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Highlights of the NGC 2264 Observations

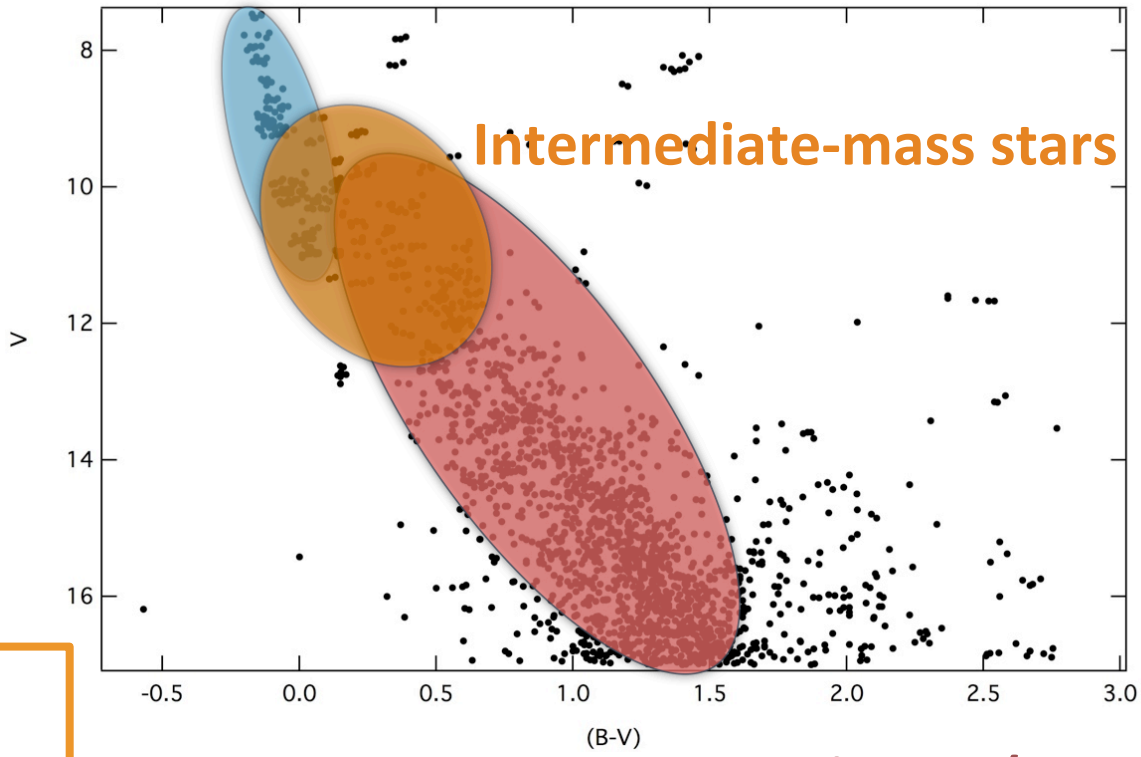
2008 (SRa01) & "*CSI2264*" in 2011/12 (SRa05)

K. Zwintz (KU Leuven) &
the CSI2264 Team

The young cluster NGC 2264

- age: 3 - 8 Myr
- d = 760 ± 80pc (Sung et al. 1997)
- > 2000 members
- numerous studies in all wavelengths

Massive O & B stars (MS)



