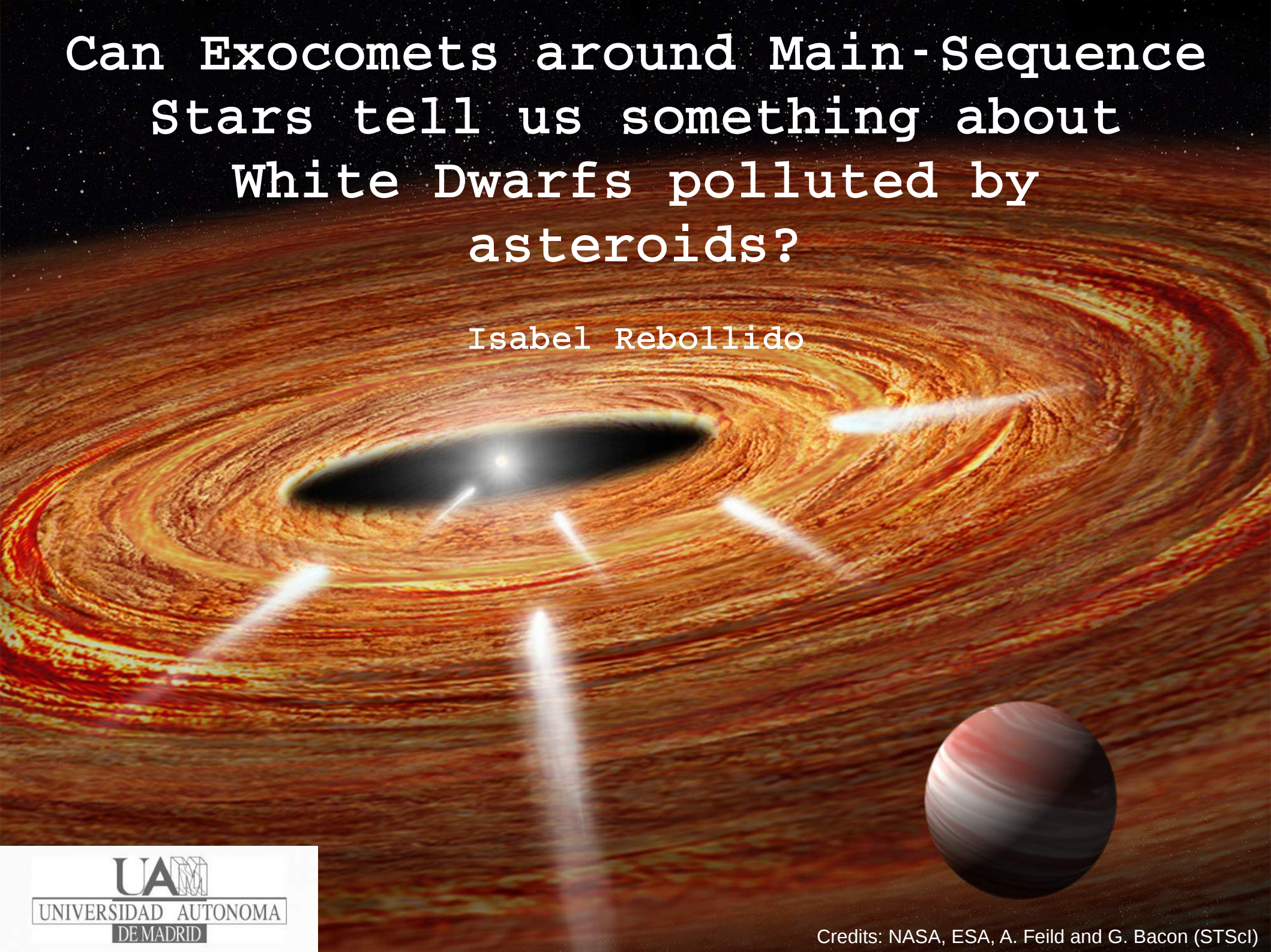
Can Exocomets around Main-Sequence Stars tell us something about White Dwarfs polluted by asteroids?

Isabel Rebollido



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Credits: NASA, ESA, A. Feild and G. Bacon (STScI)

Outline

(a) Exocomets: An Overview

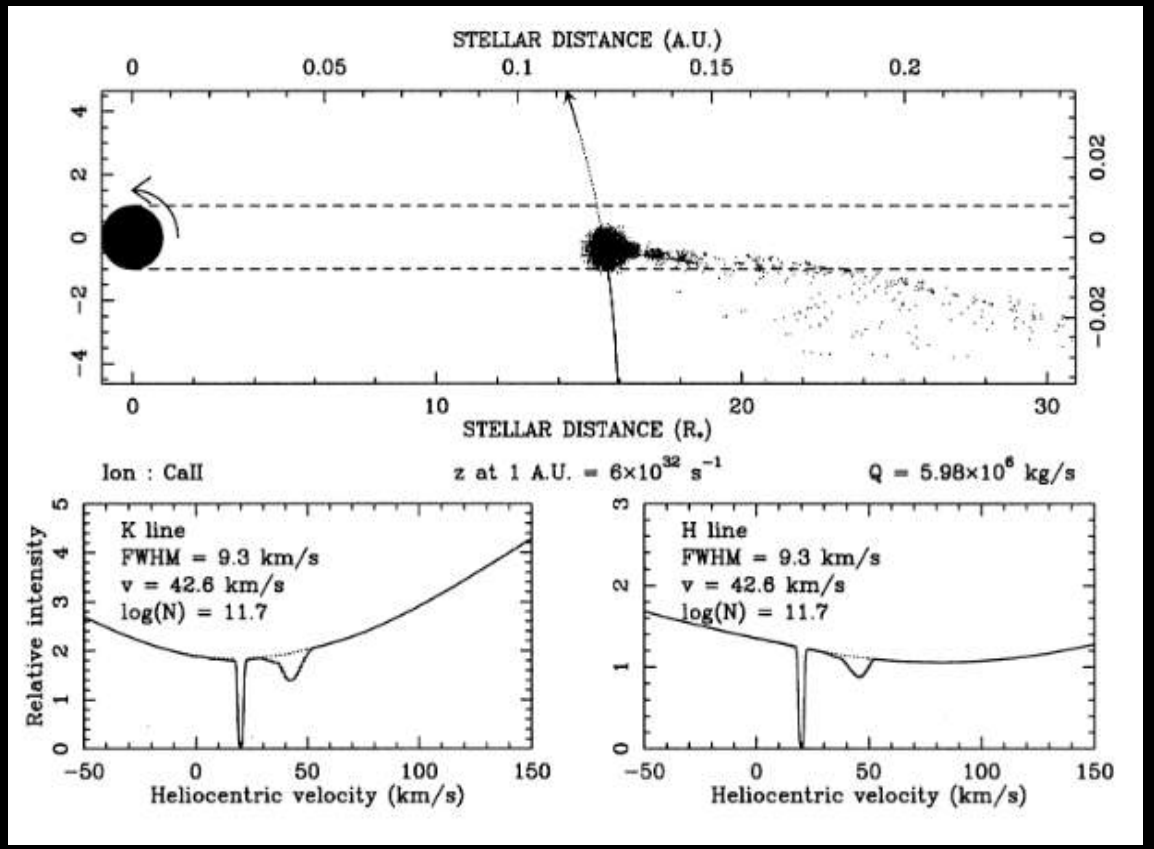
(b) Our Survey

(c) Main Sequence-White Dwarf connection

Exocomets: An Overview

Exocomets: An Overview

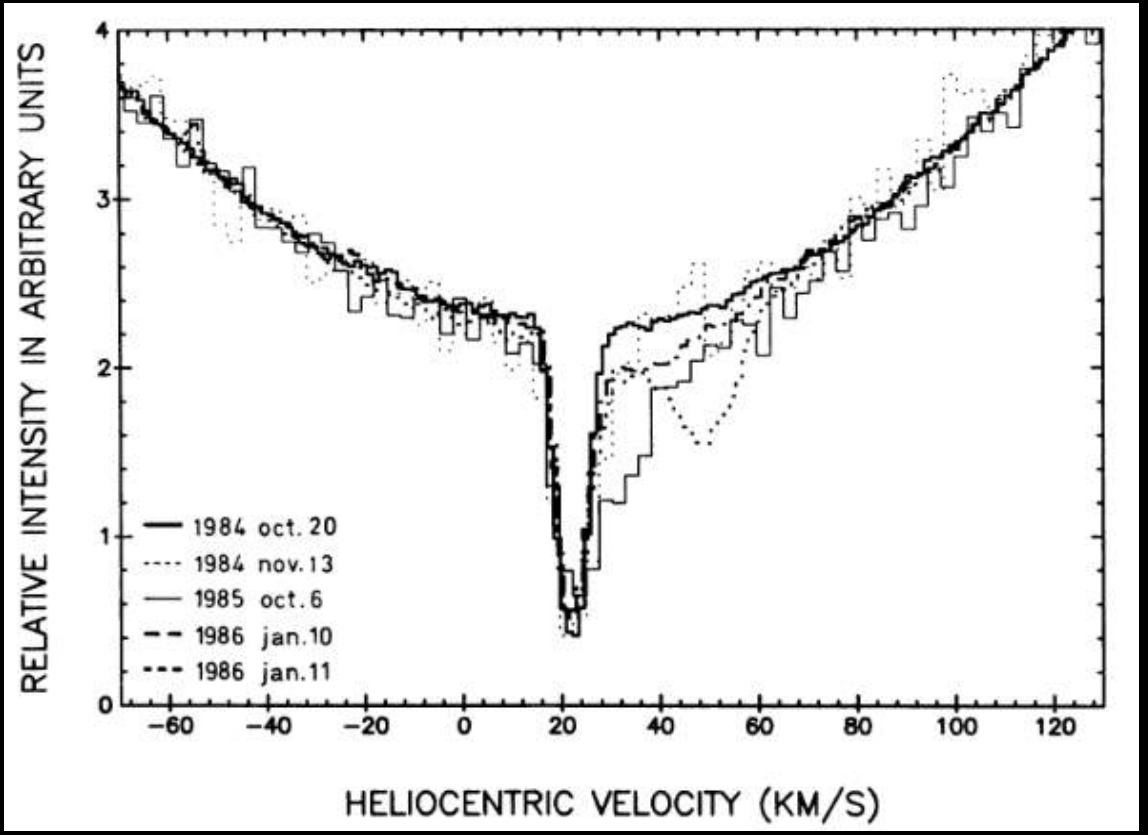
- Detectable when the coma of a comet passes in front of a star
- A doppler-shifted absorption appears in volatile element lines (Ca II, NaI, Mg II...)



