A multi-λ study of debris discs around late-type MS stars.

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Outline

- Science case: Debris disk around late-type MS stars
- The workflow
- Some preliminary results

Debris discs around late stars

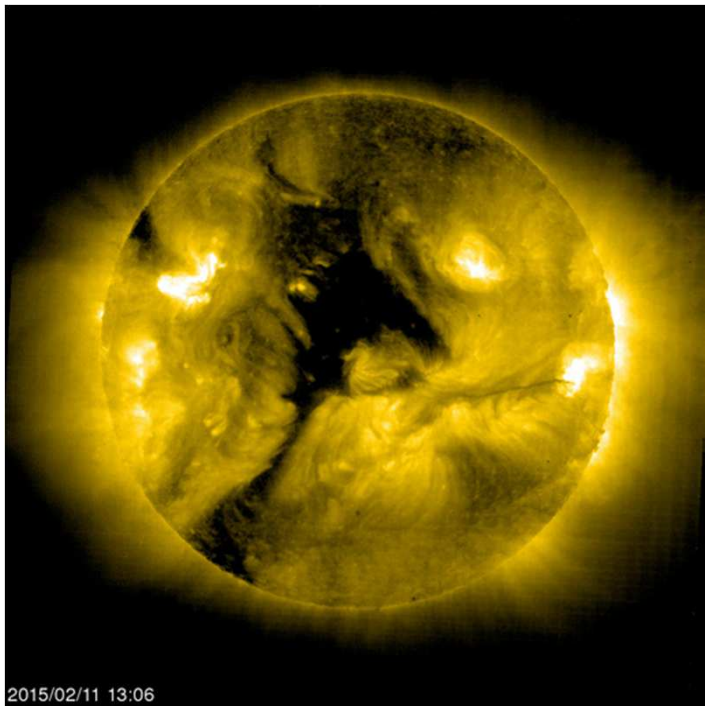
Science case

• Young stars are fast rotators
(heritage of the parental cloud)

• For late-type (F-M) stars, the rotation produces a dynamo mechanism which is responsible of the coronal activity, and consequently, the X-ray emission.

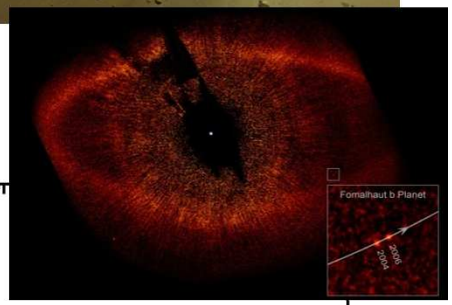
• The younger the star is, the faster it rotates, and the stronger its X-ray emission is.

• So, stellar age can be estimated from F_x/F_{bol} (Sanz-Forcada et al 2010)

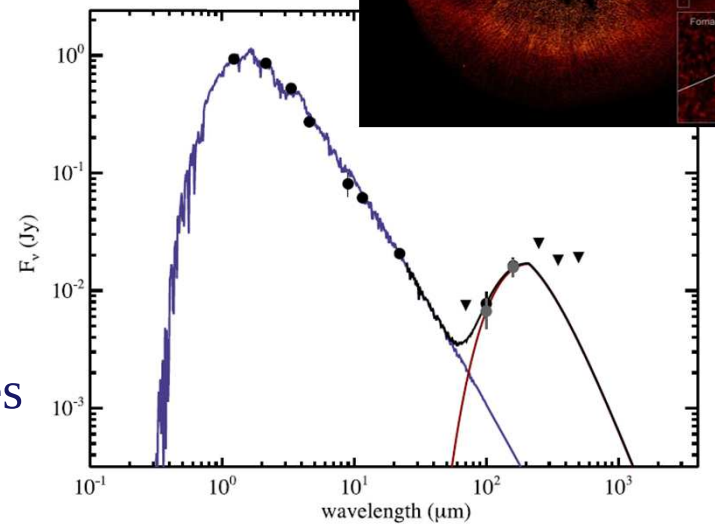


Debris discs around late stars

Science case



- Debris discs are the equivalents of the Kuiper Belt
- Typical SEDs with infrared excess
- It is expected that the fractional emission F_{disc}/F_{bol} of the debris discs decreases with the stellar age
- **Main goals:**
  - Study the evolution of debris discs (IR) with the stellar age (X-ray)
  - Discovery of new debris disk candidates



