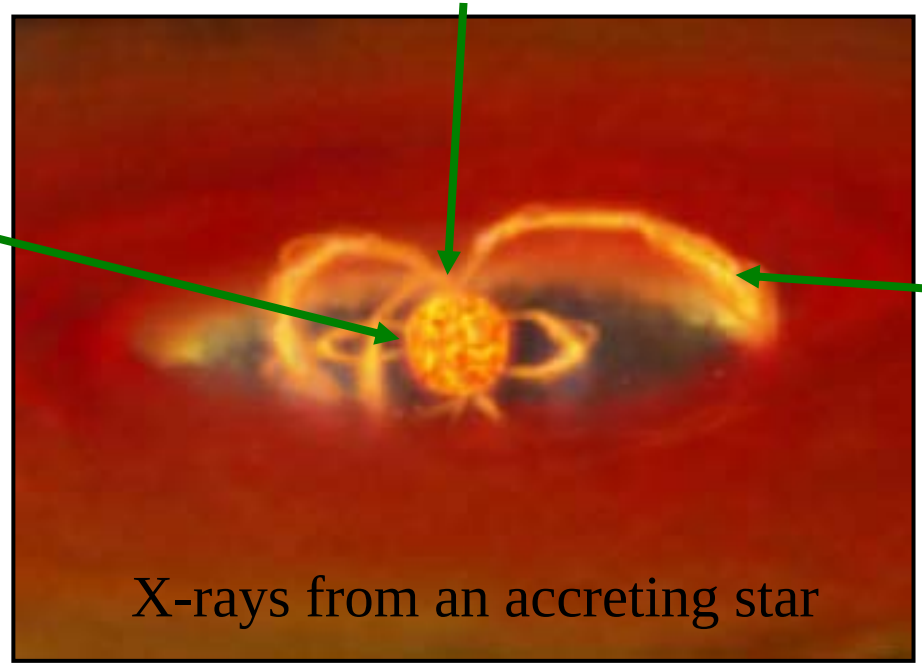
# Why are accreting T Tauri stars observed to be less luminous in X-rays than non-accretors?

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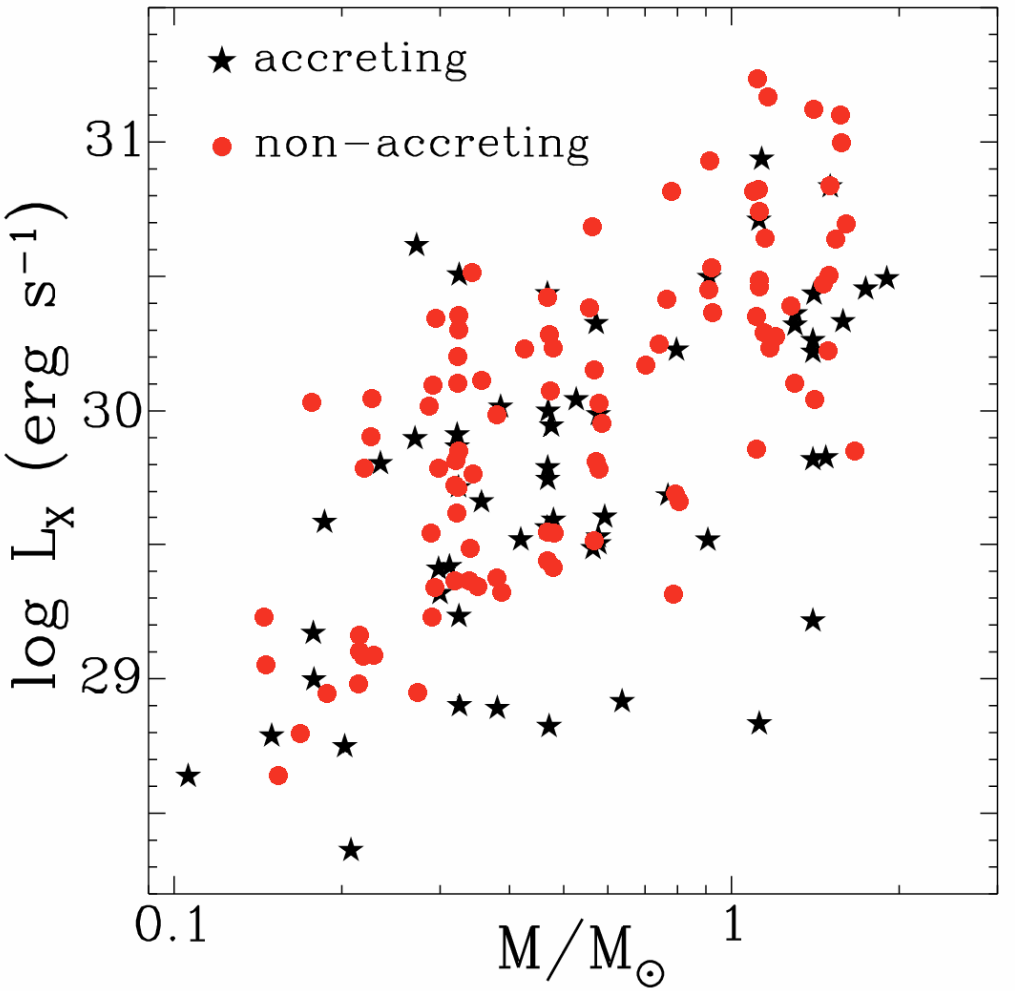
# Suppression of X-ray Emission