Beust et al. (1998)

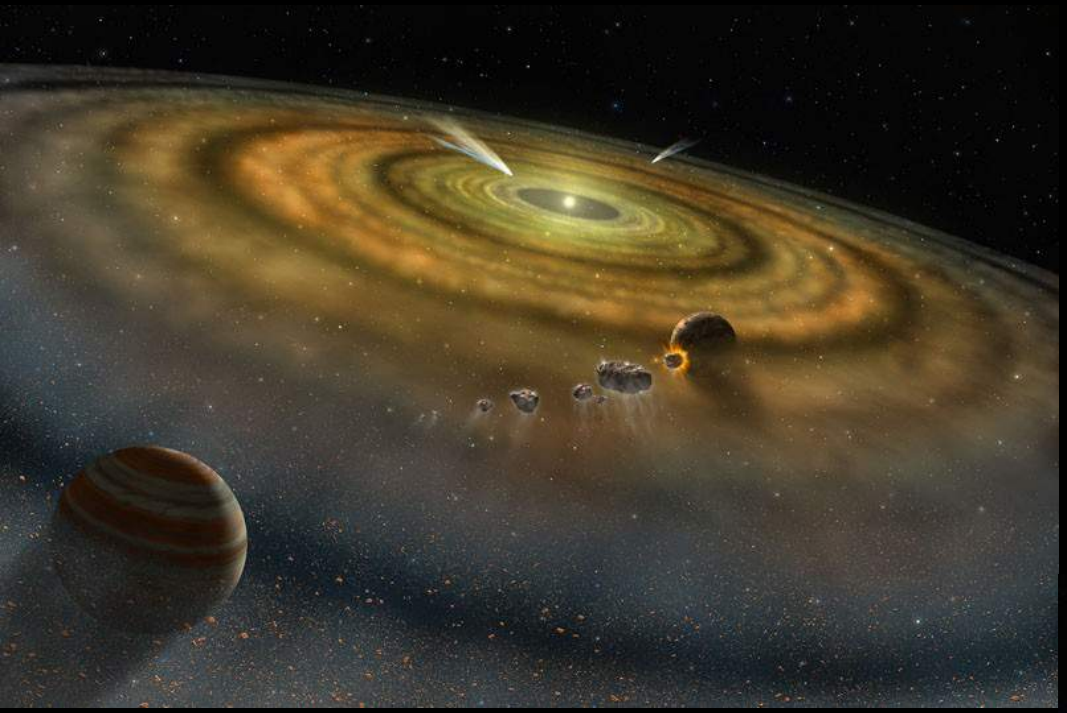
Exocomets: An Overview

- First detection of an exocometary-like event by Ferlet et al. (1987) in **β-Pictoris**
- Absorptions vary in depth and velocity as the exocometary event evolves



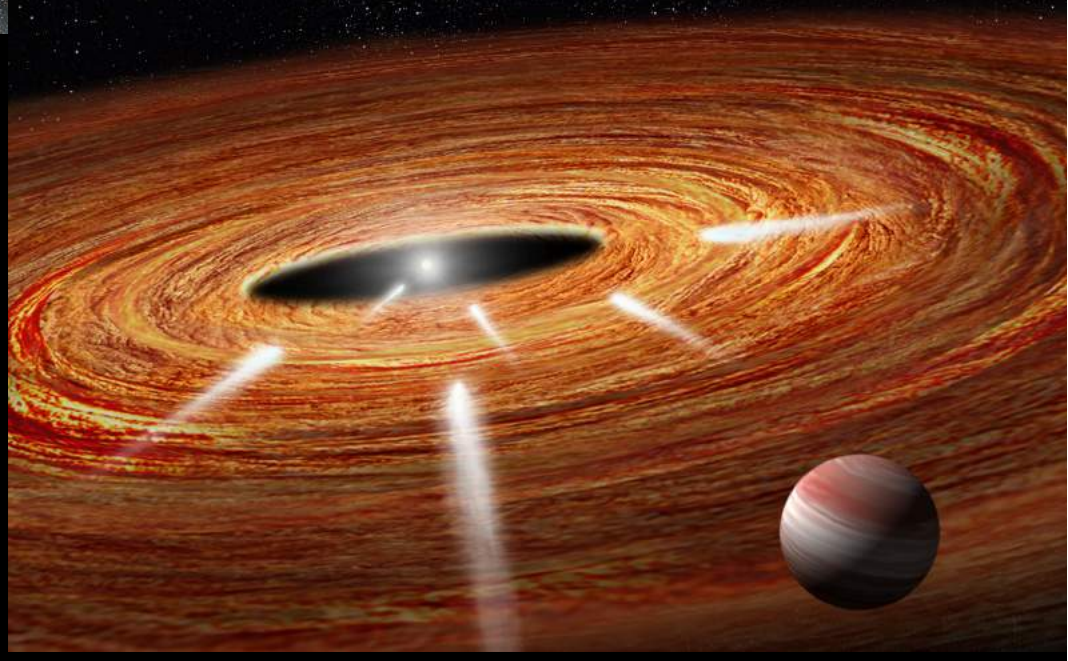
Ferlet et al. (1987)

Exocomets: An Overview



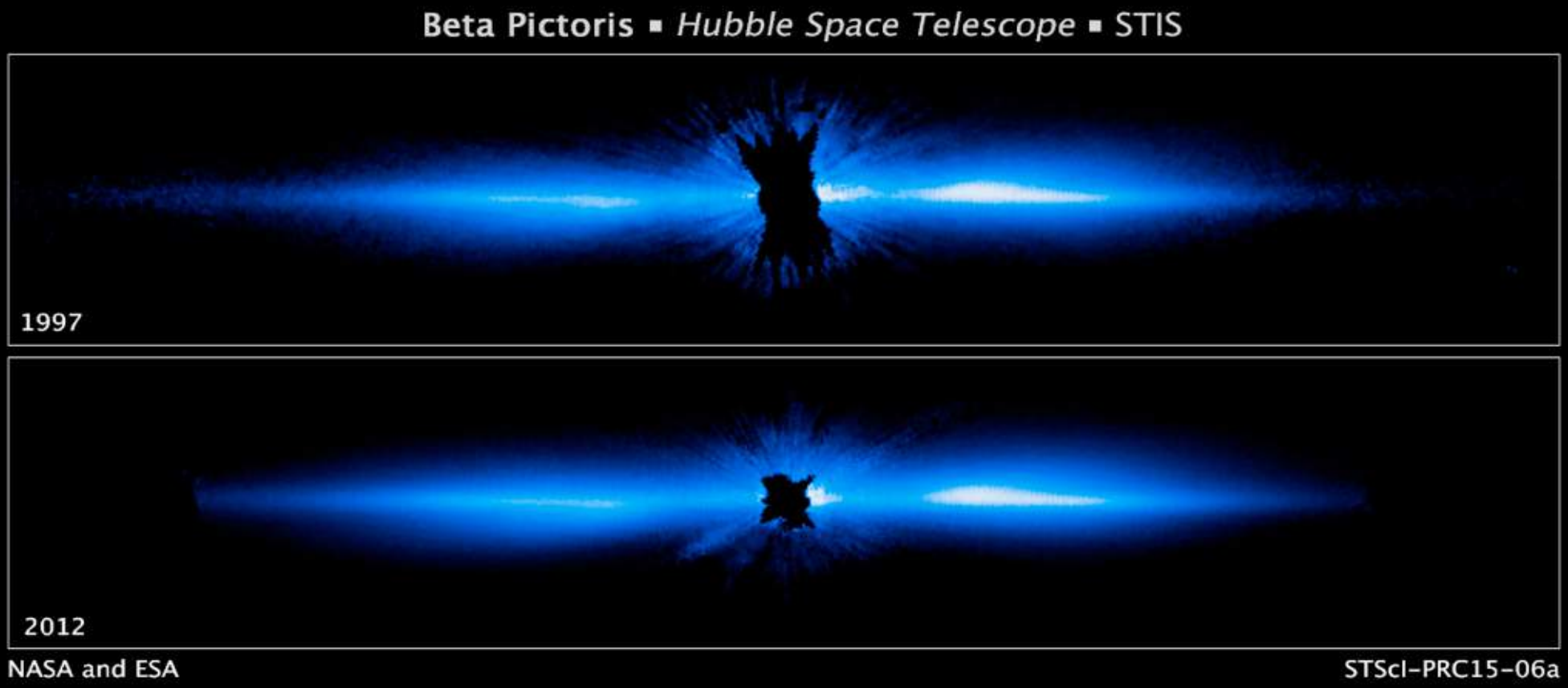
Credit: NASA/FUSE, Lynette Cook

Credit: NASA, ESA, A. Feild and G. Bacon

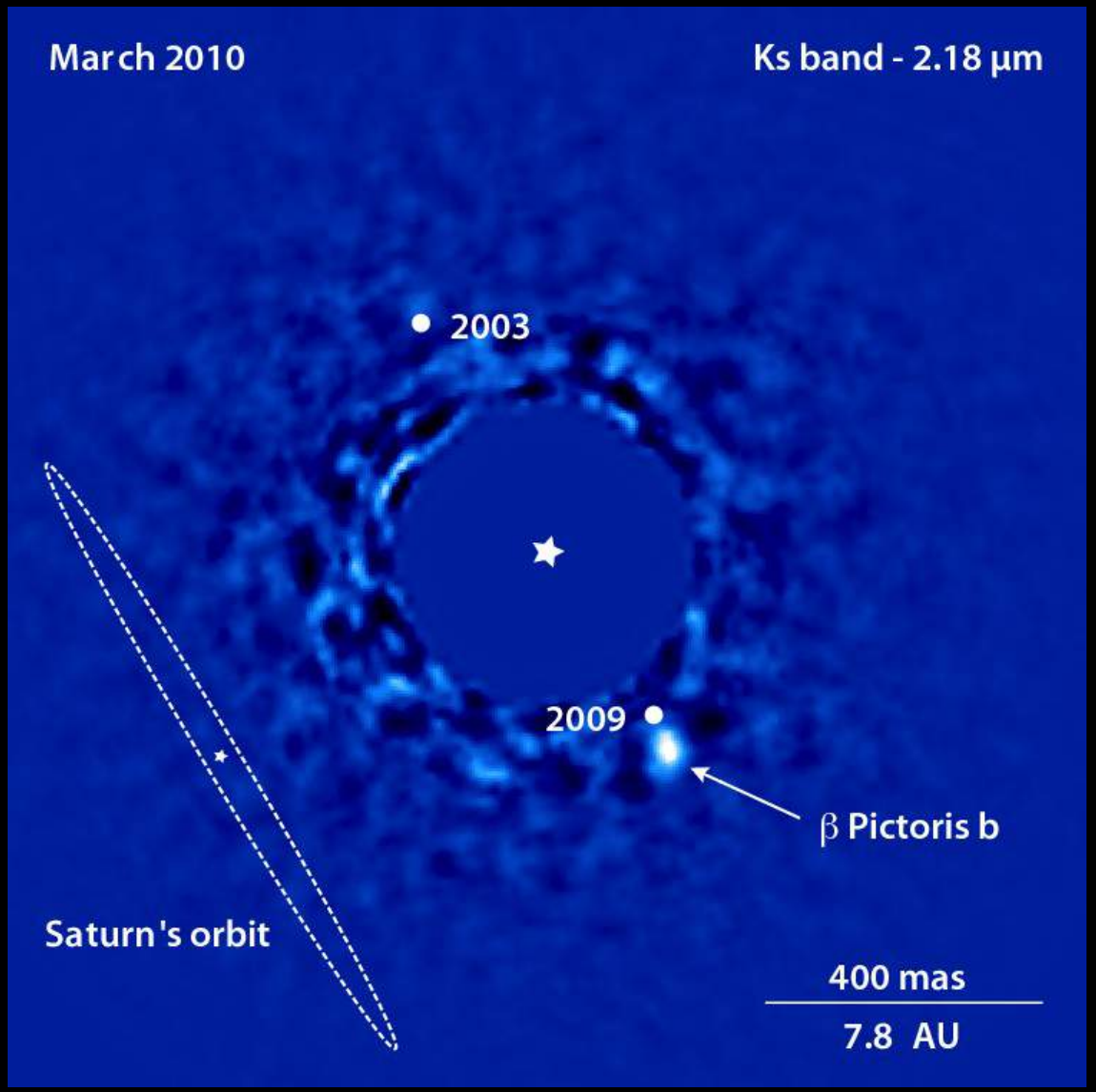


Exocomets: An Overview

- Up to date, ~ 15 stars are known to have exocomets
- All of them are A-Type stars
- β-Pic is the best studied exocomet-host star