Workflow

- Select galactic objects from the ARCHES cross-correlated catalogues by proper motion filtering
- Identify IR excess from the SEDs
- Obtain F_{bol} (F_{star}) from atmosphere model fitting
- Obtain F_{disc} from black body fitting
- Study the relation F_x/F_{bol} vs. F_{disc}/F_{bol}

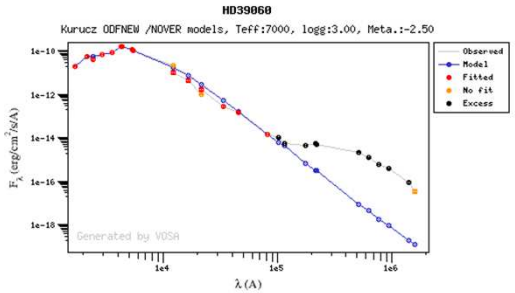
Debris discs around late stars

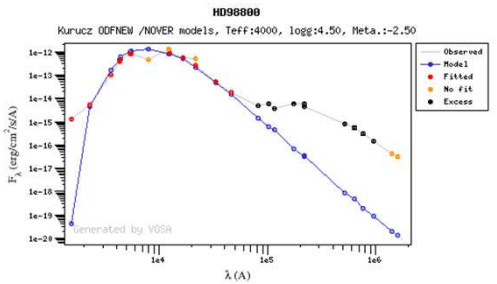
Workflow validation

- Tested with a sample of warm debris disc candidates around late-type stars (Fujiwara et al. 2013, A&A, 550, A45).

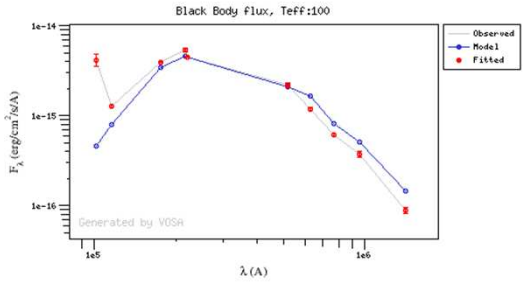
- We detected the infrared excess and recovered the physical properties for the star and the disk for most of them.