(NGC 2264: Flaccomio et al 2006)

The observed X-ray luminosity of accreting stars is a factor of ~ 2 less than non-accretors.

Stelzer & Neuhäuser 2001

Flaccomio et al 2003a,b; 2006

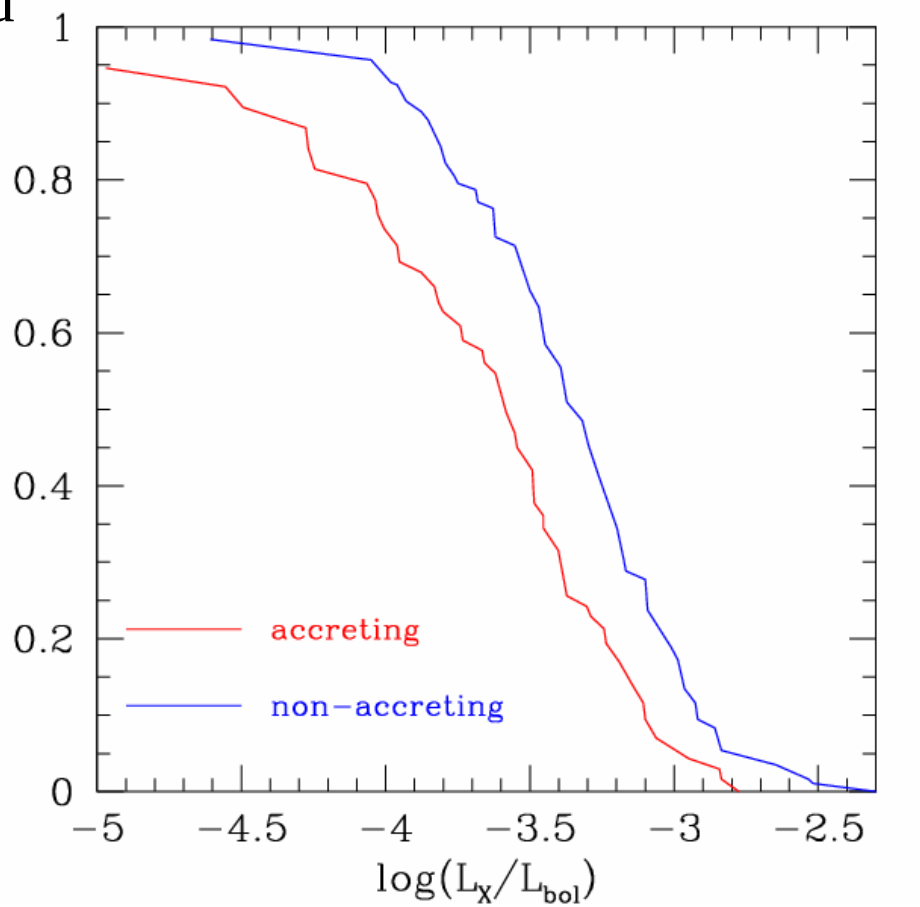
Stassun et al 2004a

Preibisch et al 2005

Telleschi et al 2007

# X-ray Luminosity Functions

- Accreting stars are observed to be less luminous in X-rays.
- Detected in various star forming regions:
  - ONC
  - NGC 2264
  - Chamaeleon I
  - Taurus-Auriga




(NGC 2264: Flaccomio et al 2006)

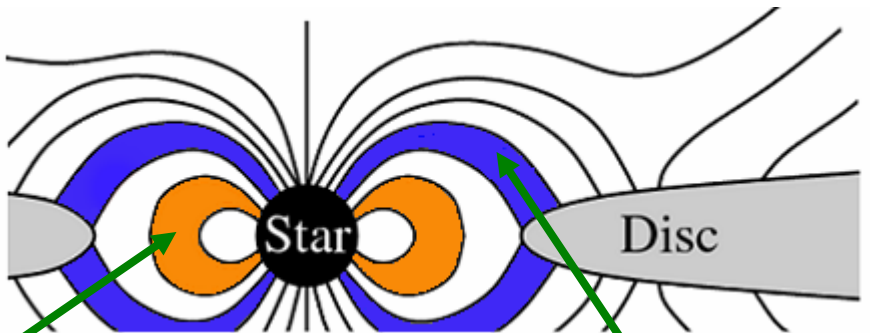
# Suppression of X-ray Emission

- Absorption of X-rays by discs and magnetic breaking effects can be ruled out (e.g. Flaccomio et al 2003b; Preibisch et al. 2005; Telleschi et al. 2007)
- Perhaps accretion modifies the stellar structure (Siess et al 1999; Stassun et al 2004b).
- Could be due to accretion columns rotating across the line-of-sight, and/or altering the coronal geometry.

# Suppression of X-ray Emission

- May be caused by accretion columns:
  - X-ray attenuation by the dense accreting gas.
  - Mass loaded field lines reduce the available coronal volume.

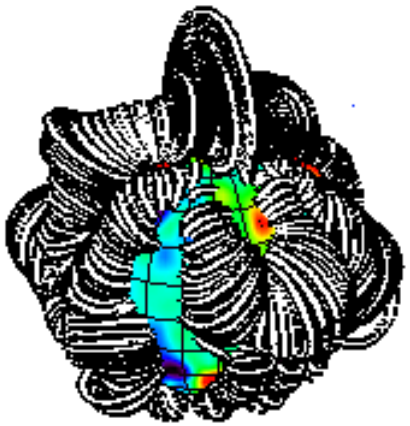
(Modified from Matt & Pudritz 2005)

