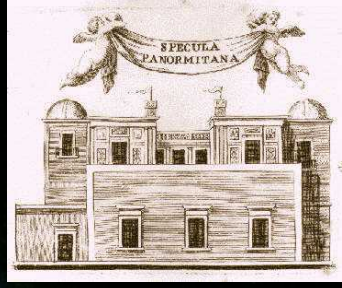

Characteristic UV spectra from stellar accretion

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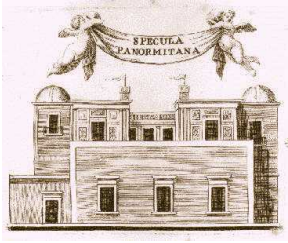


Bright hot impacts by erupted fragments falling back on the Sun:

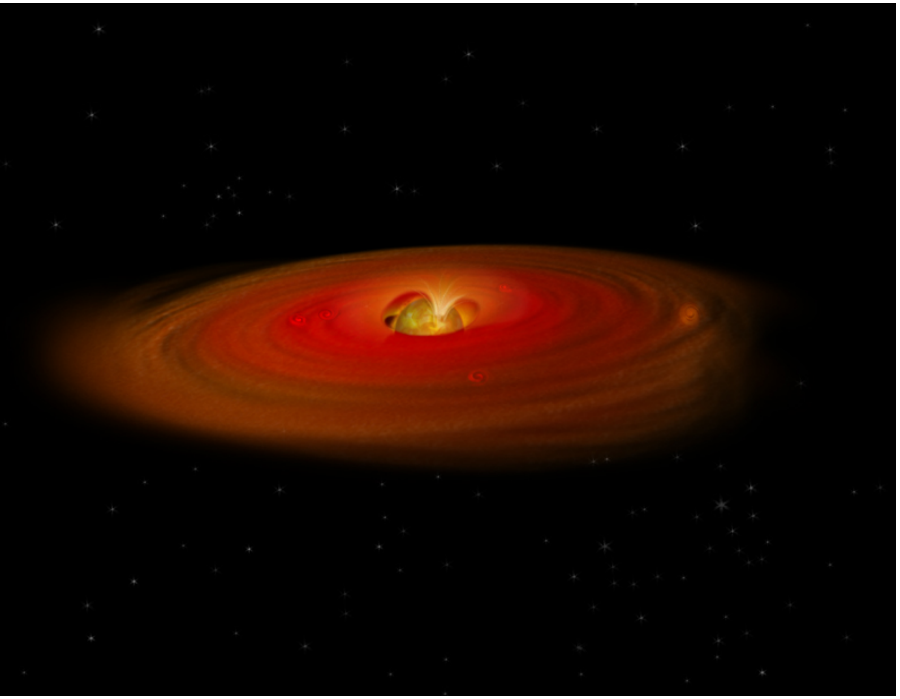
1) a template for stellar accretion (Science, 2013)

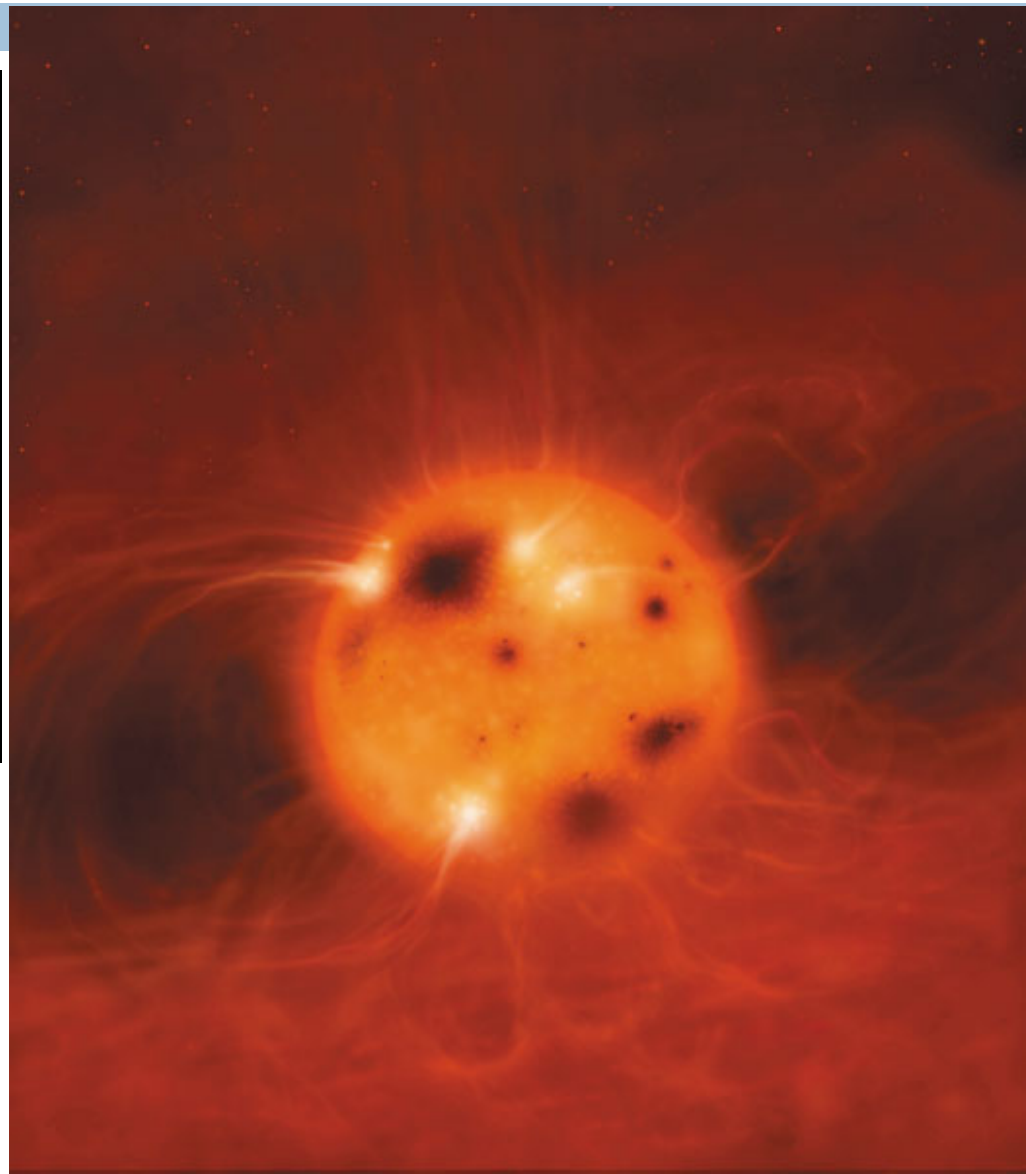
2) UV redshifts in stellar accretion (ApJL 2014)