Exocomets: An Overview



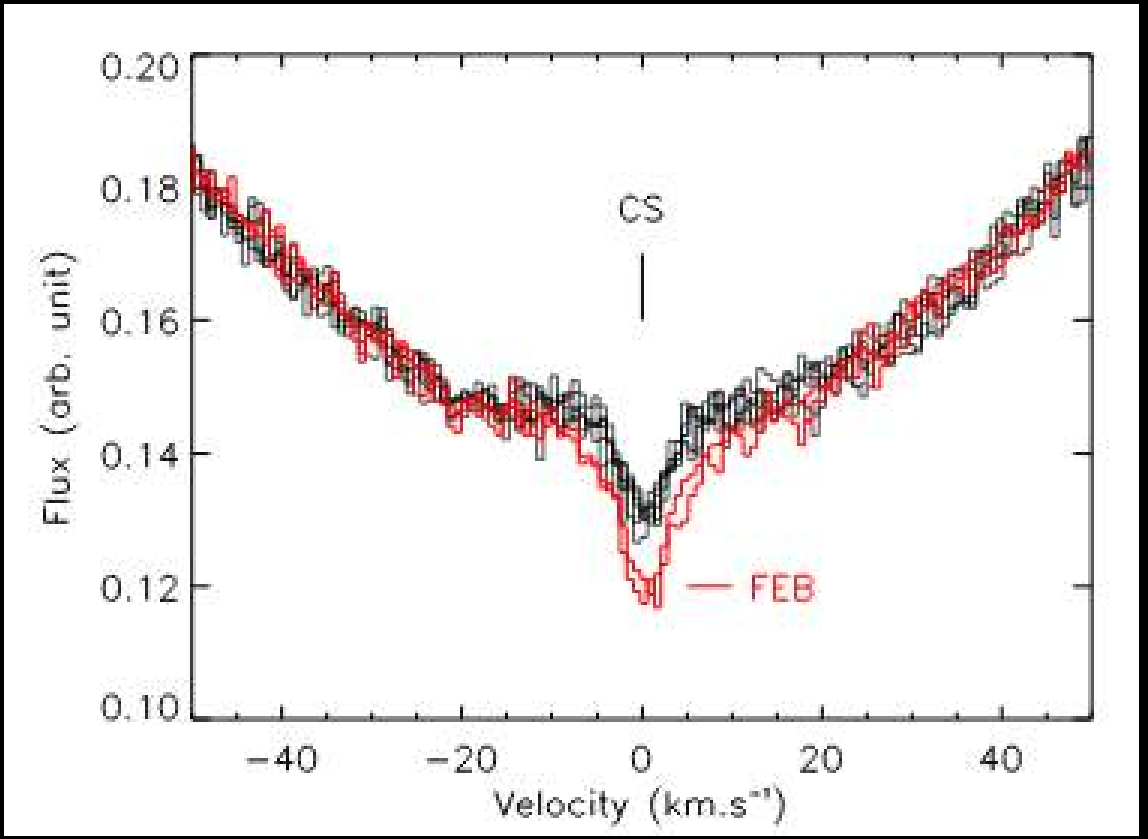
Bonnefoy et al. (2011)

Our Survey

Our Survey: Sample

We selected stars with different criteria:

- ***Previously reported FEBs*** *(Falling Evaporating Bodies)*

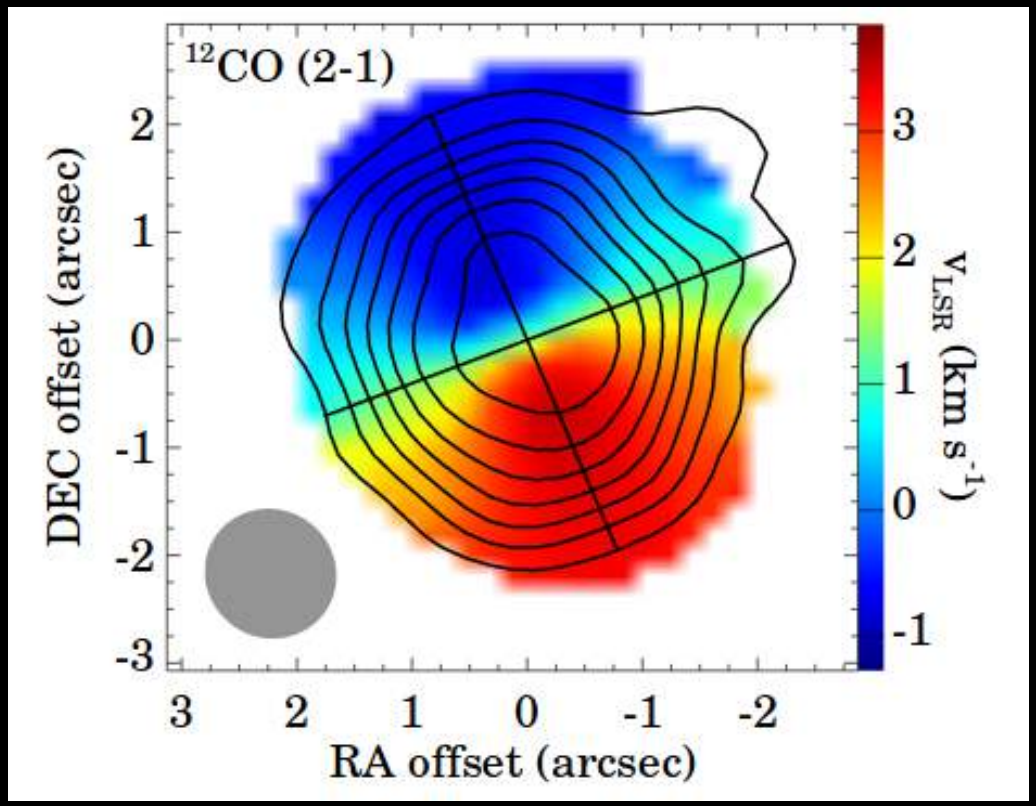


Kiefer et al. (2014)

Our Survey: Sample

We selected stars with different criteria:

- ***Previously detected gas in debris discs***: FIR to mm

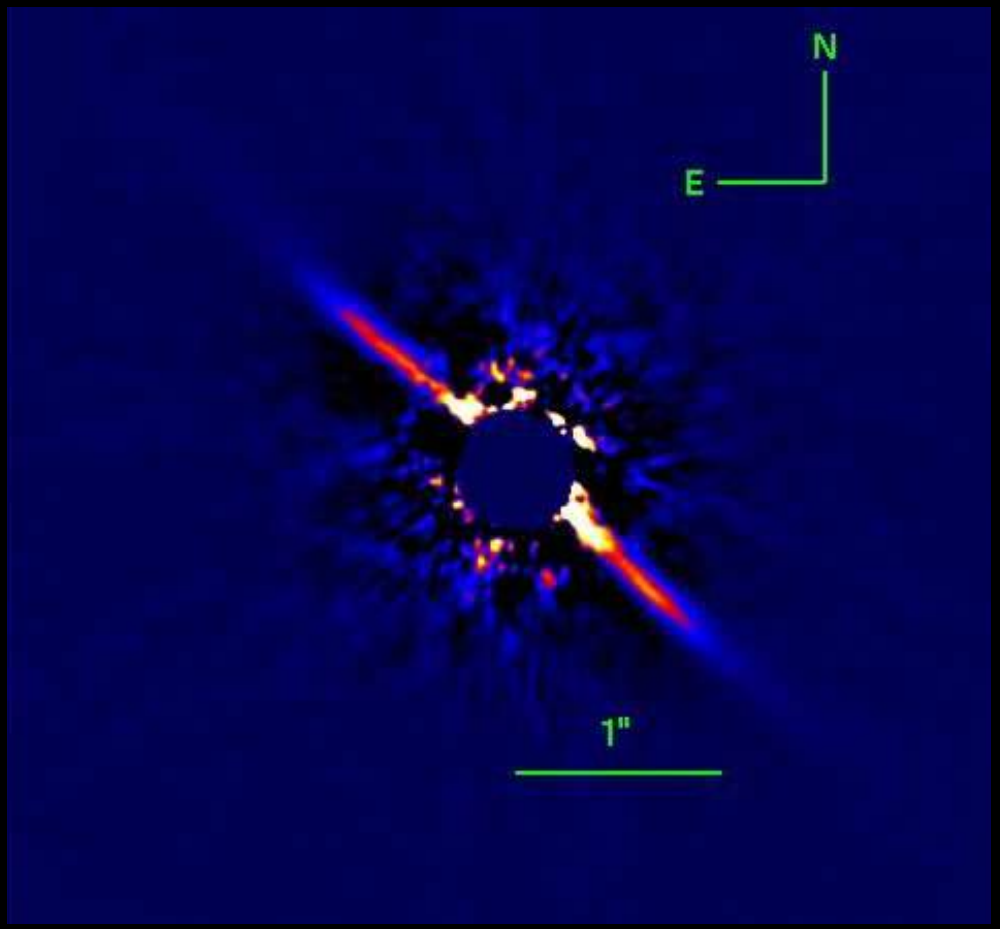


Kospal et al. (2013)

Our Survey: Sample

We selected stars with different criteria:

- ***Edge on debris discs***: favourable orientation

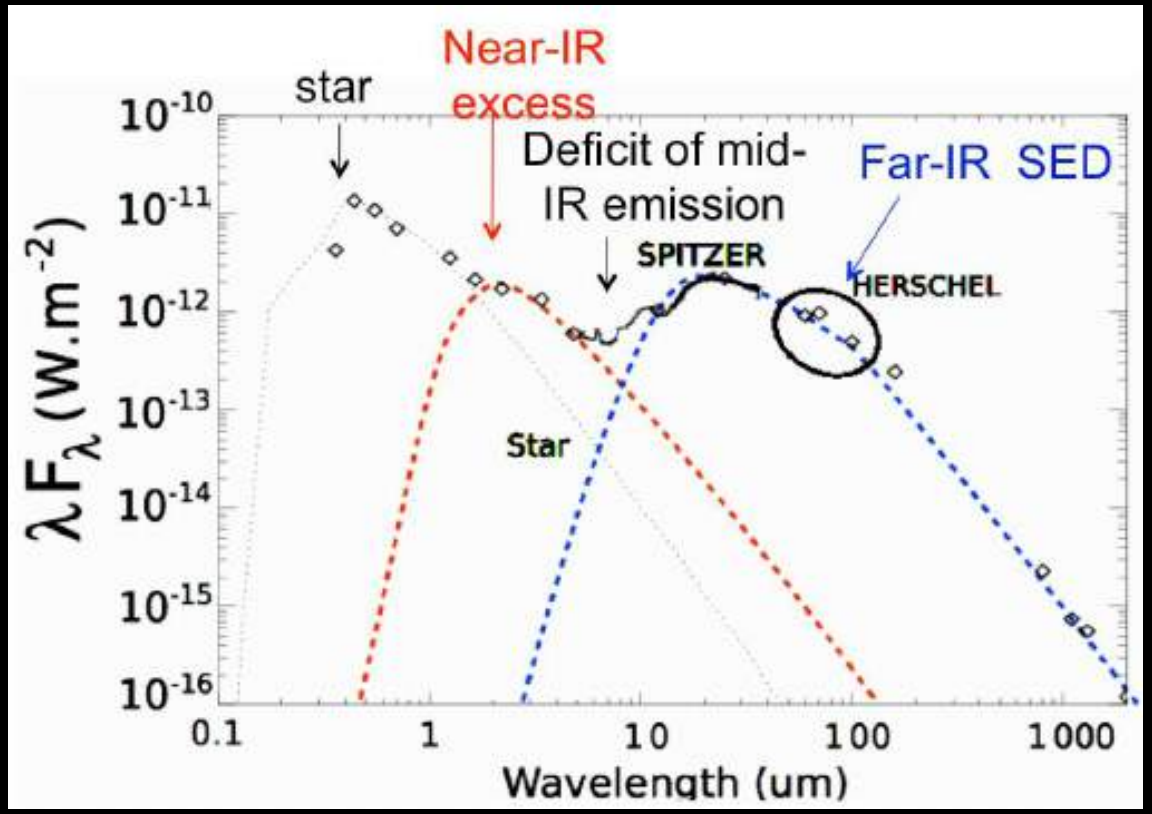


Thayne et al. (2012)

Our Survey: Sample

We selected stars with different criteria:

- ***Presence of H/K excesses***: related to hot dust

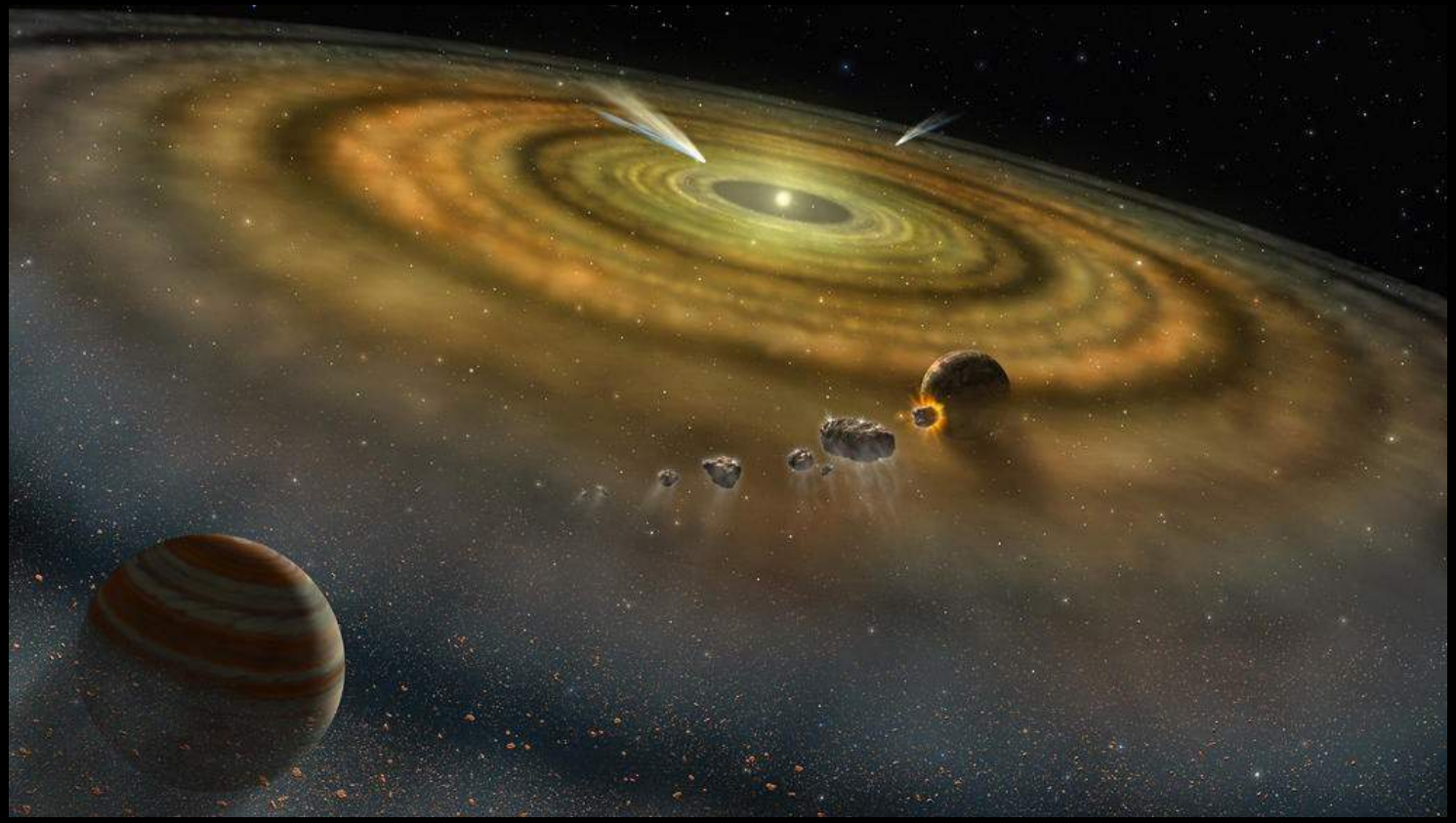


Labadie et al. (2014)

Our Survey: Sample

We selected stars with different criteria:

- ***Young discs***: ongoing interactions between planetesimals



Credit: NASA/FUSE, Lynette Cook

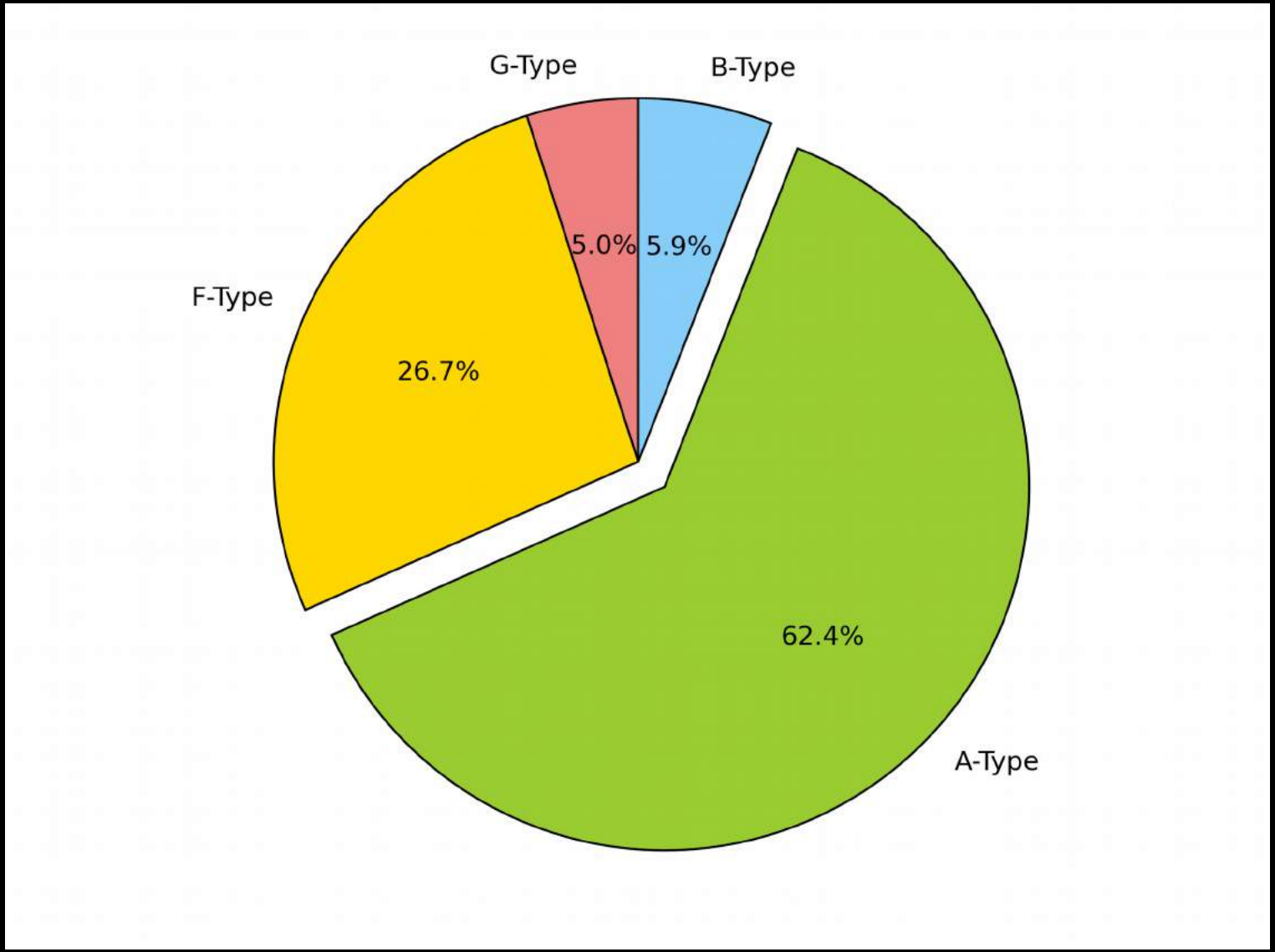
Our Survey: Sample

We selected stars with different criteria:

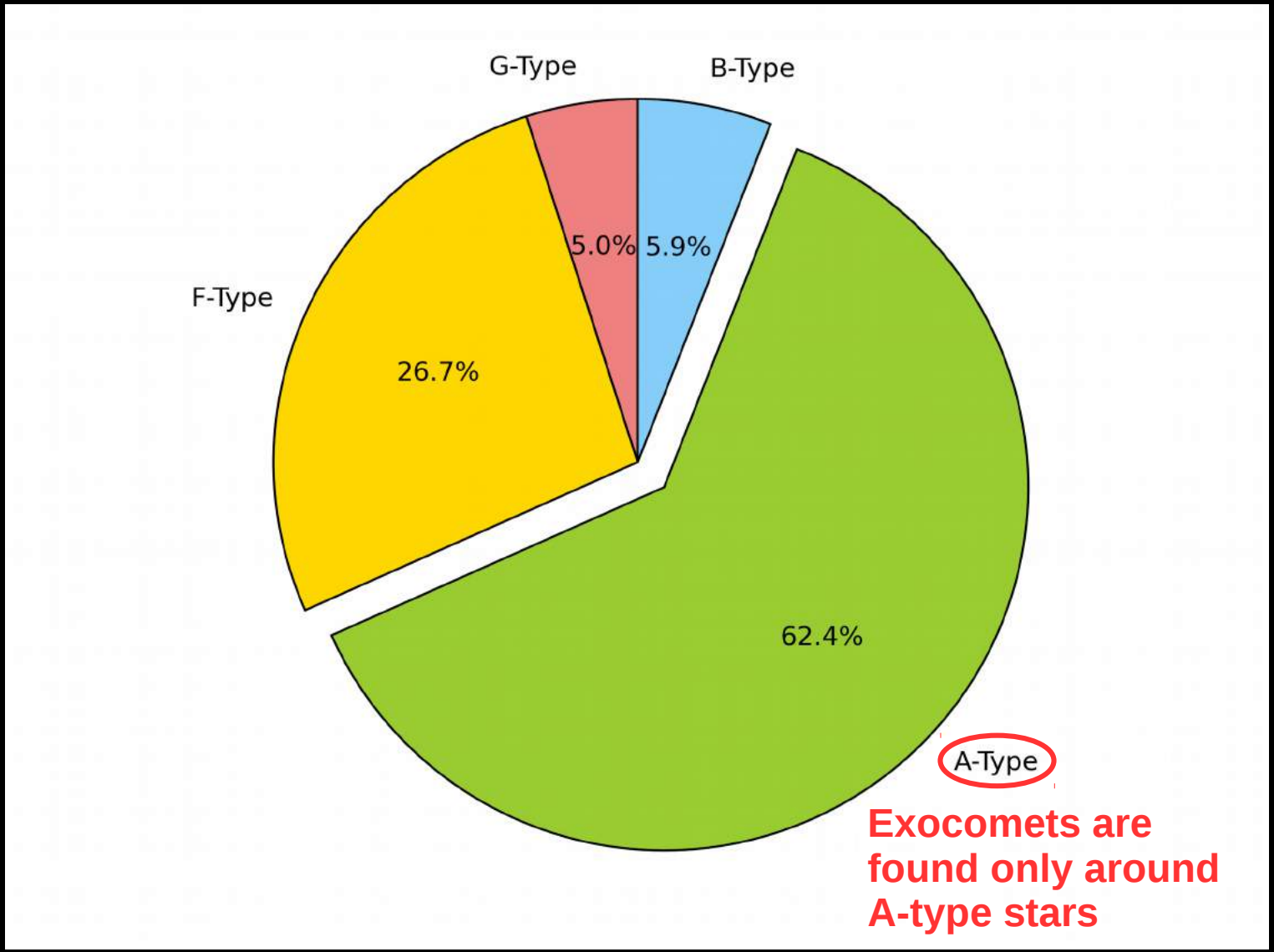
- ***Previously reported FEBs***
- ***Previously detected gas***: FIR and radio
- ***Edge on debris discs***: favouring the vision line
- ***Presence of H/K excesses***: related to hot dust
- ***Young discs***: high levels of solids interactions