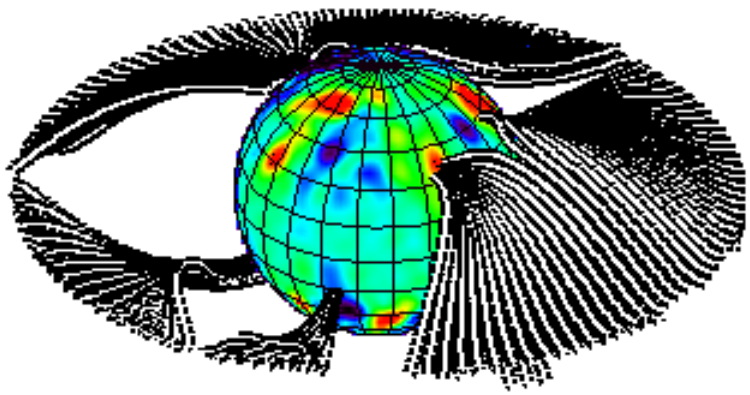



Low density hot coronal loops

Loops cooled by accreting material – no X-ray emission

# Field Extrapolations

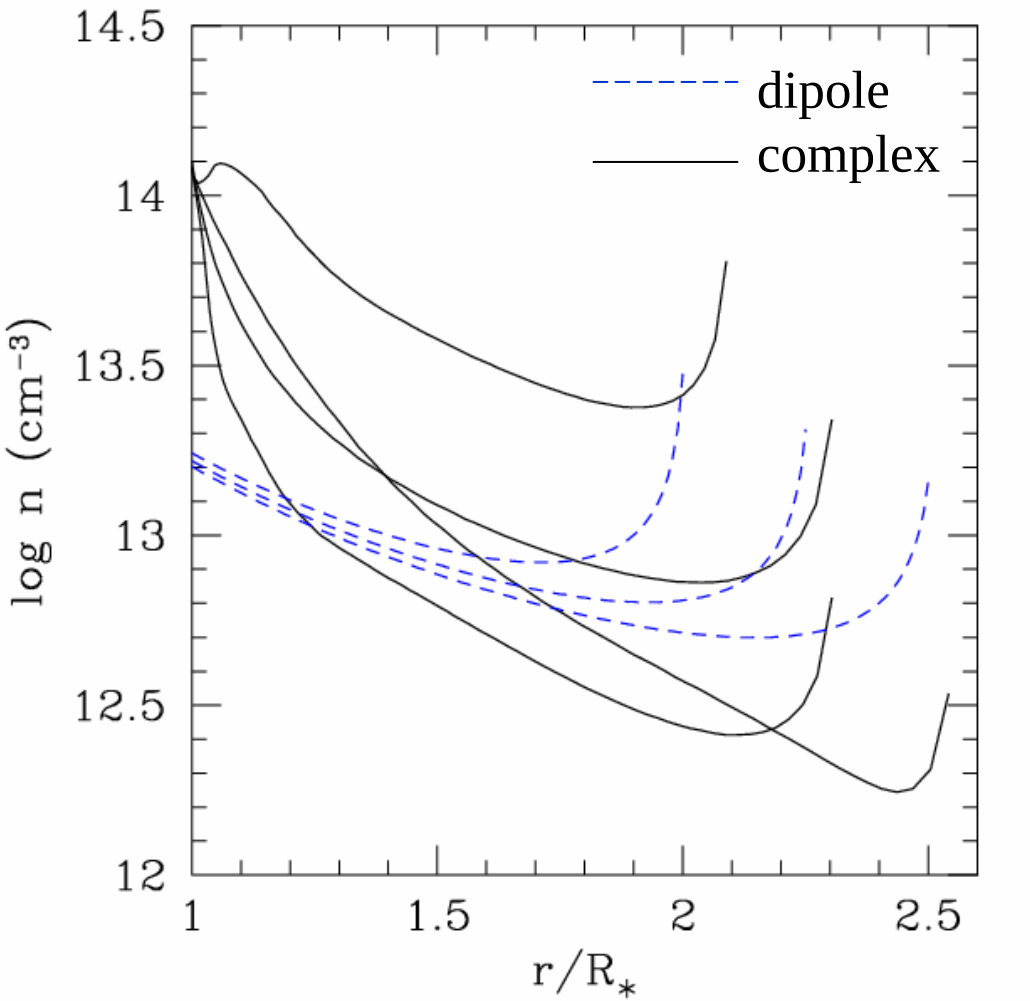




(Gregory, Wood & Jardine 2007)

- Complex fields extrapolated from surface maps of main-sequence stars.
- Isothermal corona in hydrostatic equilibrium.
- Satisfies observational constraints.