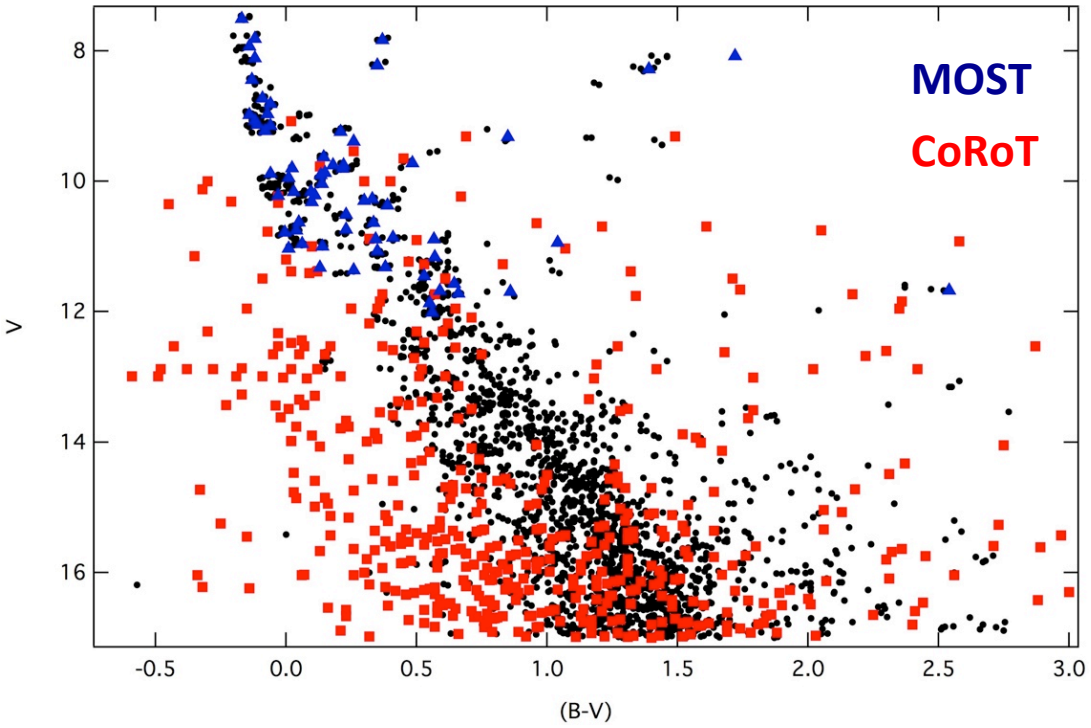
Low-mass T Tauri stars (PMS)

Early stellar evolution & Time Domain Phenomena: a niche for CoRoT

Data taken from the WEBDA database

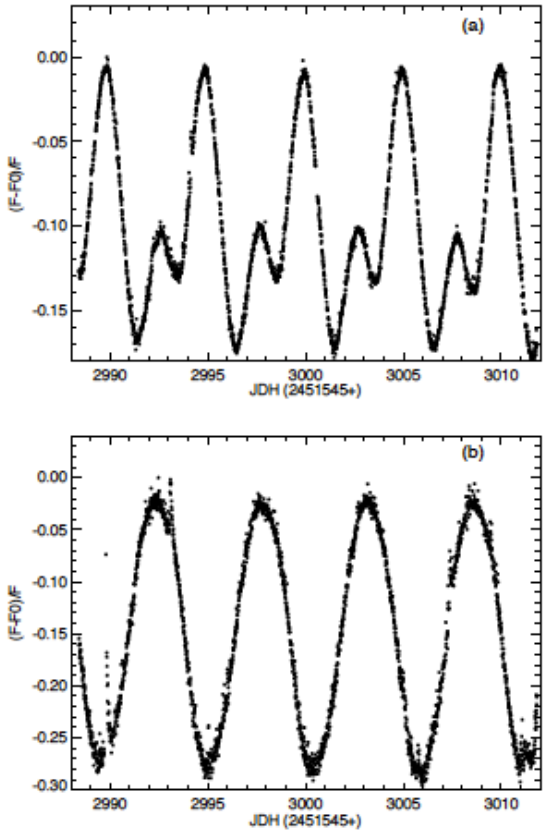
CoRoT & NGC 2264 in 2008

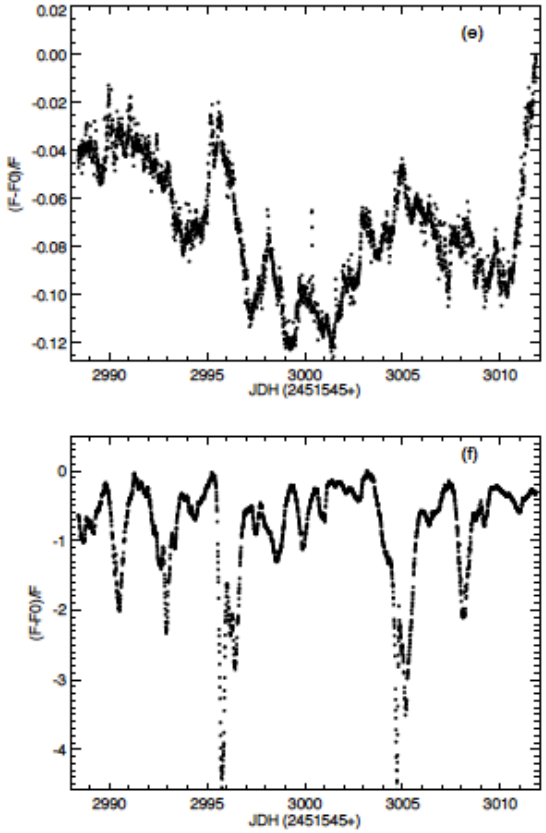
- 4 subteams (PI: F. Favata)
  - **Interaction of YSOs with their circumstellar matter** (S. Alencar)
  - Rotation & Activity (G. Micela)
  - Stellar & Planetary Transits (S. Aigrain)
  - **Asteroseismology** (K. Zwintz)
- SRa01: 23.4 days
- 636 stars observed