Fabio Reale (Univ. Palermo)
Salvatore Orlando (INAF-OAPa)
Paola Testa (Harvard CfA, USA)
Giovanni Peres (Univ. Palermo)
Enrico Landi (Univ. Michigan, USA)
Carolus (Karel) J. Schrijver (LMSAL, USA)

AIA20110607_055937_0171.fits

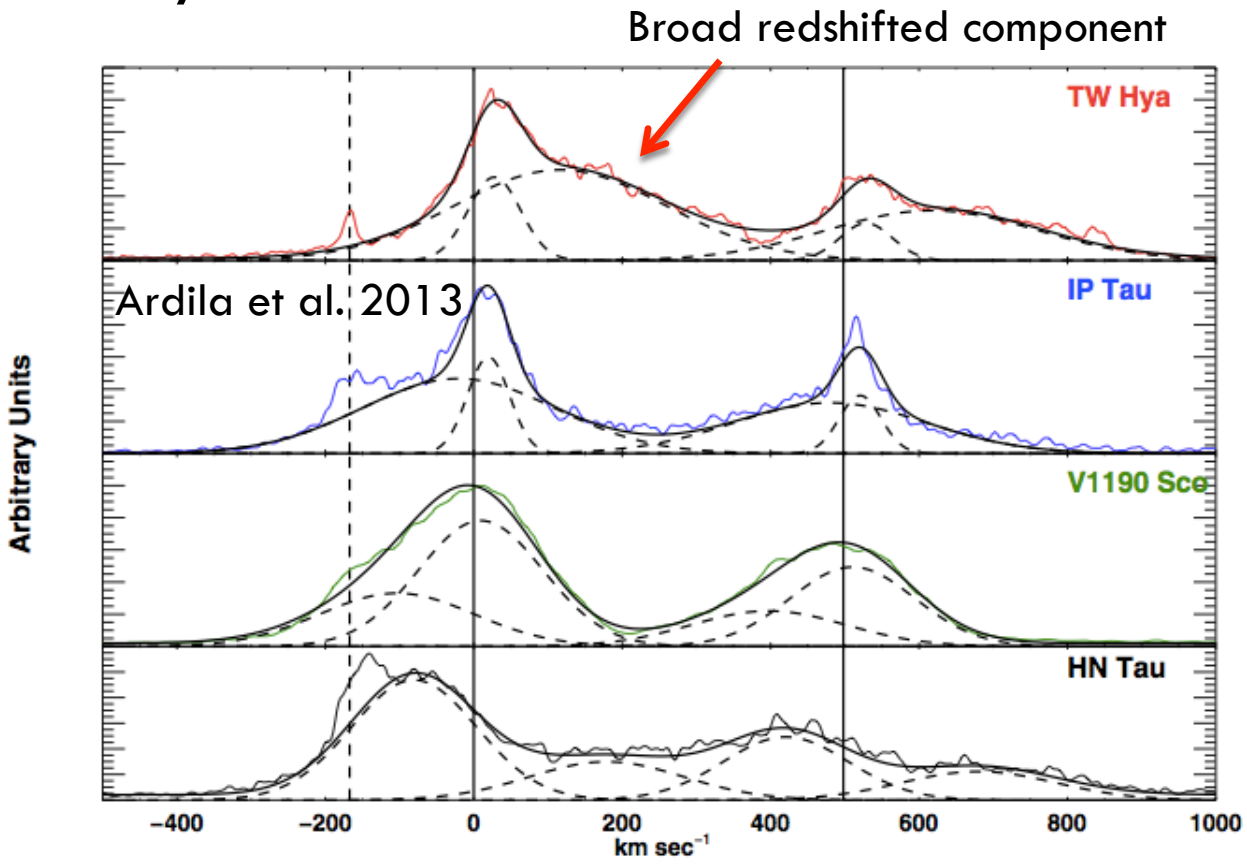
Accretion flows on young stars (T Tauri)