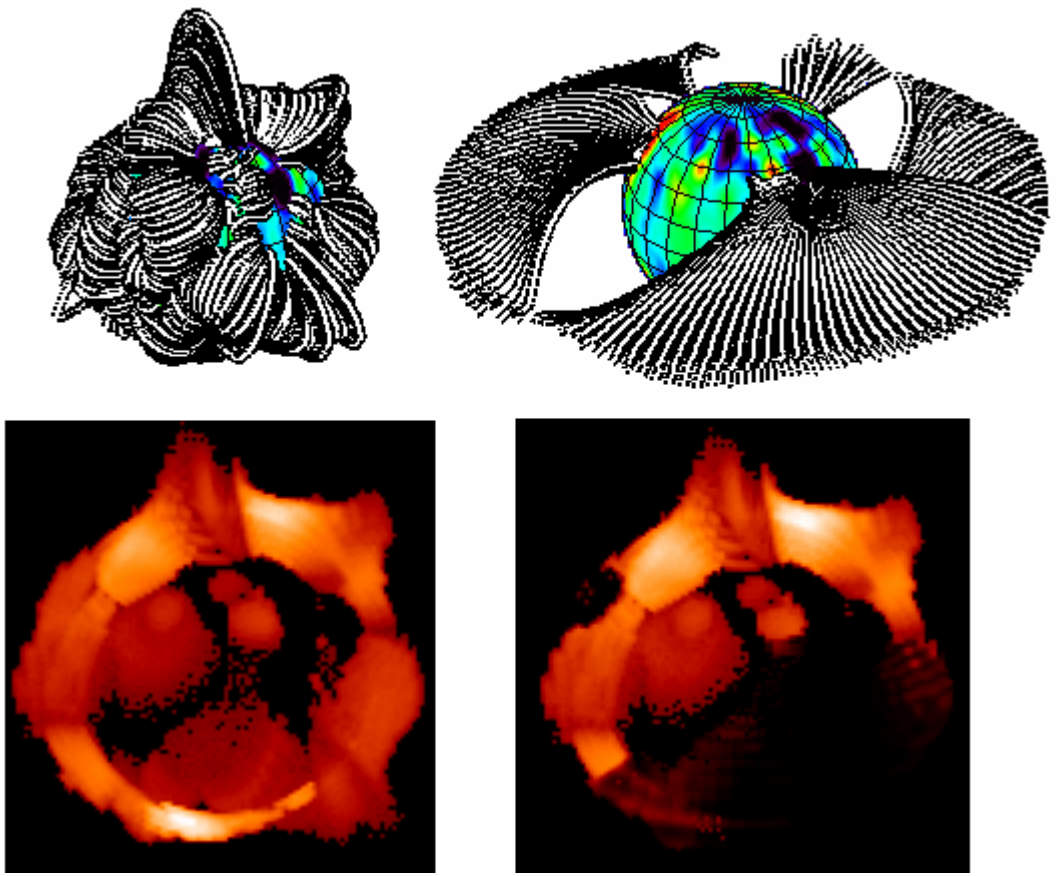
# Accretion Flow Model




(Gregory, Wood & Jardine 2007)

- Assumes
  - conservation of mass and magnetic flux.
  - field is not distorted via disc interaction or by accretion.
- Steeper density gradient for complex field accretion.

# Radiative Transfer



(Gregory, Wood & Jardine 2007)

- Factor of ~1.4-2.0 reduction in the observed X-ray emission (averaged across a complete rotation cycle) with accretion.
- Depends strongly on the field geometry and stellar inclination.

# Summary

- Attenuation of coronal X-rays by gas in accretion columns can, at least in part, explain the observed reduction of X-ray emission in accreting stars (Gregory, Wood & Jardine 2007).
- Some evidence for this (Stassun et al 2004a; Güdel et al 2007).
- But, other effects may be important – e.g. coronal stripping (Jardine et al 2006; Gregory et al 2007, in prep.).