~ 100 stars

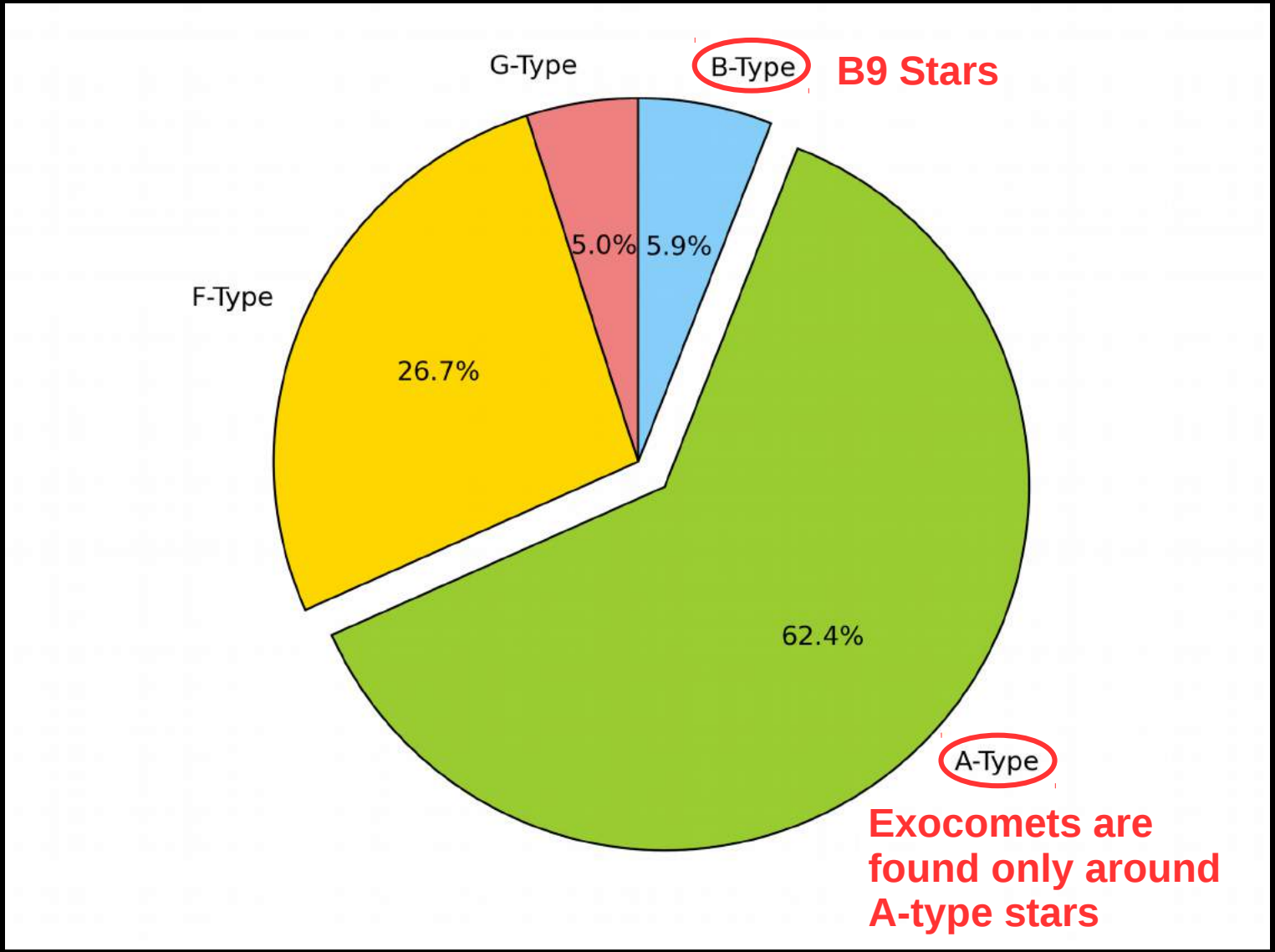
Our Survey: Sample



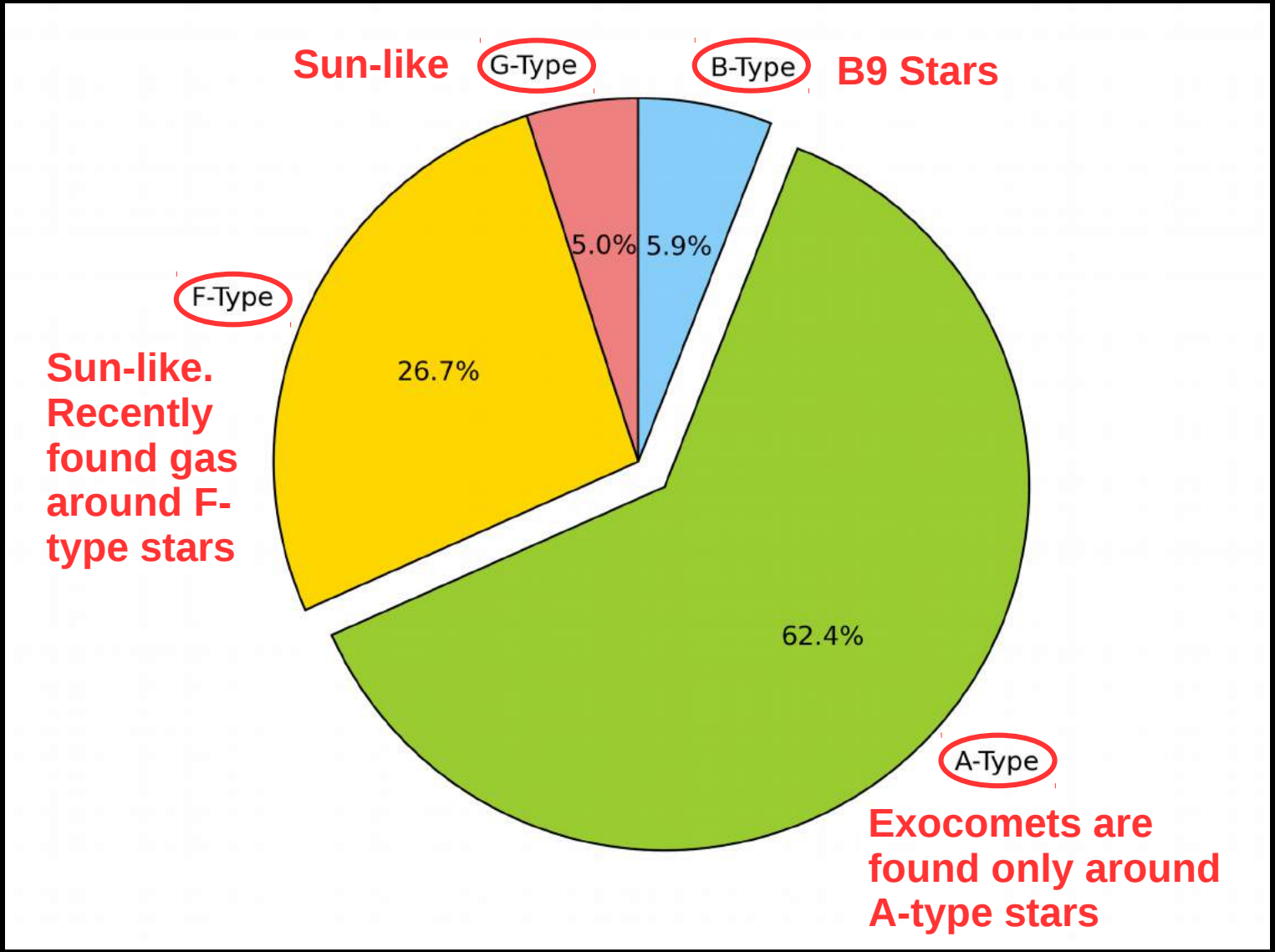
Our Survey: Sample



Our Survey: Sample

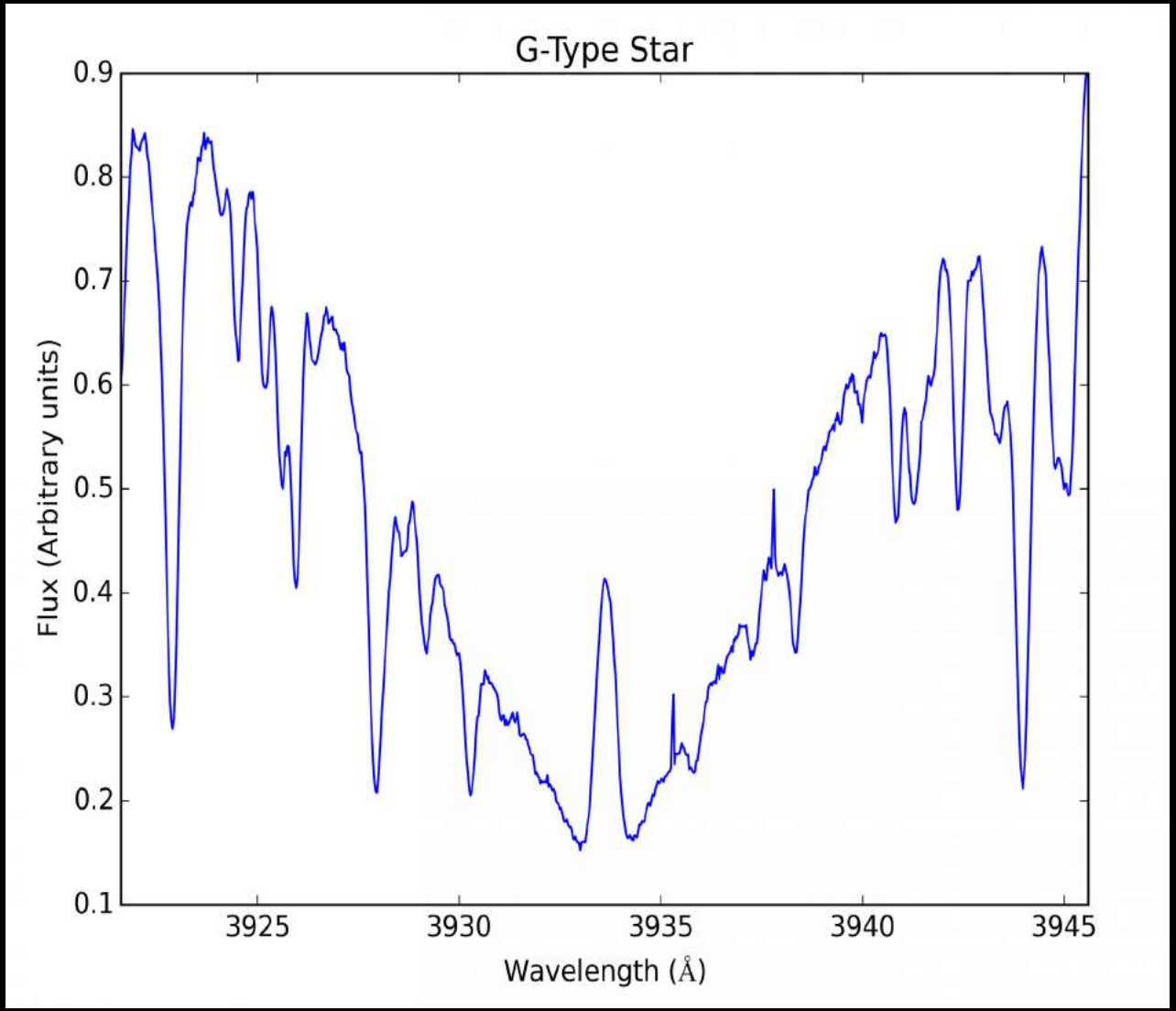


Our Survey: Sample



Our Survey: Sample

Chromospheric emission hinders exocometary detections



Our Survey: Data

We observed ***~100*** stars obtaining over ***1200*** high resolution spectra

24 Nights
655 spectra

6 Nights
207 spectra

8 Nights
244 spectra

Service mode
64 spectra

Our Survey: Data

We observed ***~100*** stars obtaining over ***1200*** high resolution spectra

24 Nights
655 spectra

6 Nights
207 spectra

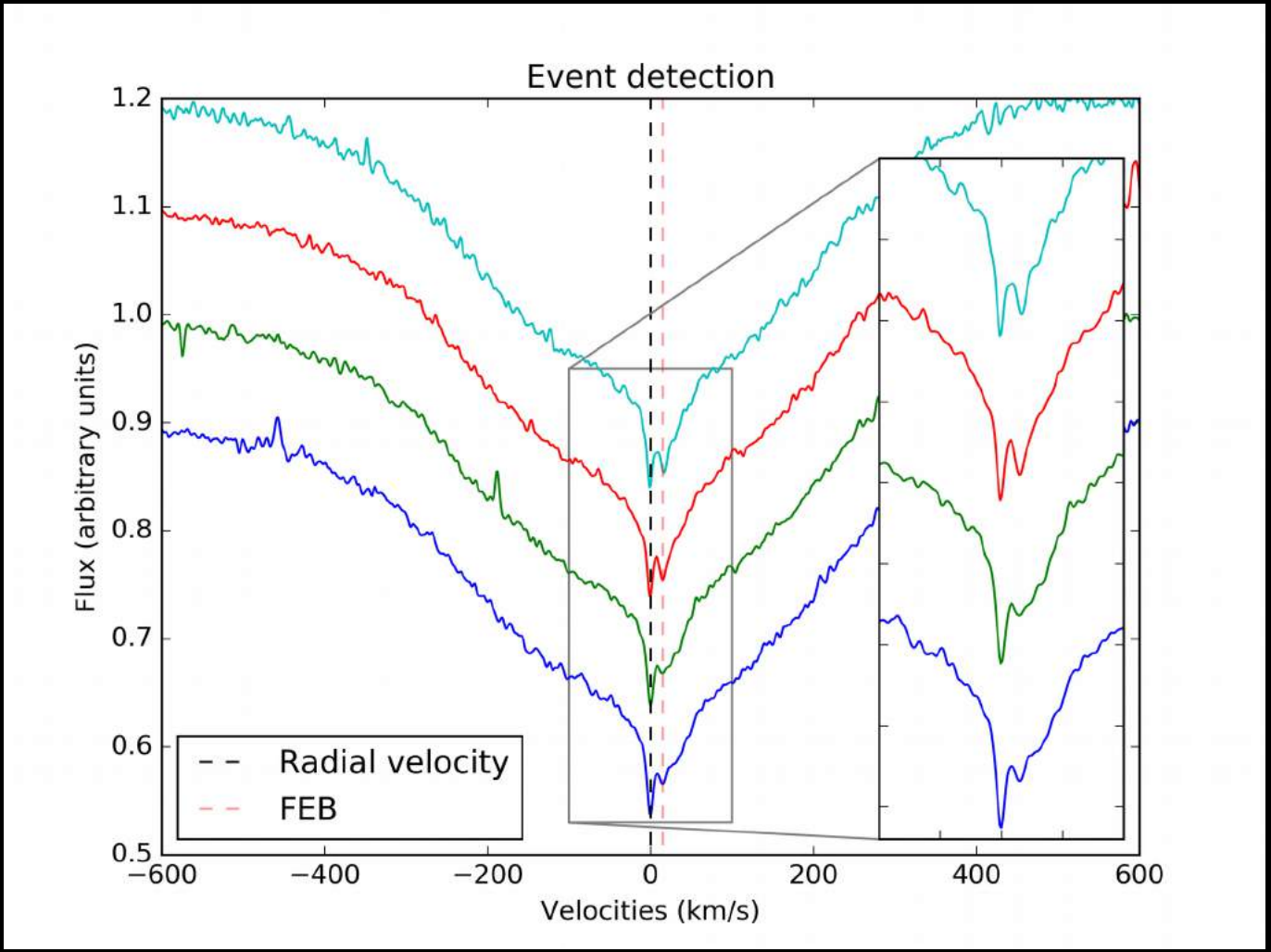
Observations Ongoing

8 Nights
244 spectra

Service mode
64 spectra

Our Survey: Time variability

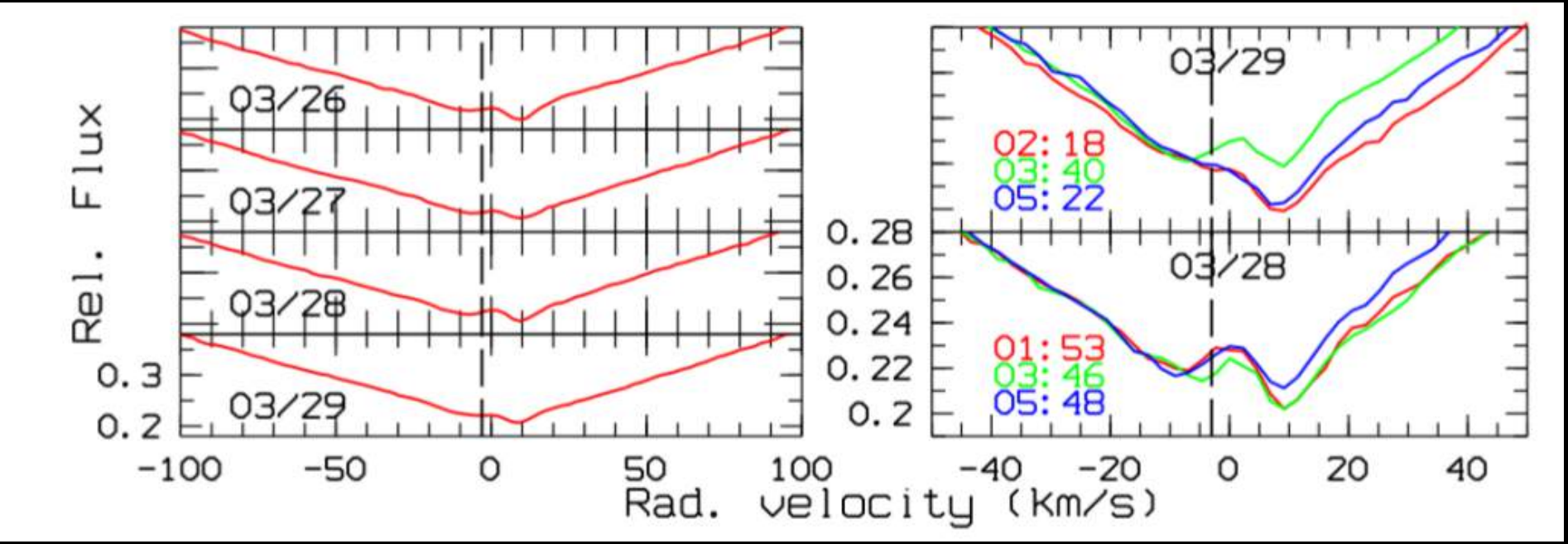
Constructing a time series of spectra per star allows us to detect variability