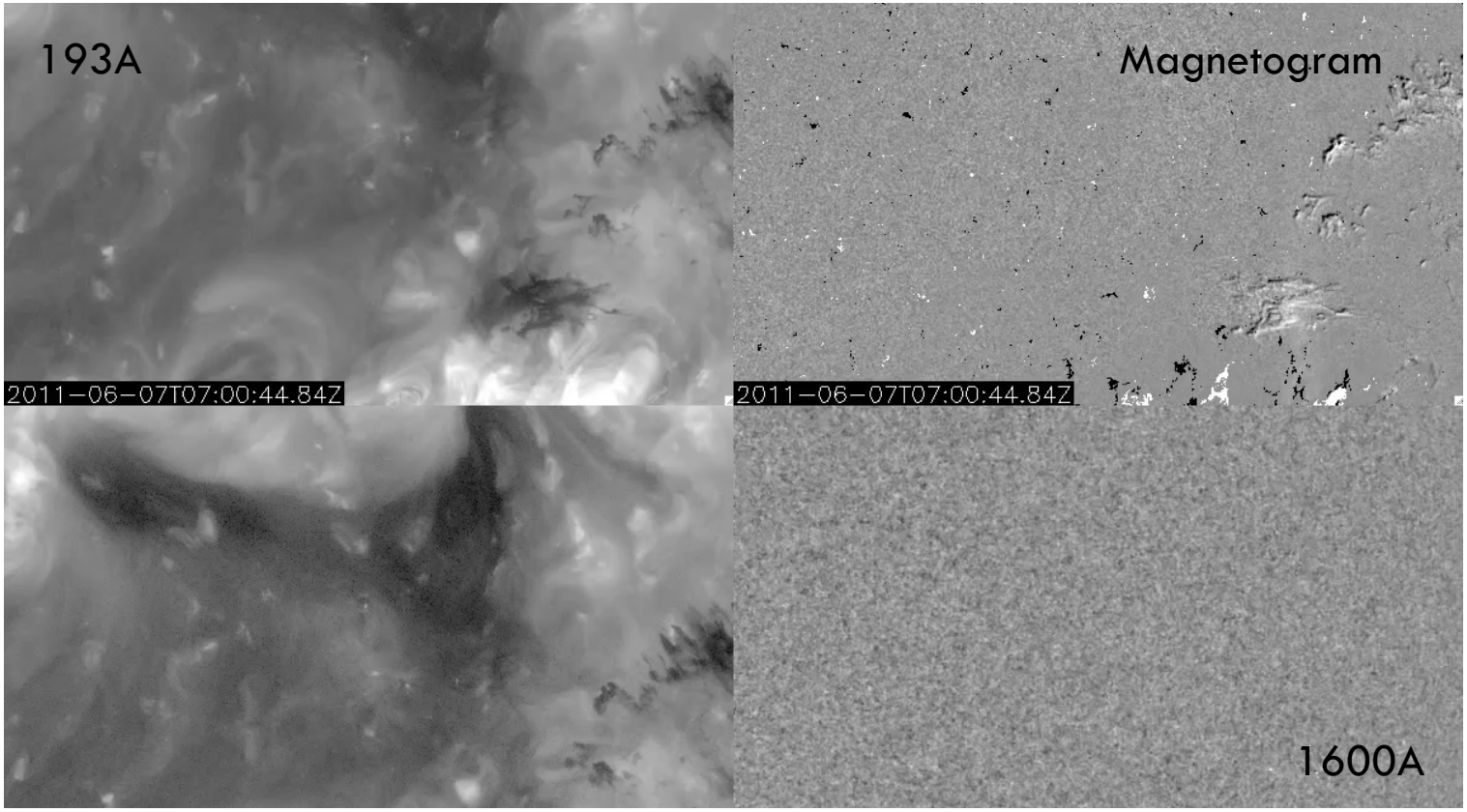
T Tauri stars: C IV 1550A doublet

- Magnetic geometry?
- Turbulence?



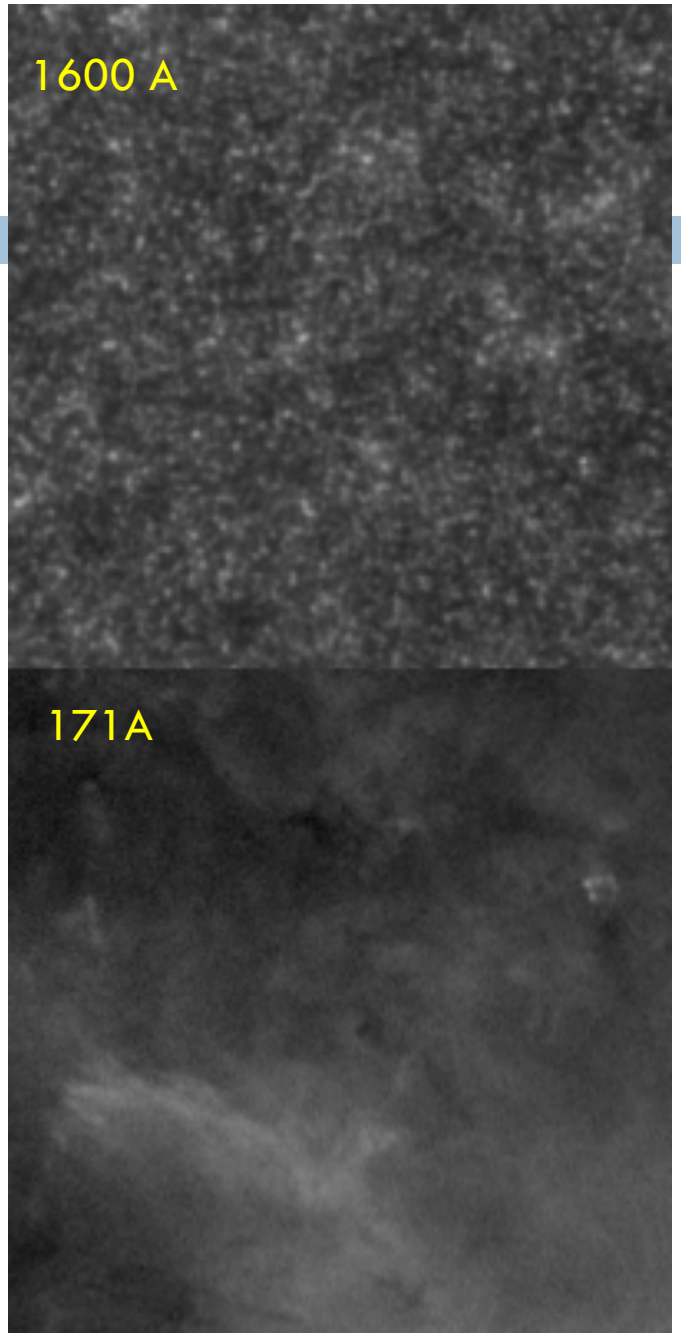
The UV emission: The impact

We focus on the impact at 7:27 UT (second arrow)

