Stellar X-ray Accretion Signatures

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XMM-Newton: The Next Decade
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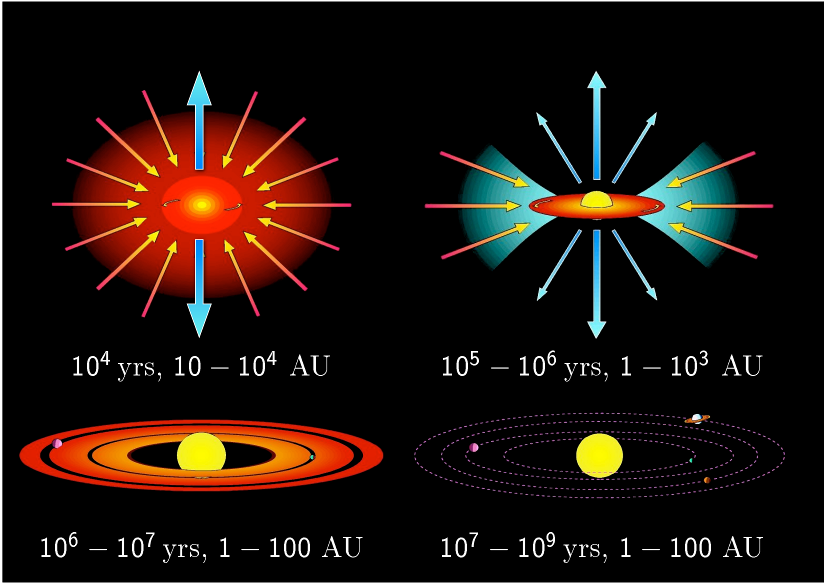
Star & planet formation in a nutshell



Adapted from McCaughrean

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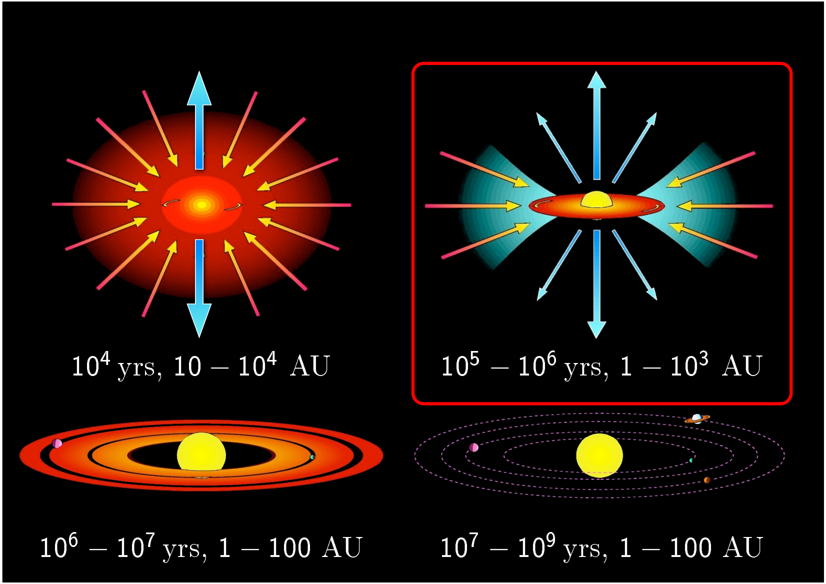

