretion Rate



From Edgar (2004) $\mathcal{M} = 1.4 \;\; \gamma = 5/3$

$$R_{\rm acc} = 0.1 b_{\rm HL}$$

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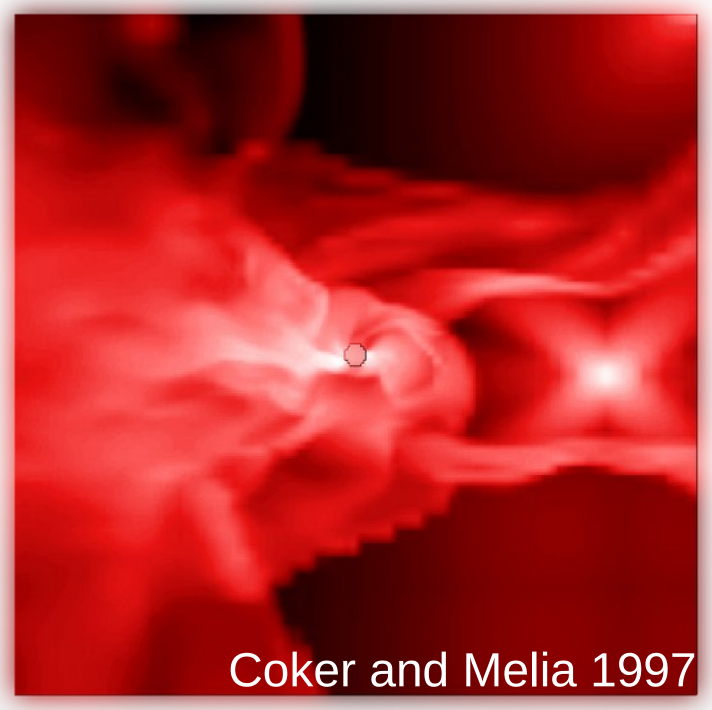
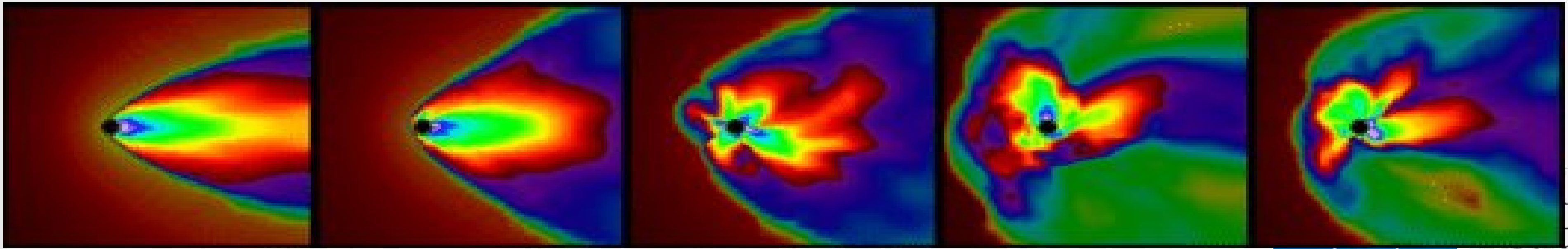
Simulations of Wind Accretion

- Many studies of wind accretion,
  1. 2D, 3D
  2. velocity gradients
  3. non-ideal solutions
- The BHL-rate is "typical"
- Hybrid Wind-RLOF ?



Coker and Melia 1997



Ruffert 1992

Products of Accretion

- Accretion luminosity:
  1. Symbiotic stars (eruptions, jets)
  2. X-ray binaries
- Chemically peculiar stars ("extrinsic")
  1. S-process: Barium stars, S-stars
  2. Carbon rich: CH stars, CEMP stars
- Wind-wind collisions (shock heating, X rays)
  1. Mostly from massive stars