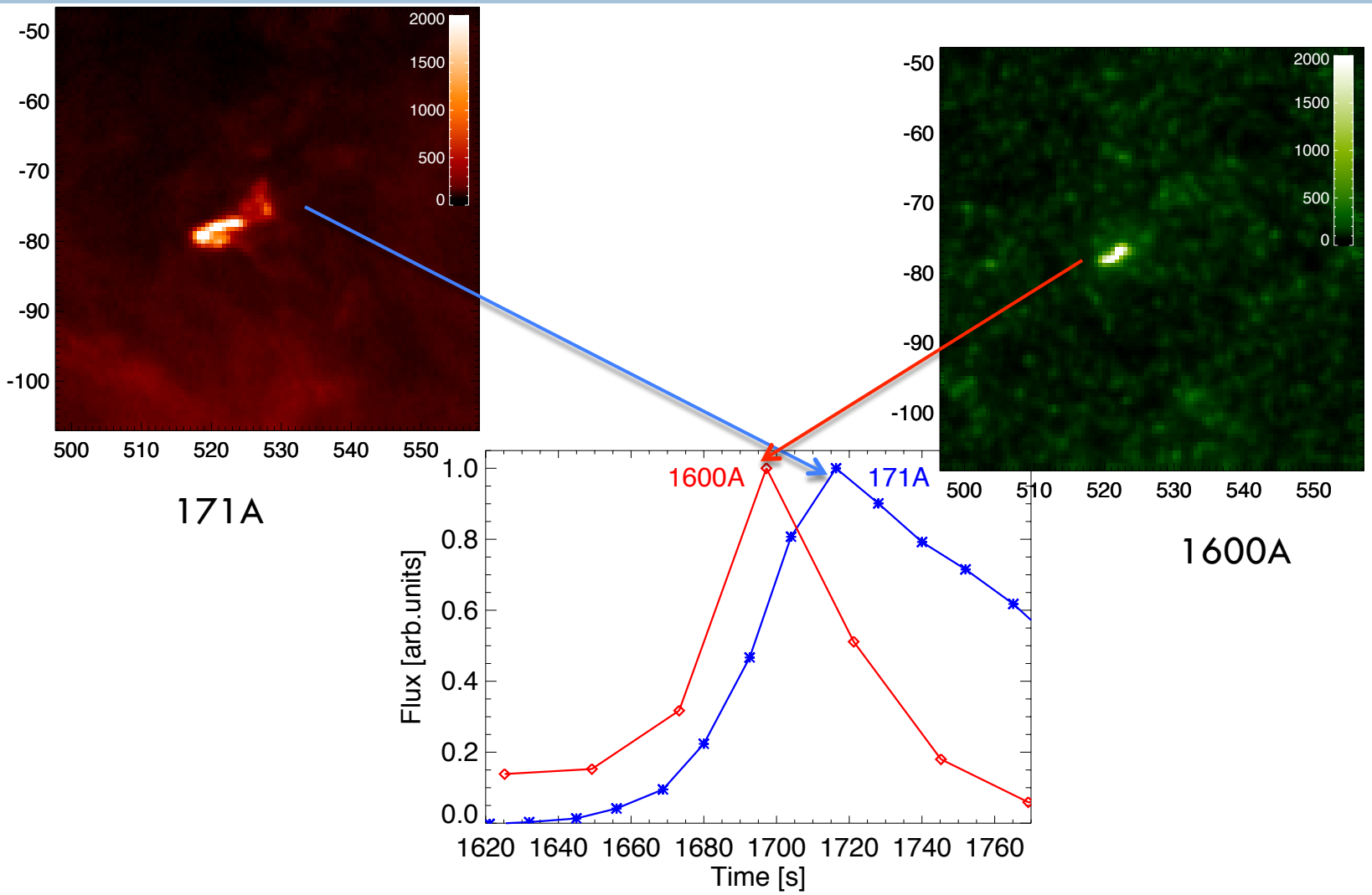


UV emission: SDO/AIA 1600 A

- Before impact, absorbed in 171A, not in 1600A
- Bright impacts both in 171A and 1600A
- The 171A emission peaks later than the 1600 A

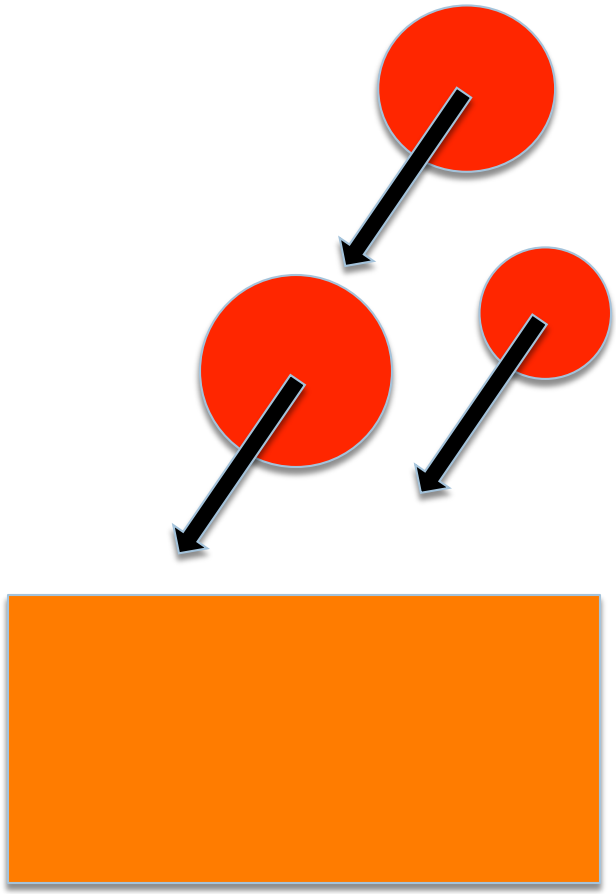


Light curves of the impact: peak delay



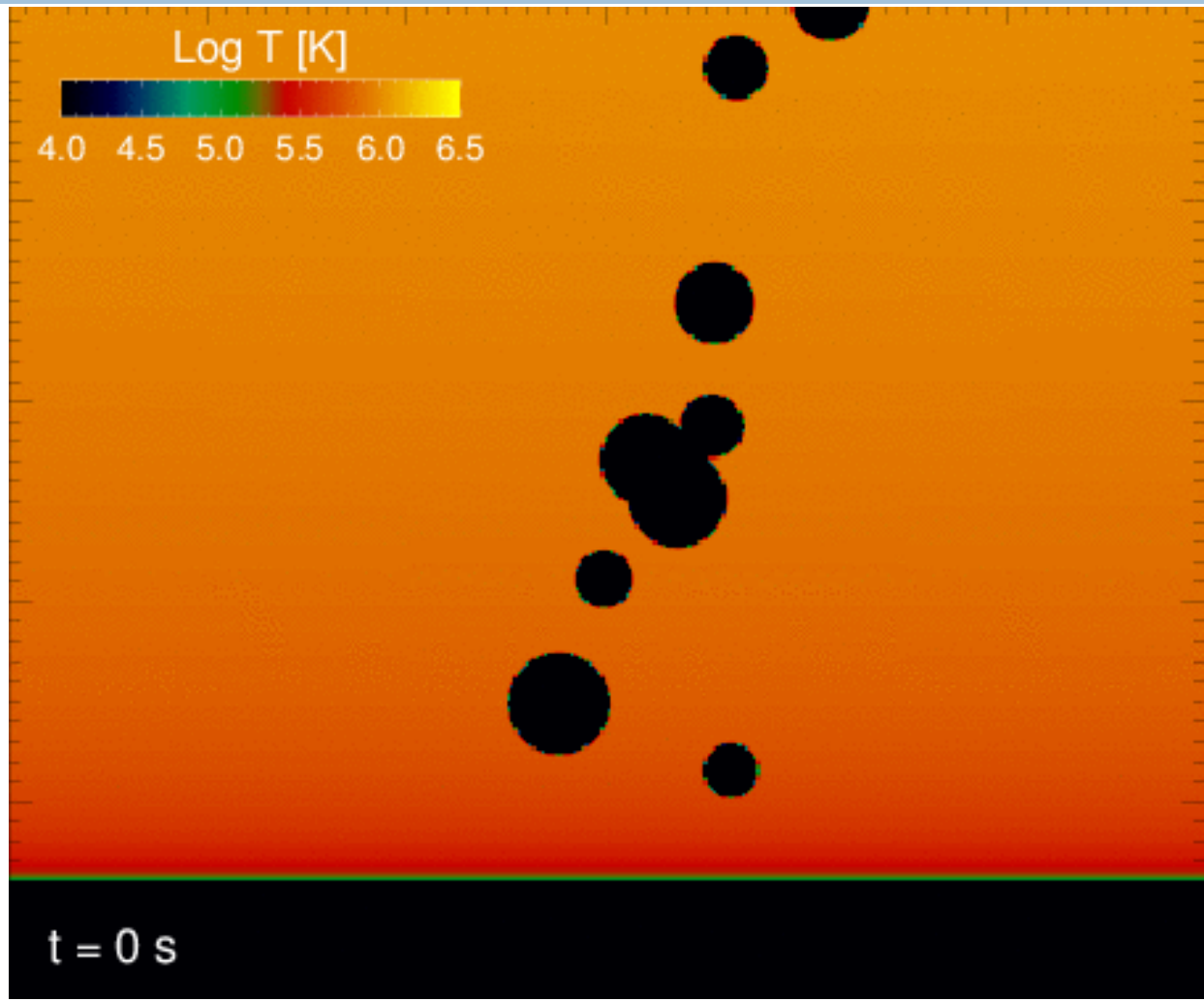
New Hydrodynamic simulations (Reale et al. 2014)