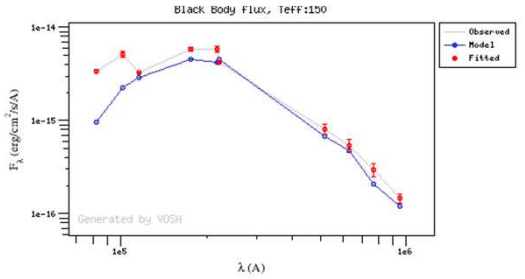
Star





Disc



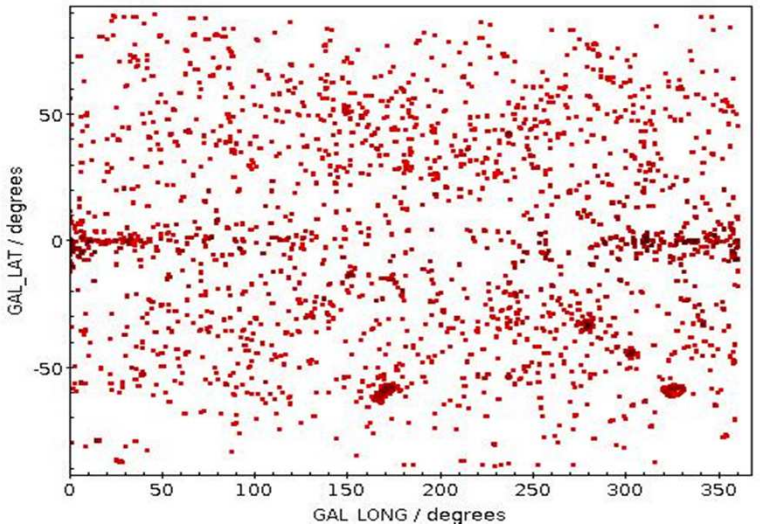


Debris discs around late stars

Preliminary results

1. **Select galactic objects from the ARCHES cross-correlated catalogues by proper motion filtering**

   - 108,037 sources not affected by bright star or galaxy from 3XMMe catalogue
   - 10713 with pm in UCAC4, good photometry and star flag
   - Selected 5819 with pm > $3\sigma_{pm}$
   - Removed 342 known objects with a classification different than single star in SIMBAD

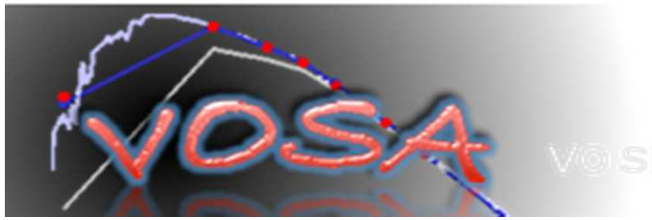


Debris discs around late stars

Preliminary results

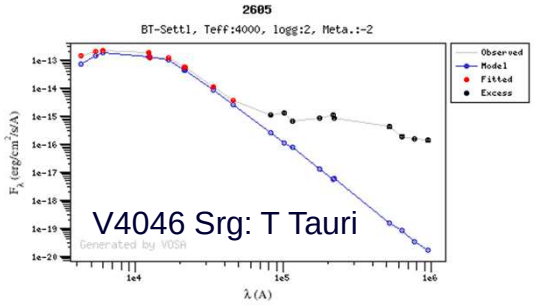
2. Identify IR excess from the SEDs

- Use VOSA to build the SEDs with VO photometry

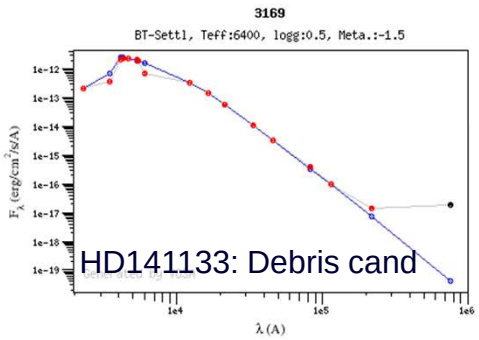


VO SED Analyzer

- Automatic detection of 439 infrared excess candidates
  - 18 known (>2 references)
  - 54 with one or two references
  - 367 completely unknown.