Our Survey: Results

The most important result so far is the exocometary events detected in Φ Leo

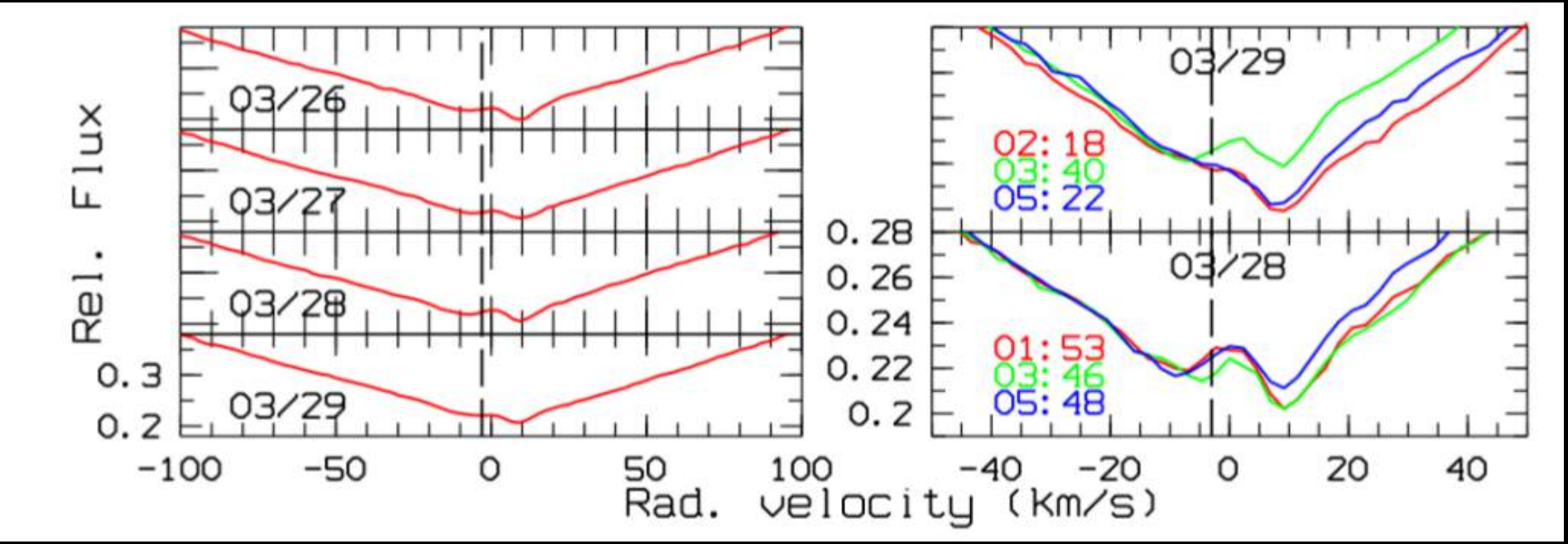
It's only second to **β-Pic** in amount of events detected, with a wide range of time variations.



(Eiroa, Rebollido et al. 2016)

Our Survey: Results

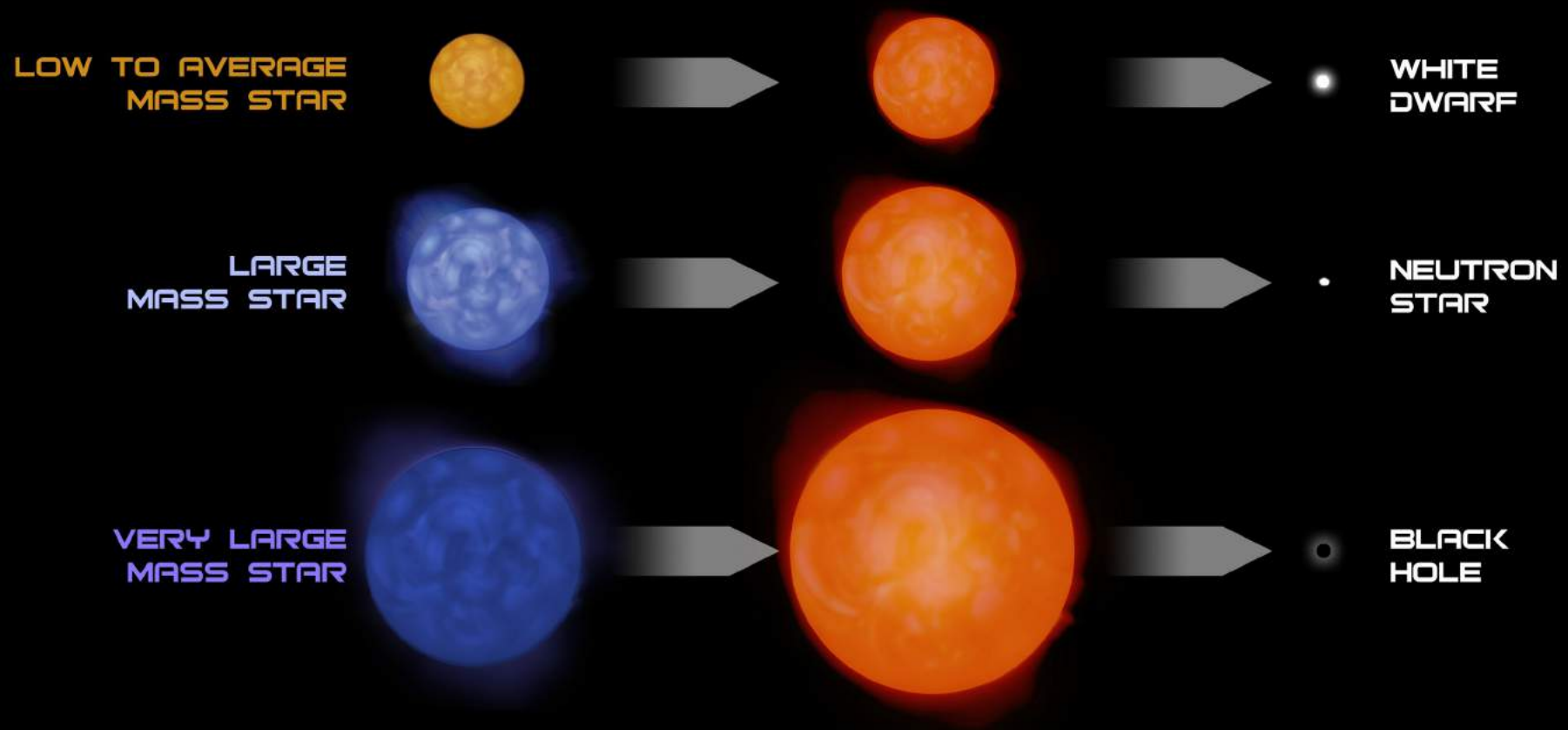
- Older than β-Pic (~20Myr against ~500-900 Myr)
- High frequency of events in different timescales
- Is there a planet?



(Eiroa, Rebollido et al. 2016)

Main Sequence-White Dwarf connection

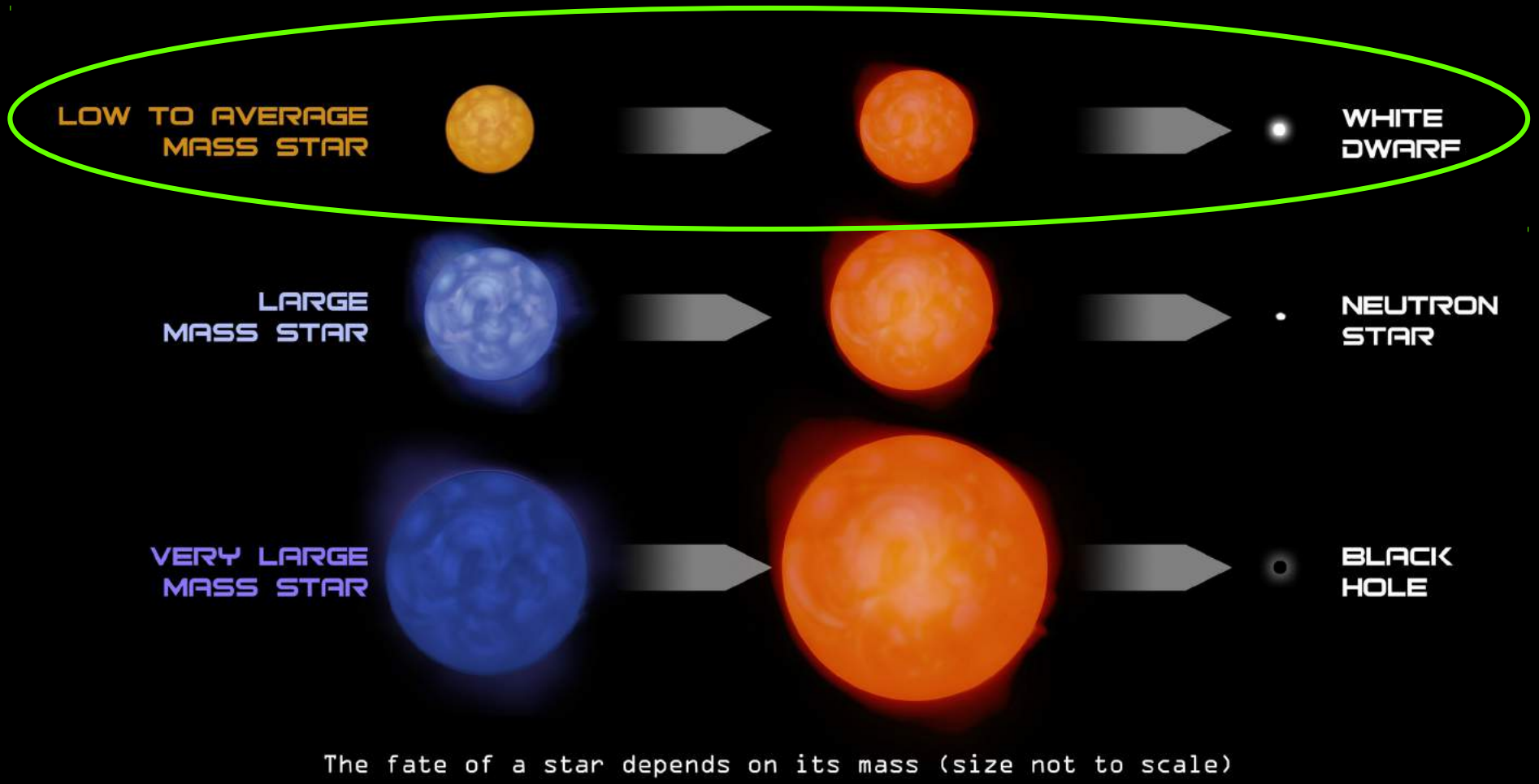
White Dwarfs: Stellar Evolution



The fate of a star depends on its mass (size not to scale)