- 2D cartesian
- 20 random droplets:
  - Radius: $1.4 < R < 2.6\ 10^8$ cm
  - Avg. separation: $\sim 10^9$ cm
  - V=400 km/s
  - Density: 5×10^{10} cm^{-3}
- Oblique trajectory (75°)



New hydrodynamic simulations (Reale et al. 2014): free-falling random dense fragments

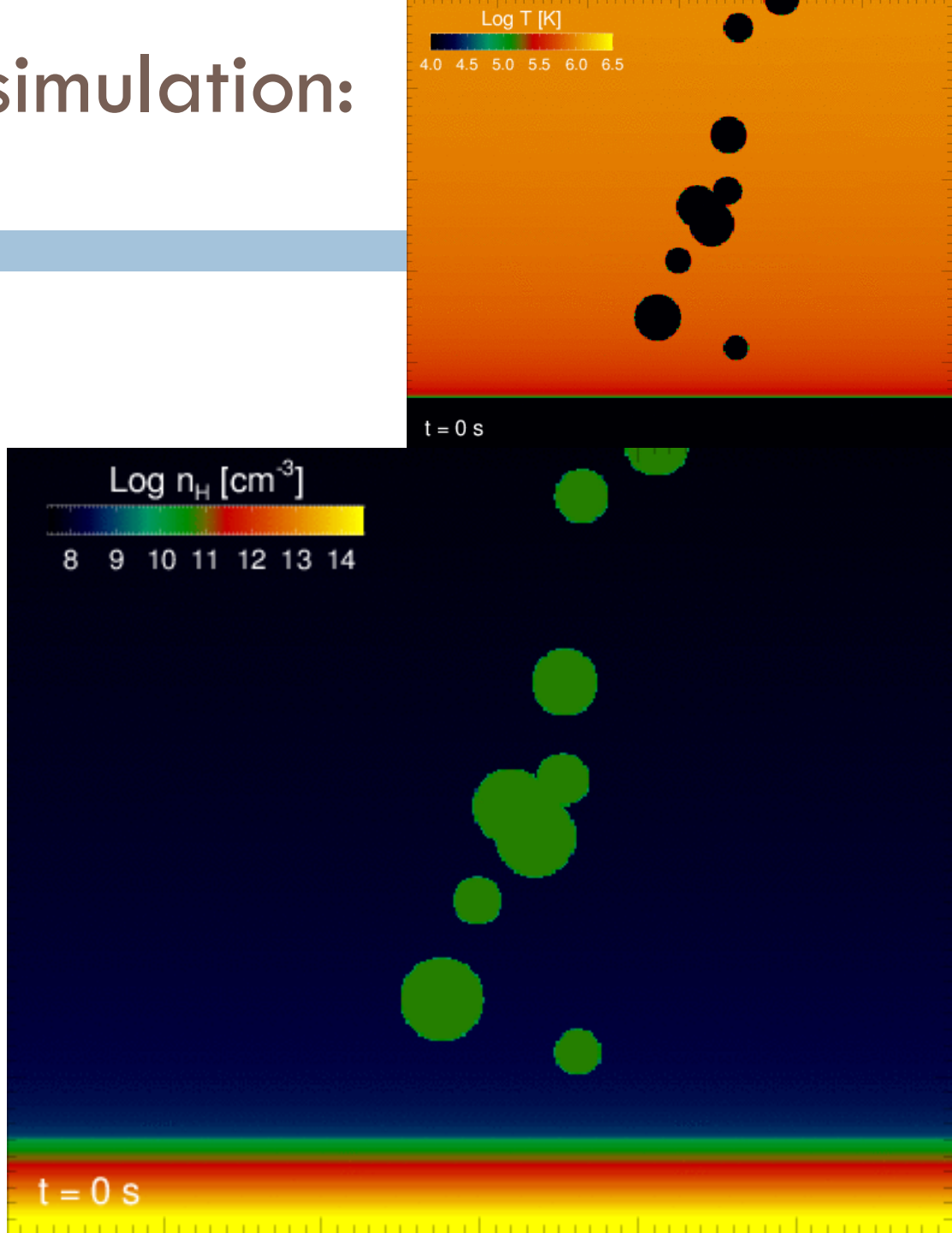
- Asymmetric surge
- Next falling fragments hit by the surge
- Structured temperature