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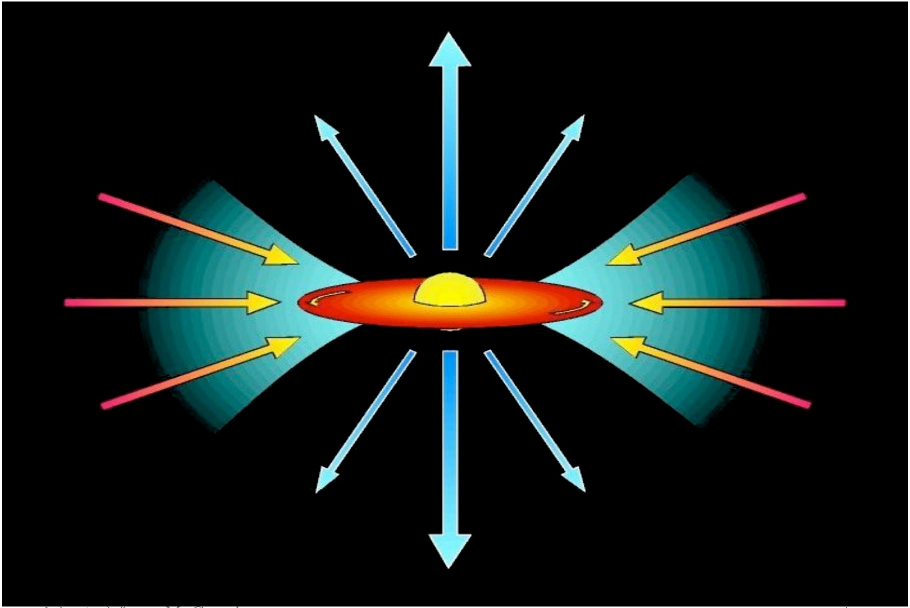

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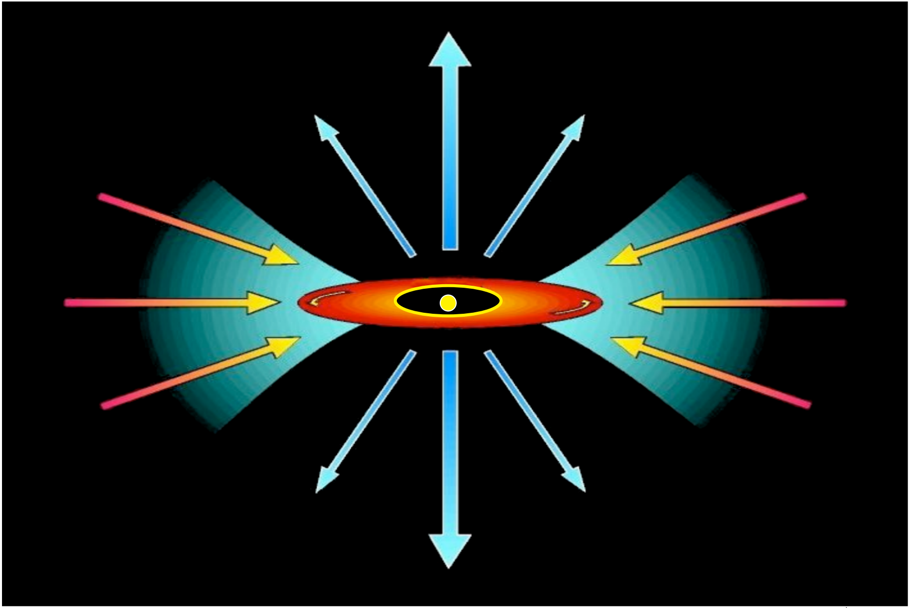

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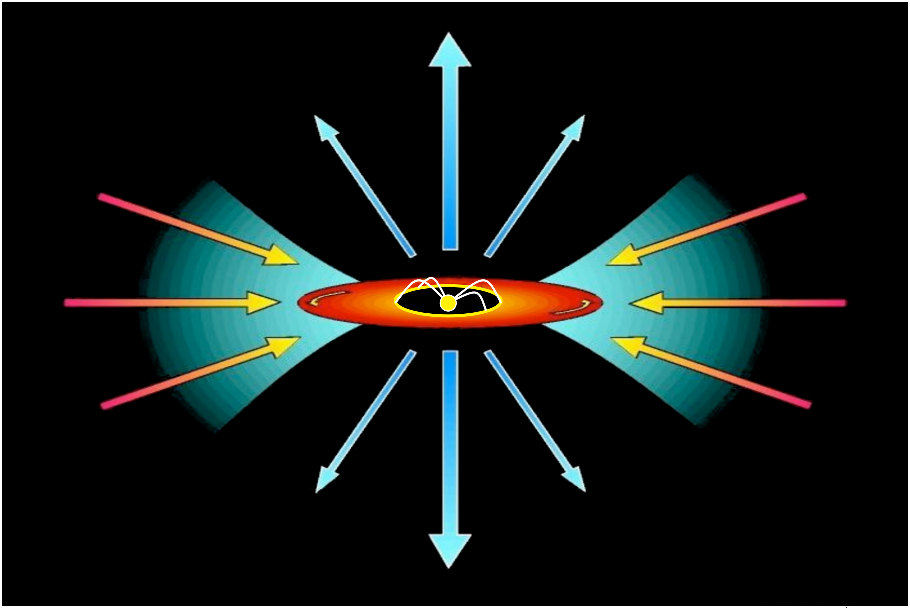