Highlights from 2008 - YSOs

Alencar et al. (2010)





28 spot-like

- sinusoidal-like
- stable shape

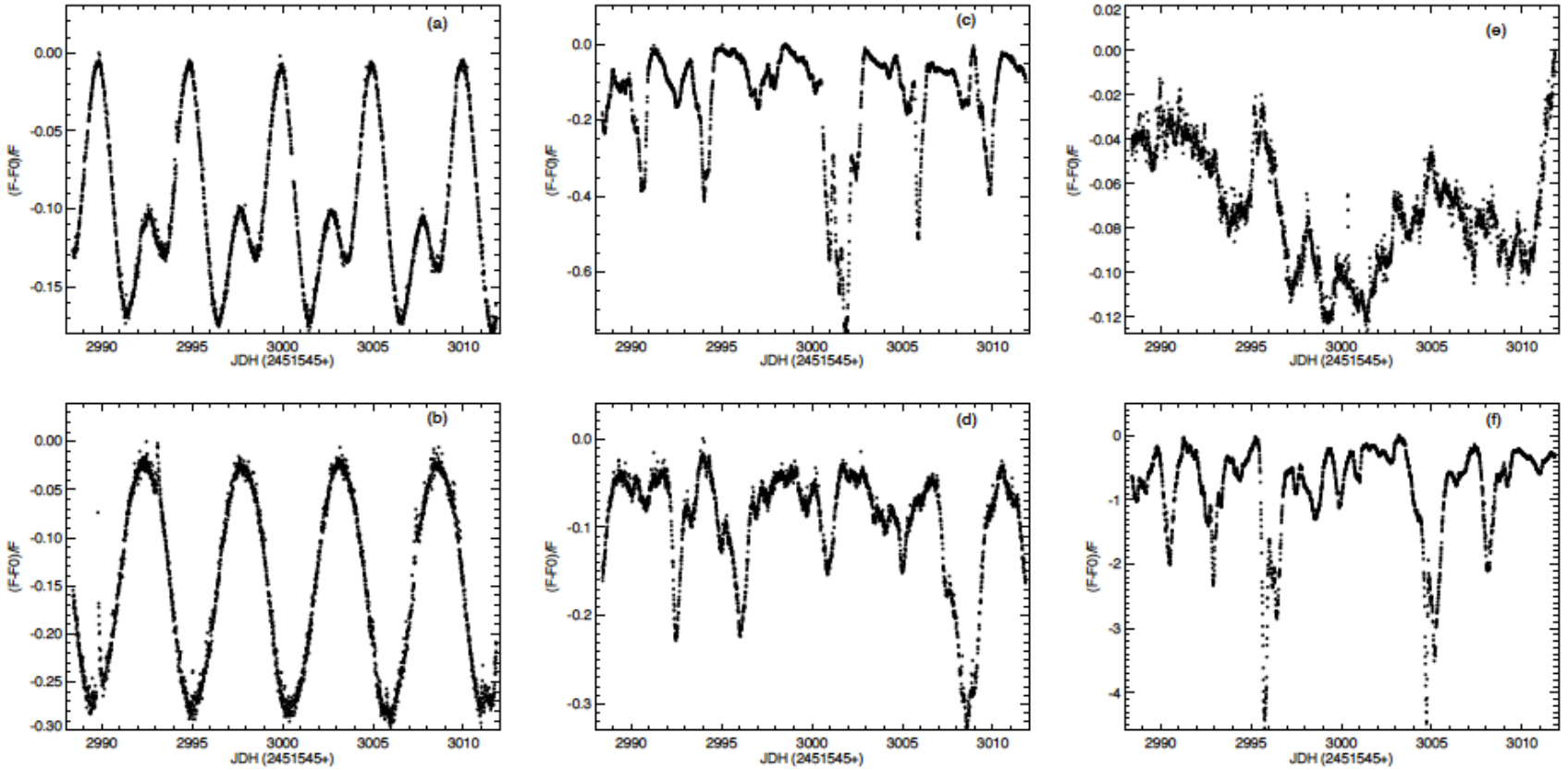
32 irregular

- obscuration
- non-steady accretion

Highlights from 2008 - YSOs

Alencar et al. (2010)