Temperature

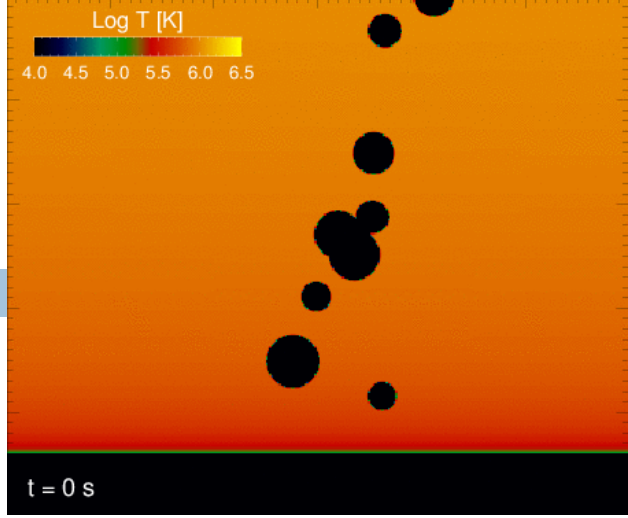
Hydrodynamic simulation: the density

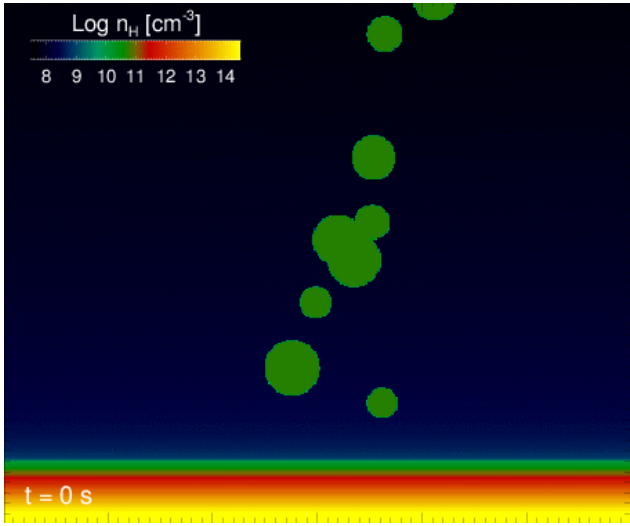
- Dense (RED) shells BEFORE impacts



Density

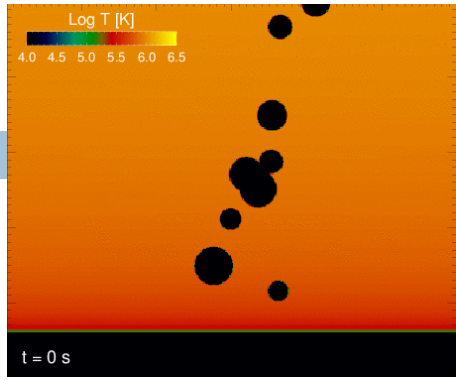
The EUV emission: mostly from the surge

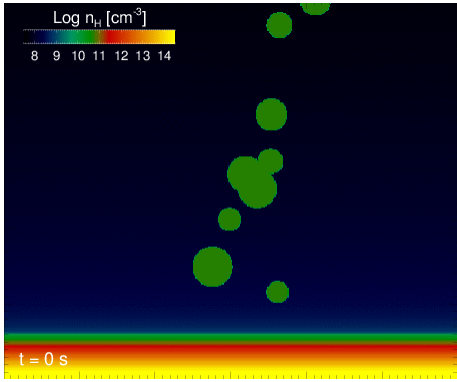




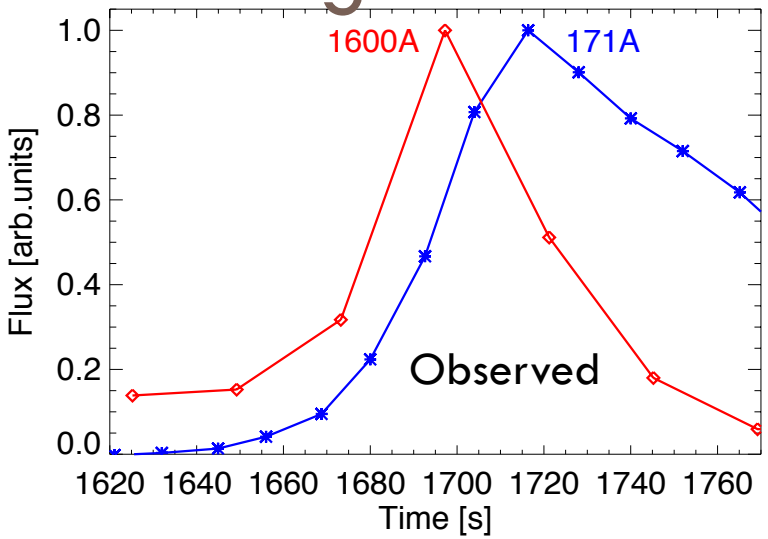
Emission absorbed below the line

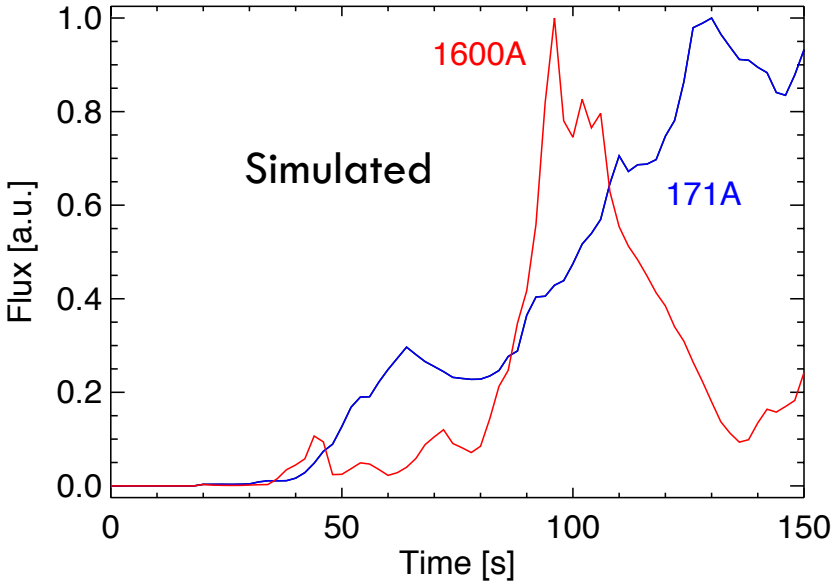
The UV emission: mostly from thin shells of still downfalling fragments