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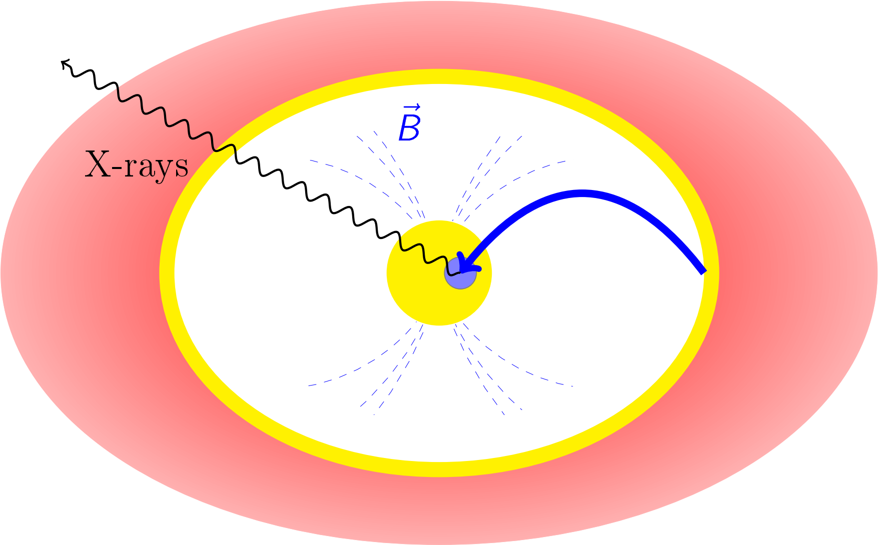
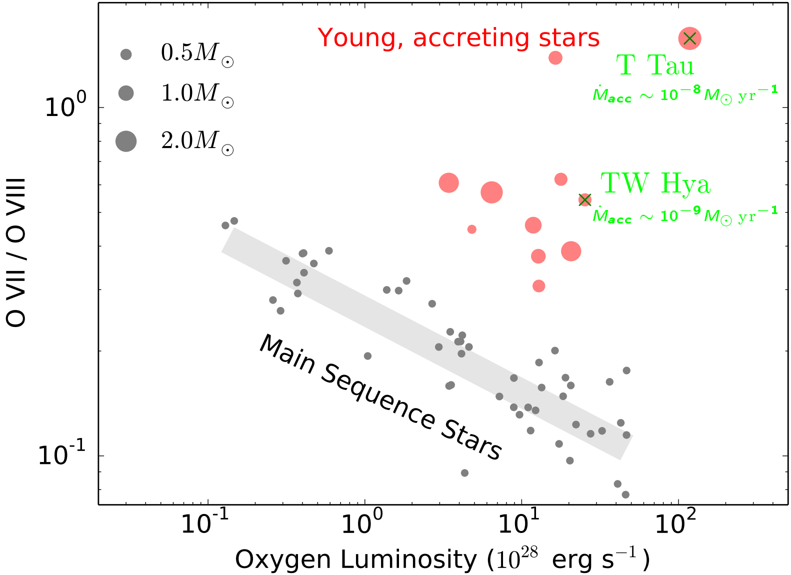
Accretion onto Stars



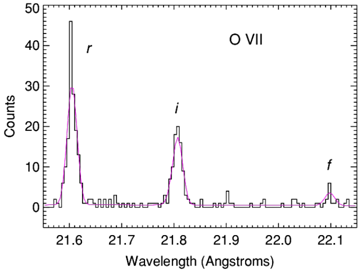
Soft excess



see also Ness es al. (2002), Güdel & Telleschi (2007)

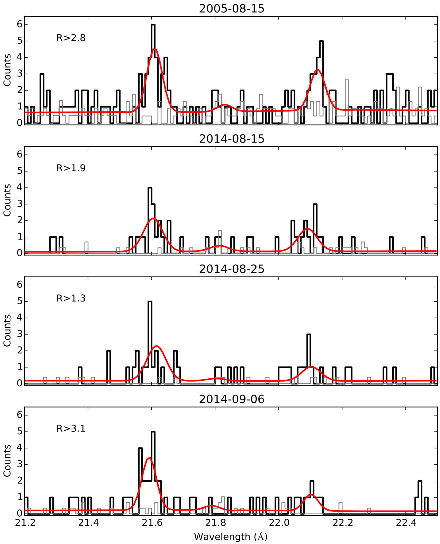
High Densities?