Credit: NASA/CXC/M.Weiss

White Dwarfs: Stellar Evolution



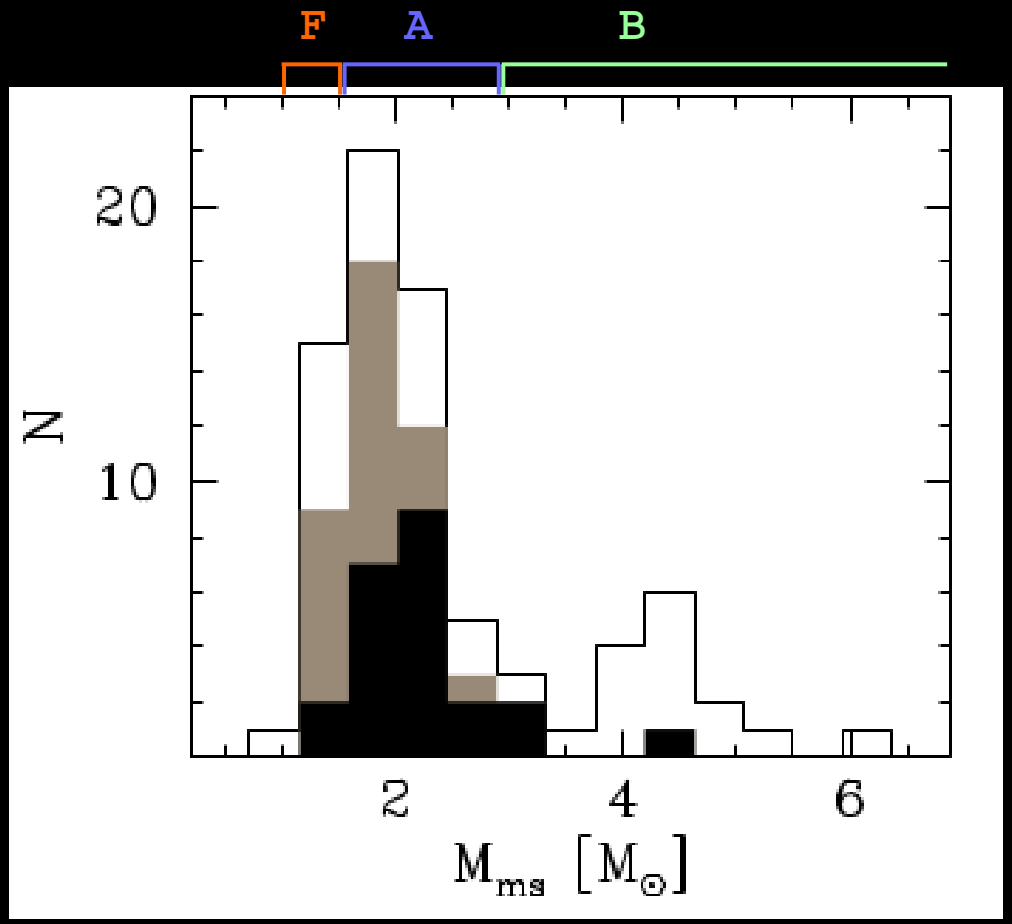
Credit: NASA/CXC/M.Weiss

White Dwarfs: Pollution

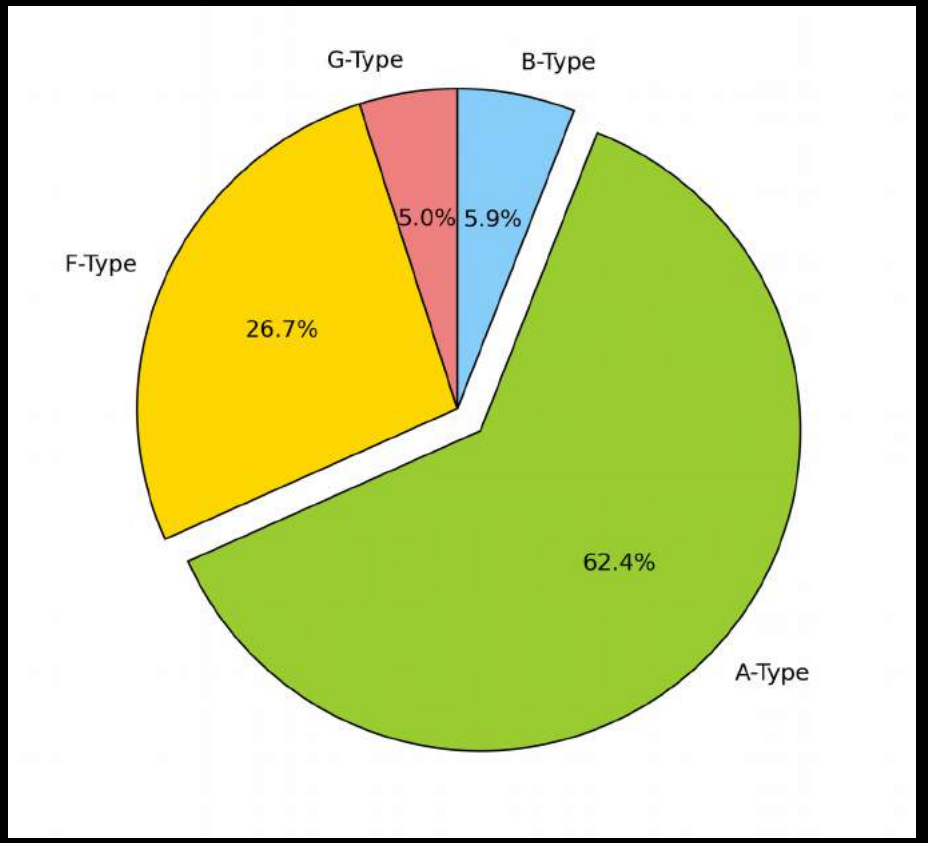
- Small traces of metals are found where they can only be supplied by an external source
- Koester et al. (2014) find 50% of their sample show traces of pollution

Credit: CfA/Mark A. Garlick

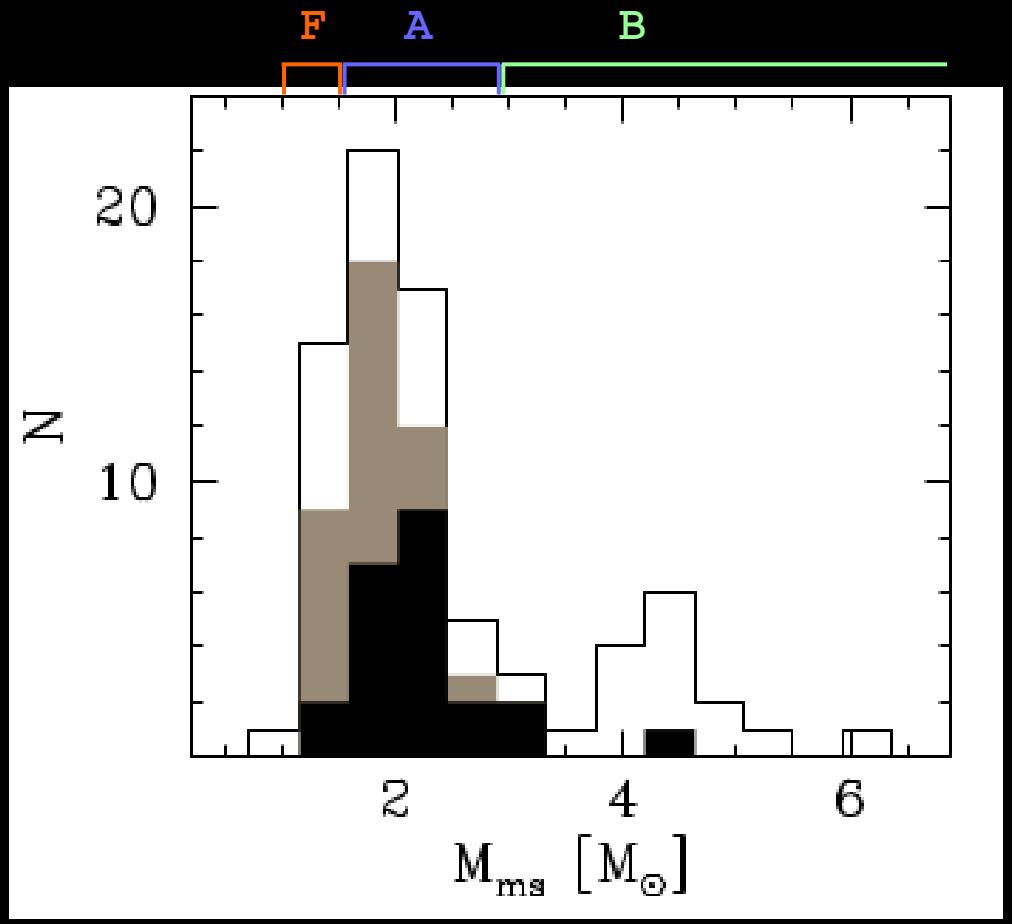
White Dwarfs: Pollution

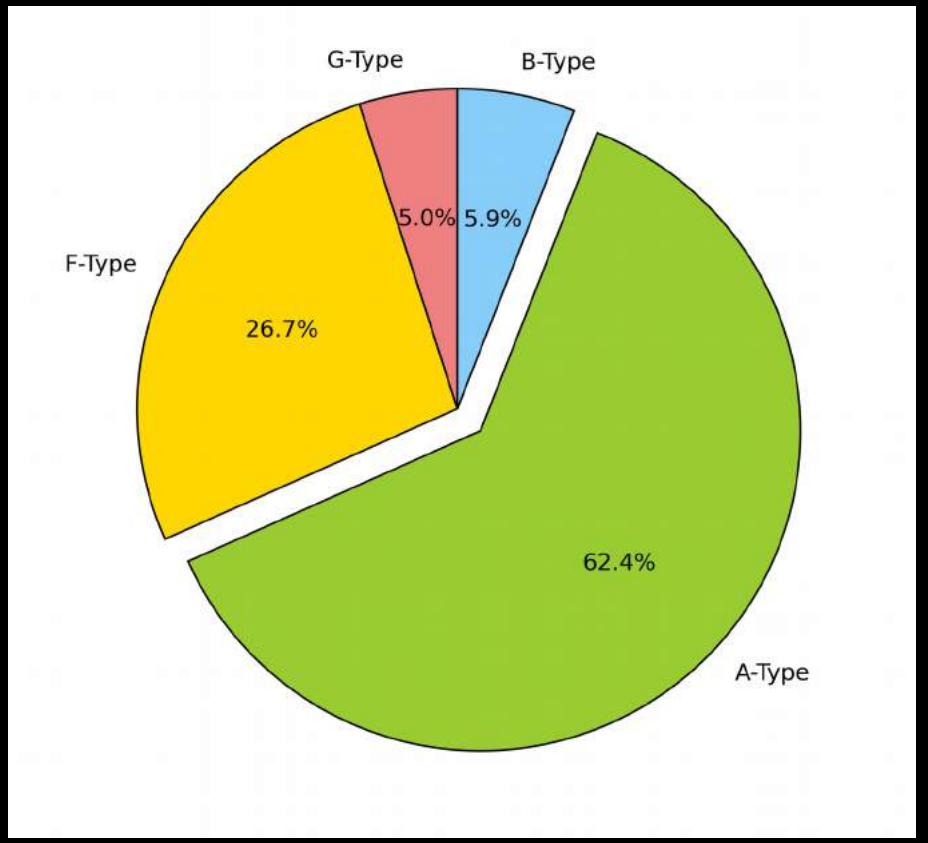


Koester et al. 2014



White Dwarfs: Pollution





Koester et al. 2014

Raul Maldonado's talk, Tuesday 17:00

Summary

Summary

- Strong observational bias in our sample. Evidence for accretion in A-type stars
- Most of the polluted WD have progenitors of ~$2M_{Sun}$

Is there a connection?

MS → WD

Our accreting stars could represent early evolutionary stages of polluted White Dwarfs