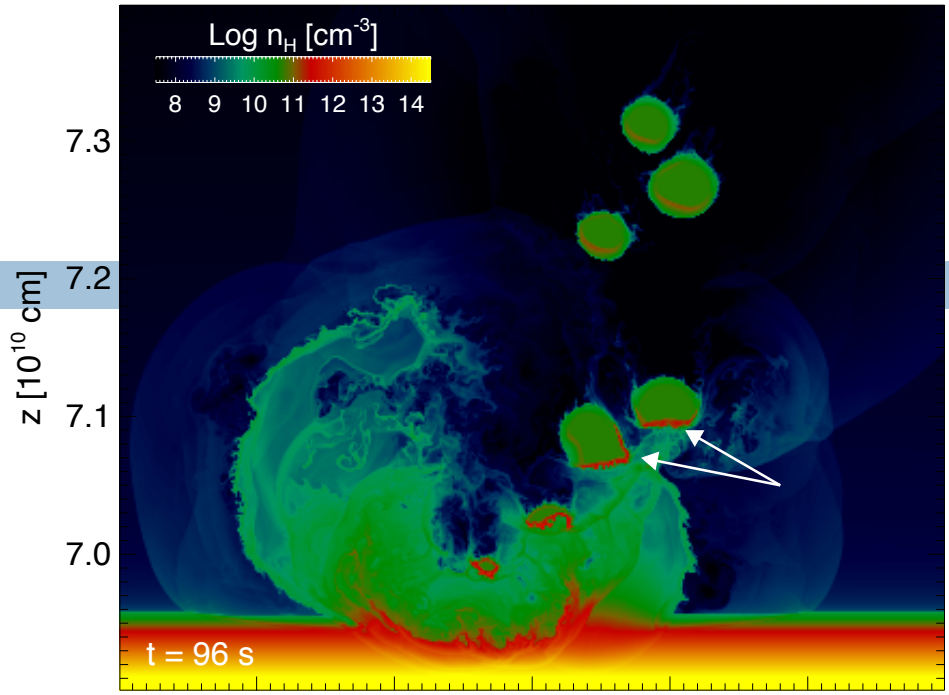


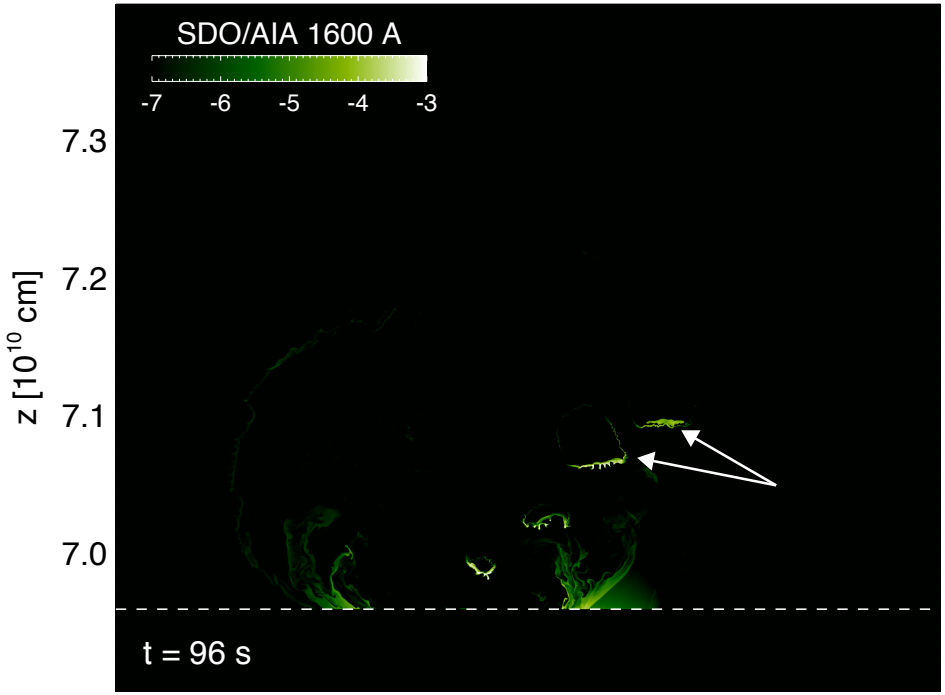


UV emission: the fragments shells



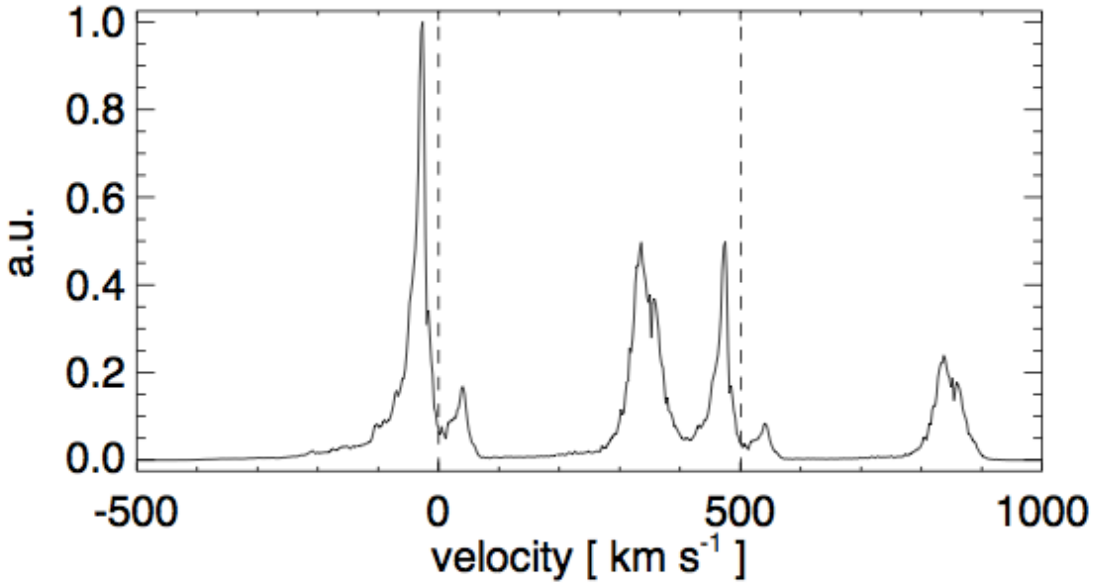






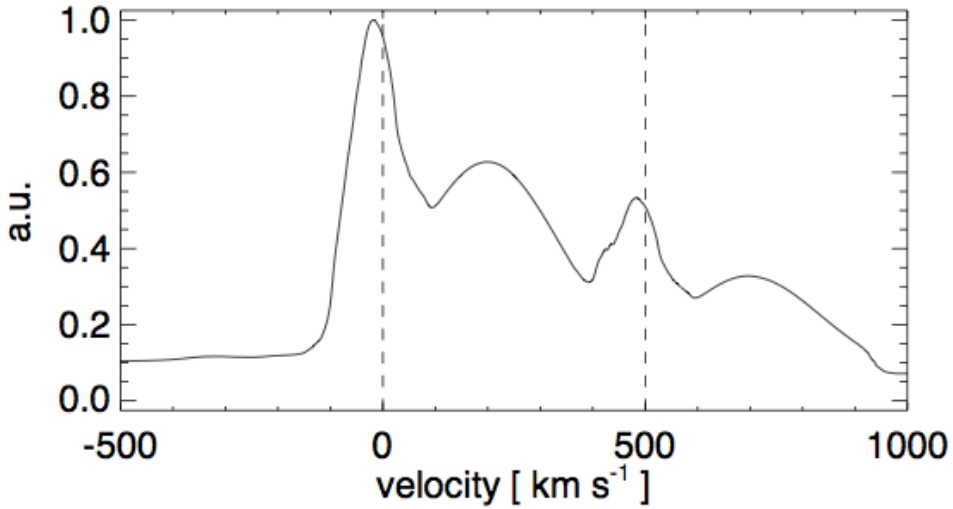
UV emission: synthesis of C IV doublet profile