NEW CLASS



28 spot-like

- sinusoidal-like
- stable shape

23 AA Tau like

- semi-regular
- 28% of all CTTSs

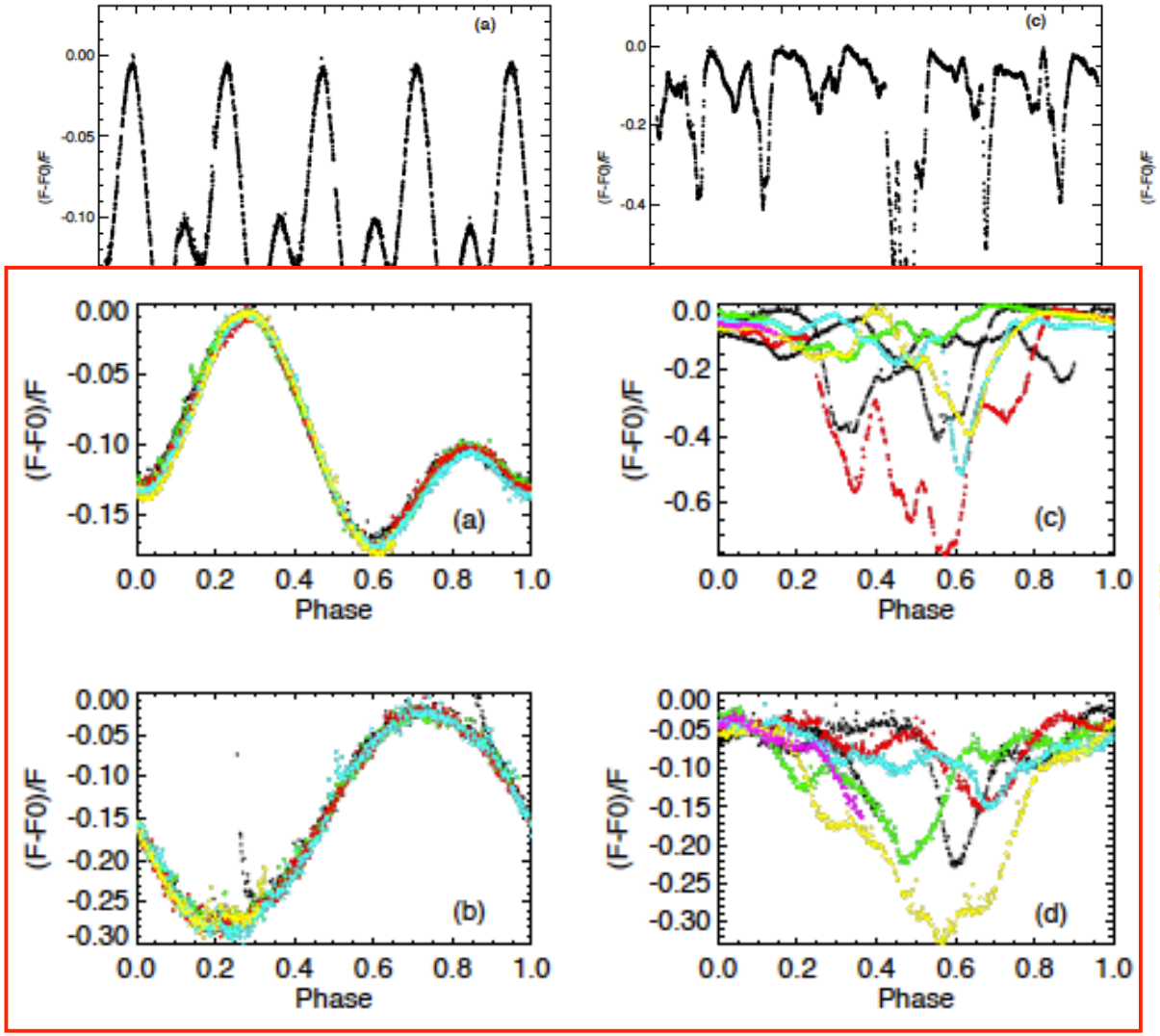
32 irregular

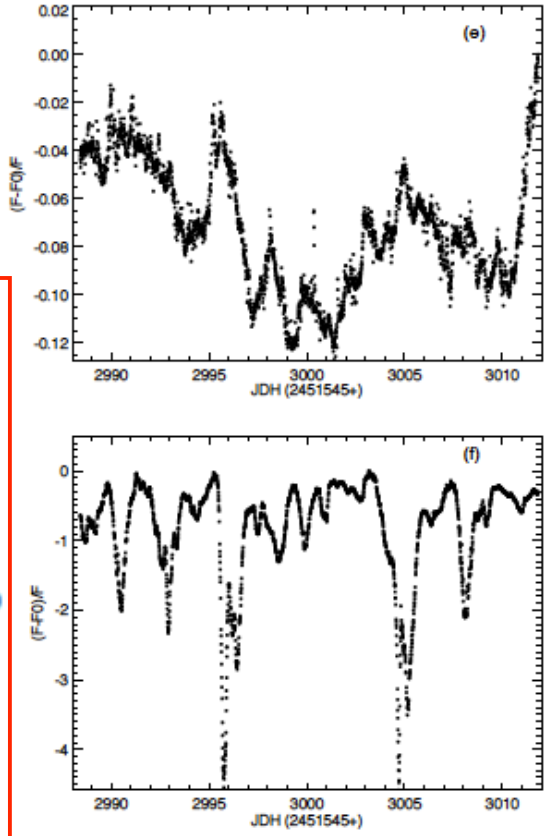
- obscuration
- non-steady accretion

Highlights from 2008 - YSOs

Alencar et al. (2010)

NEW CLASS





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Highlights from 2008 – pulsations