V4046 Srg: T Tauri



HD141133: Debris cand

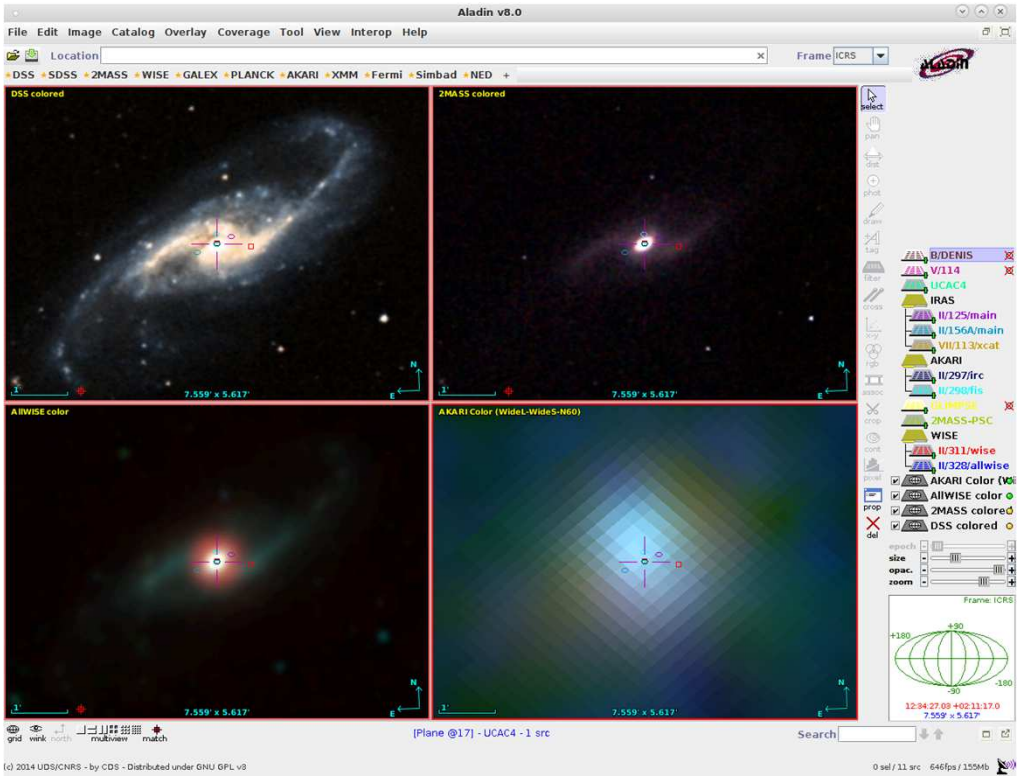
Debris discs around late stars

Preliminary results

2. Identify IR excess from the SEDs

Visualize all 439 infrared excess candidates with Aladin

- galaxies



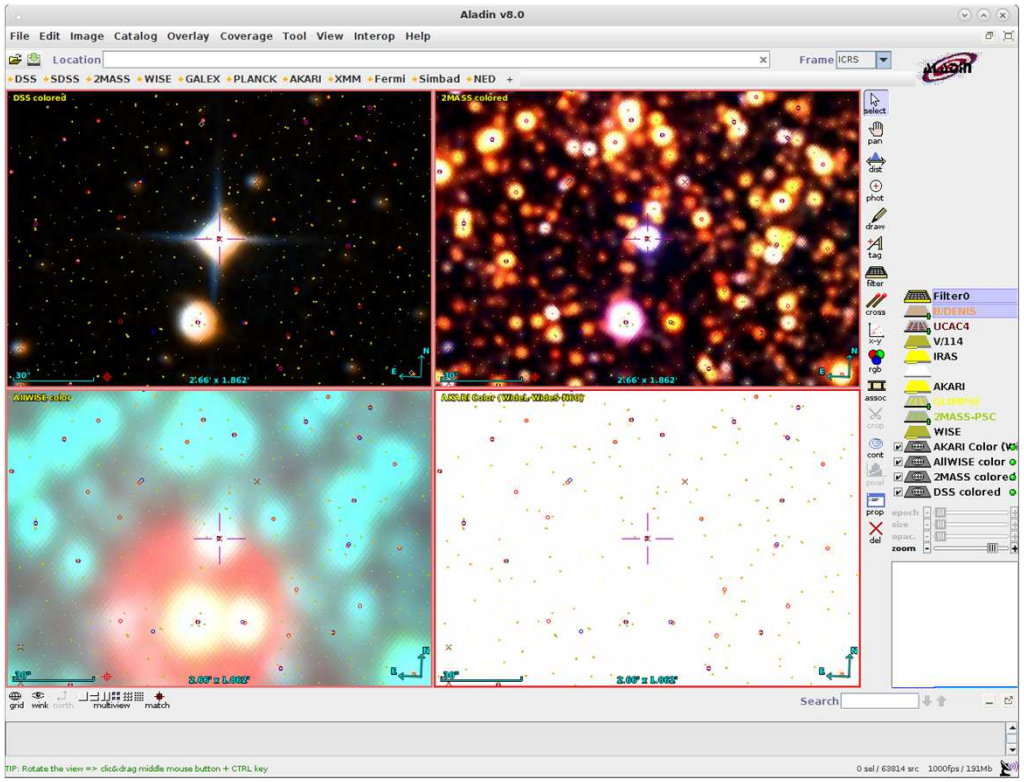
Debris discs around late stars

Preliminary results

2. Identify IR excess from the SEDs

Visualize all 439 infrared excess candidates with Aladin