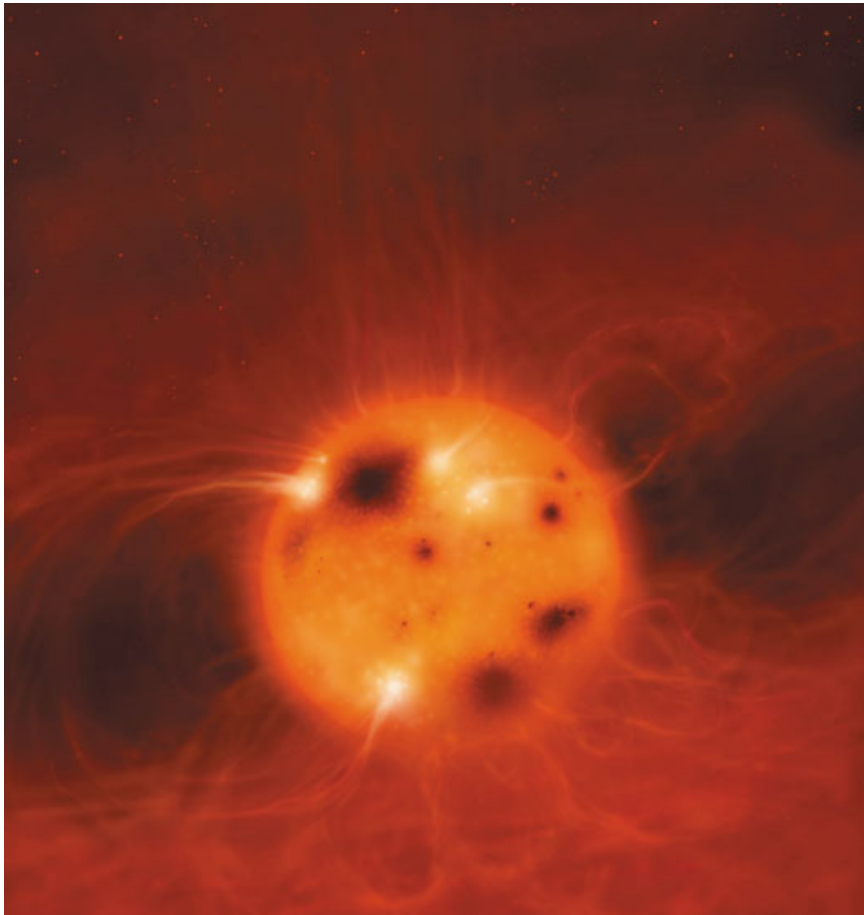
- Intense redshifted component (~ 350 km/s)
- Single accretion flow



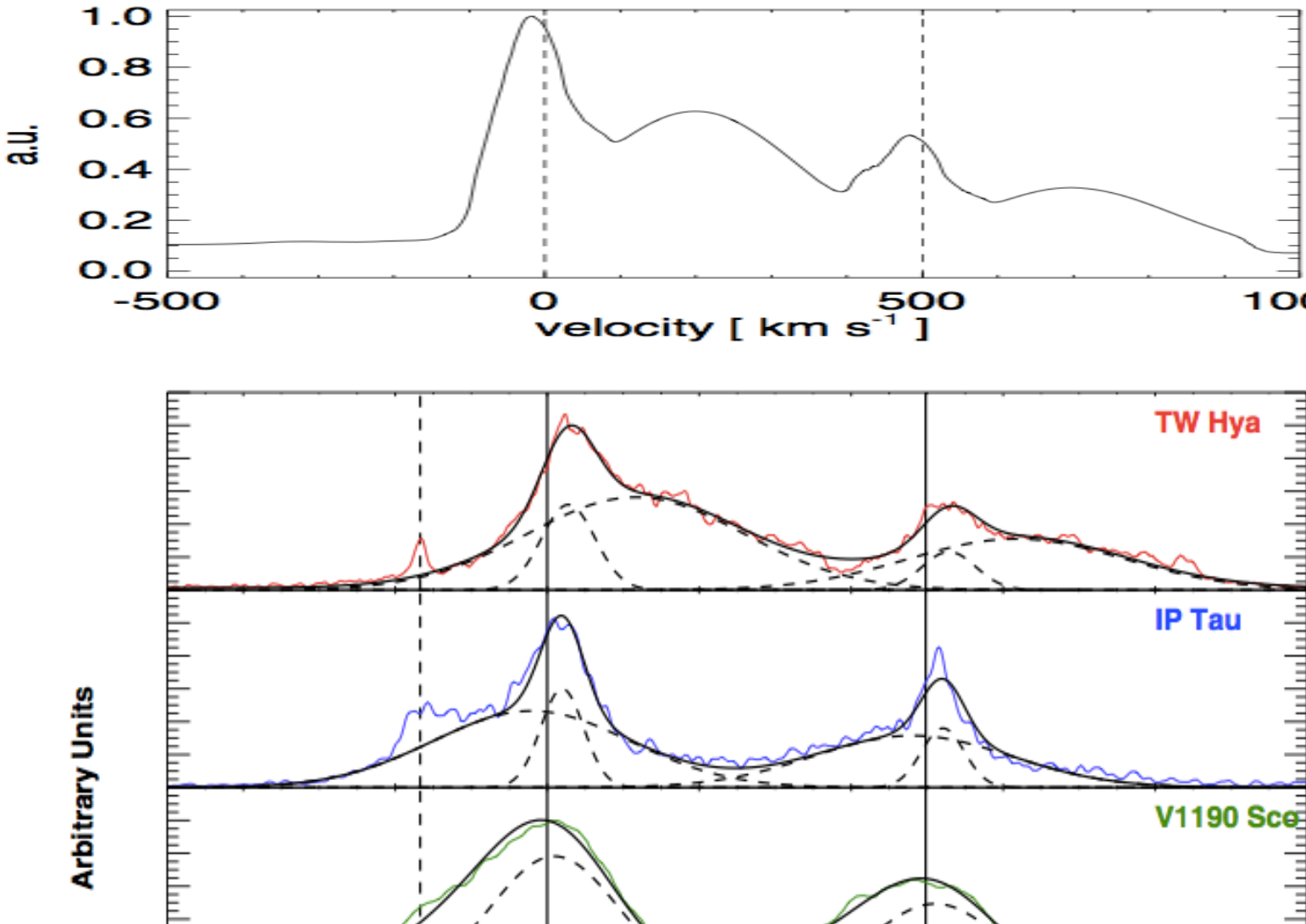
UV emission: C IV broadening

- Many flows, different orientations -> broadening





Comparison with observation



Conclusions

- This model naturally reproduces the observed high-speed UV redshift in a new way: fragments while they are still falling
- Presence or absence connected to fragmented or continuous flows
- Distributed flows?
- Importance of fragmentation: instabilities or since the beginning?
- Coronal rain?