TW Hya (0.6 $M_\odot$)



Brickhouse et al. (2010)

T Tau (2.4 $M_\odot$)

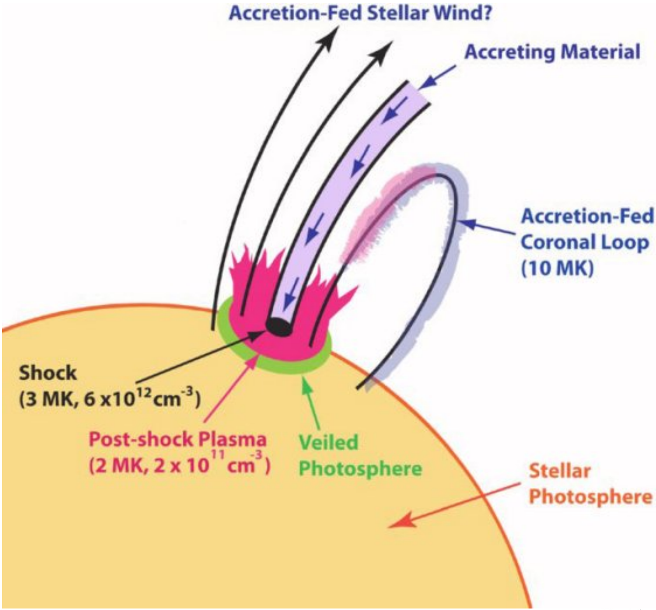


Schneider et al. (in prep.)

(2005 data published by Güdel et al., 2007)

- Emission from Accretion Shocks: $n_e \sim 10^{12}\ \mathrm{cm}^{-3}$
- TW Hya: High Density ($n_e \gtrsim 5 \times 10^{11}\ \mathrm{cm}^{-3}$)
- T Tau: Low Density ($n_e \lesssim 10^{11}\ \mathrm{cm}^{-3}$)

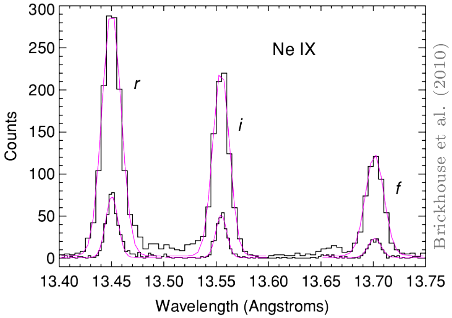
Structure of the Accretion Shock



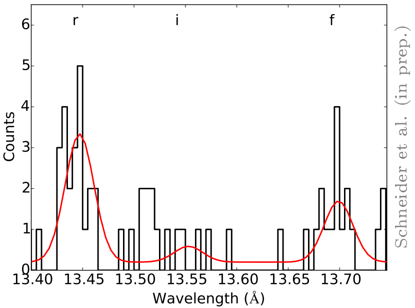
Brickhouse et al. 2010

Densities from Hotter Lines (Ne IX)

TW Hya ($0.6\,M_\odot$)



T Tau ($2.4\,M_\odot$)



- TW Hya:
  High Density ($n_e \gtrsim 3 \times 10^{12}$ cm^{-3})
- T Tau:
  Low Density ($n_e \lesssim 10^{12}$ cm^{-3})
- Similar pattern as in lower temperature tracers

Conclusions

Young, accreting stars possess an excess of soft emission independent of

- stellar mass,
- magnetic field strength.

Assuming a similar origin for TW Hya and T Tau suggests an origin in

- ~~Accretion shocks~~ (from density measurements)
- ~~Jets~~ (similar absorption)
- the splatter and different magn. field structures? Possible, but requires large covering fractions ($\gtrsim 10\,\%$)