- galaxies
- contaminated fluxes



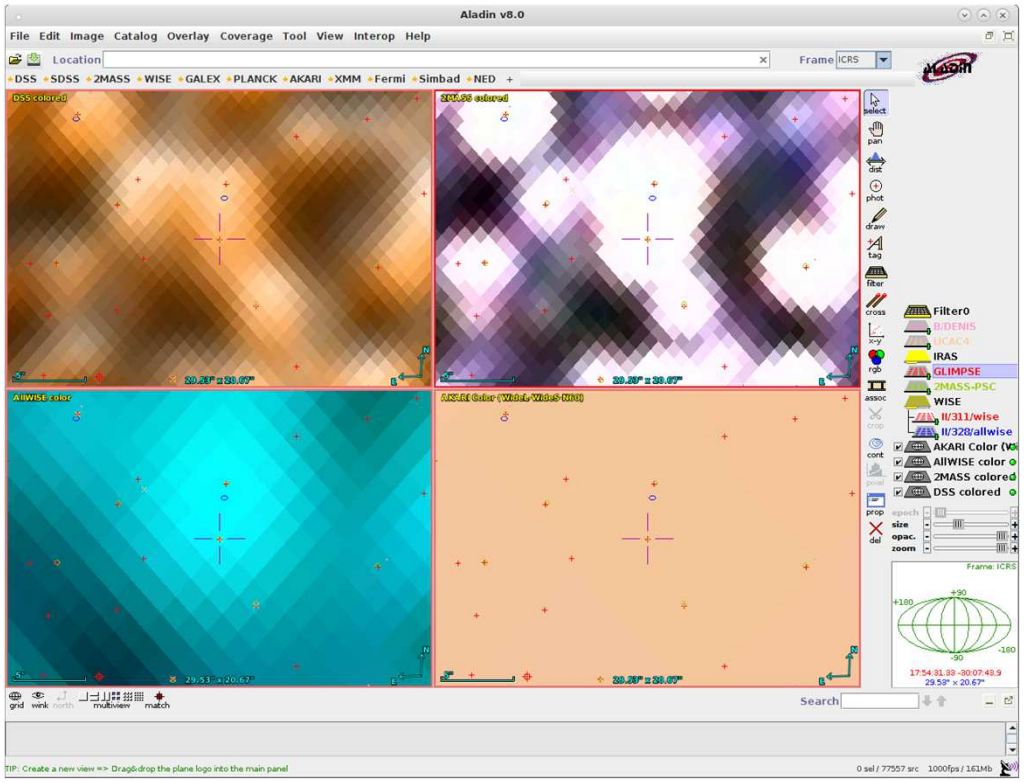
Debris discs around late stars

Preliminary results

2. Identify IR excess from the SEDs

Visualize all 439 infrared excess candidates with Aladin

- galaxies
- contaminated fluxes
- misidentifications



Debris discs around late stars

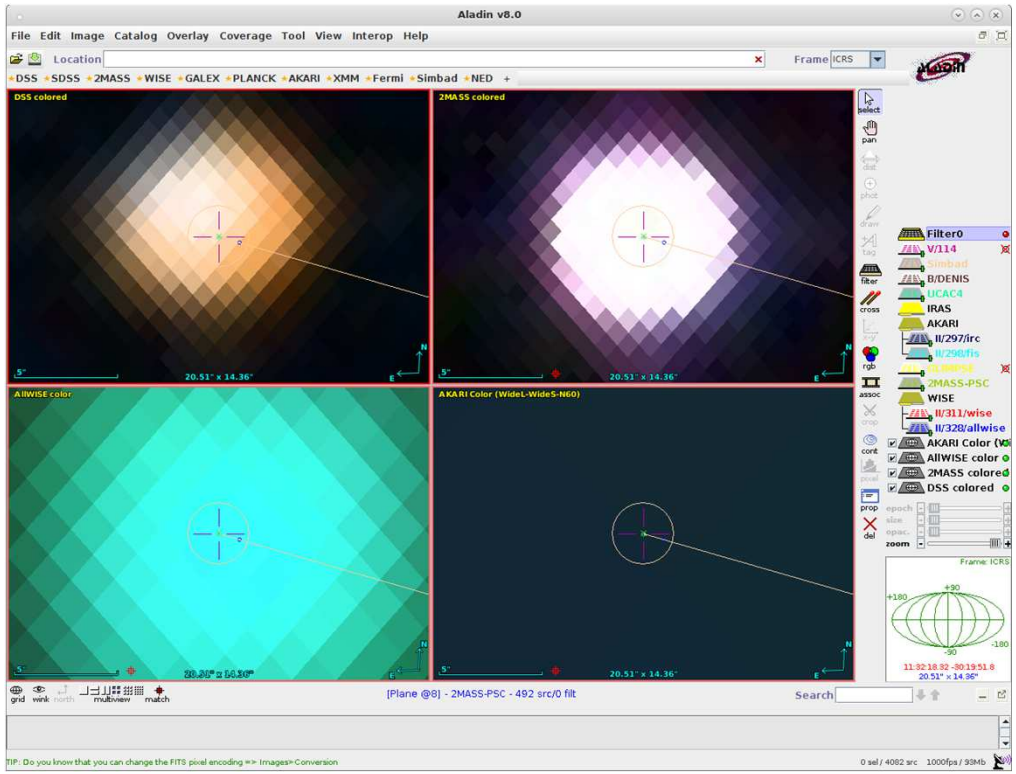
Preliminary results

2. Identify IR excess from the SEDs

Compare cleaned VOSA's SEDs with ARCHES' SEDs

Good agreement in general, but high pm sources

Final sample of 244 infrared excess sources

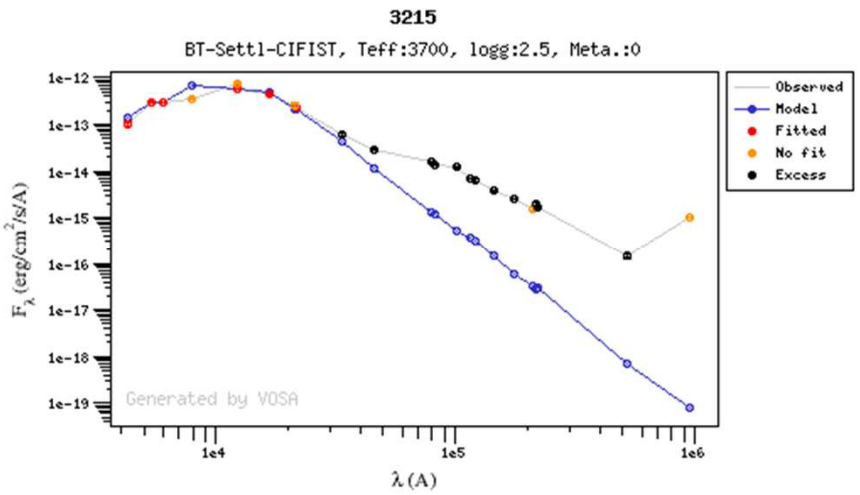


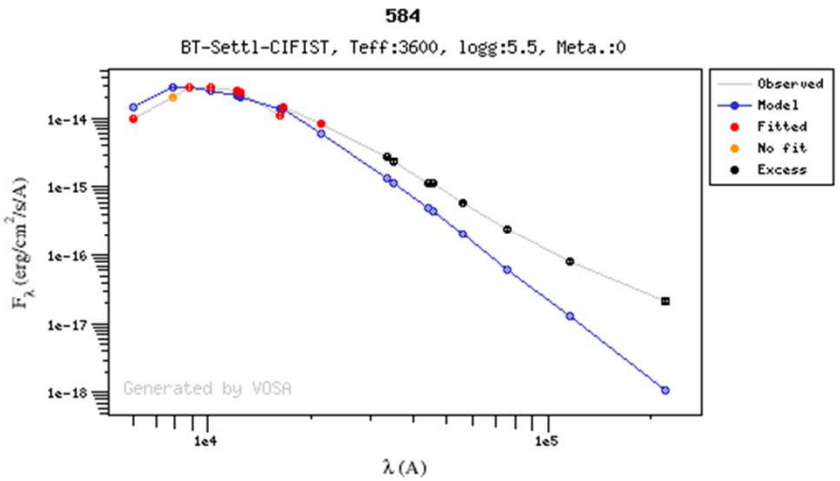
Debris discs around late stars

Preliminary results

3. Obtain stellar parameters (T_{eff}, F_{bol}, ….)

- BT-Settl atmosphere model fitting



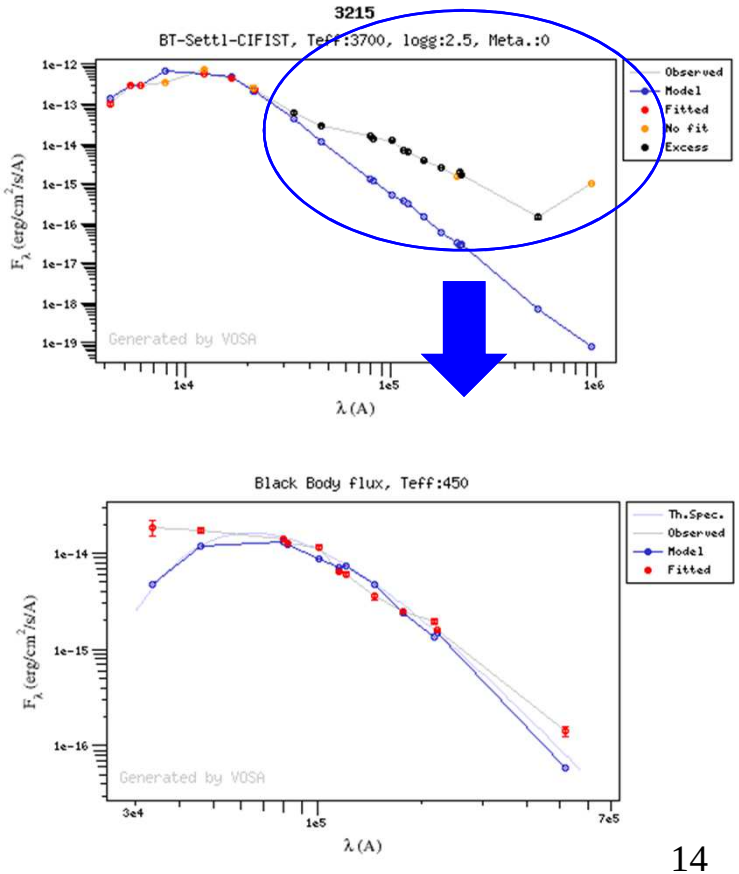


Debris discs around late stars

Preliminary results

4. Obtain F_{disc} from black body fitting

- Subtract atmospheric model fluxes from observed fluxes for points with excess
- Fit the subtracted photometry with a BB, obtaining T_{BB} and F_{disk}



Summary

- We have defined and validated a workflow
- We have detected 244 X-ray sources with IR-excess
  - Most of them are unknown
  - Several debris disc candidates.

Thanks