- **100 candidates for asteroseismology**
  - 23 young stars with (possible) pulsational variability
    - Some PMS, some very close to ZAMS
  - Need for high-resolution spectroscopy
    - Fundamental parameters & chemical abundances

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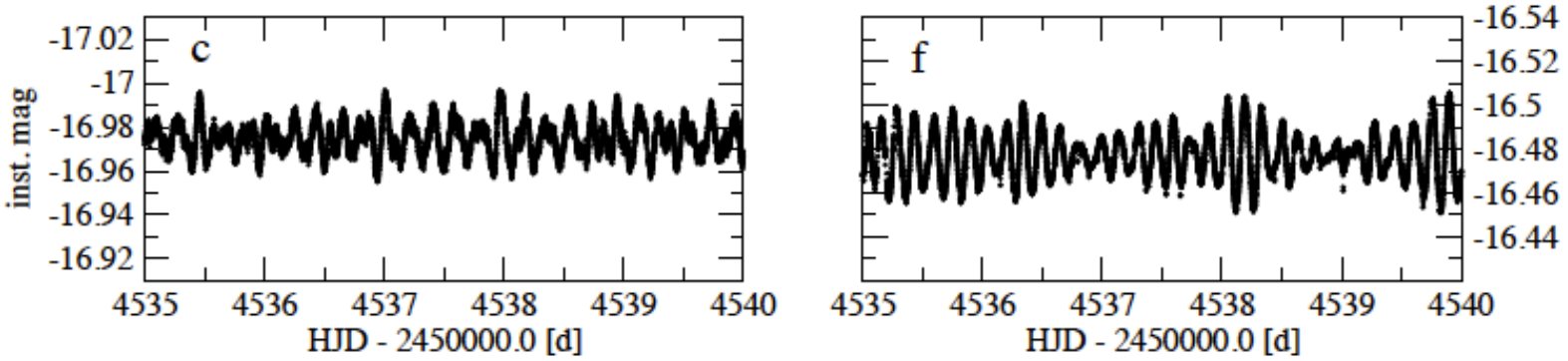
  - V 588 Mon & V 589 Mon

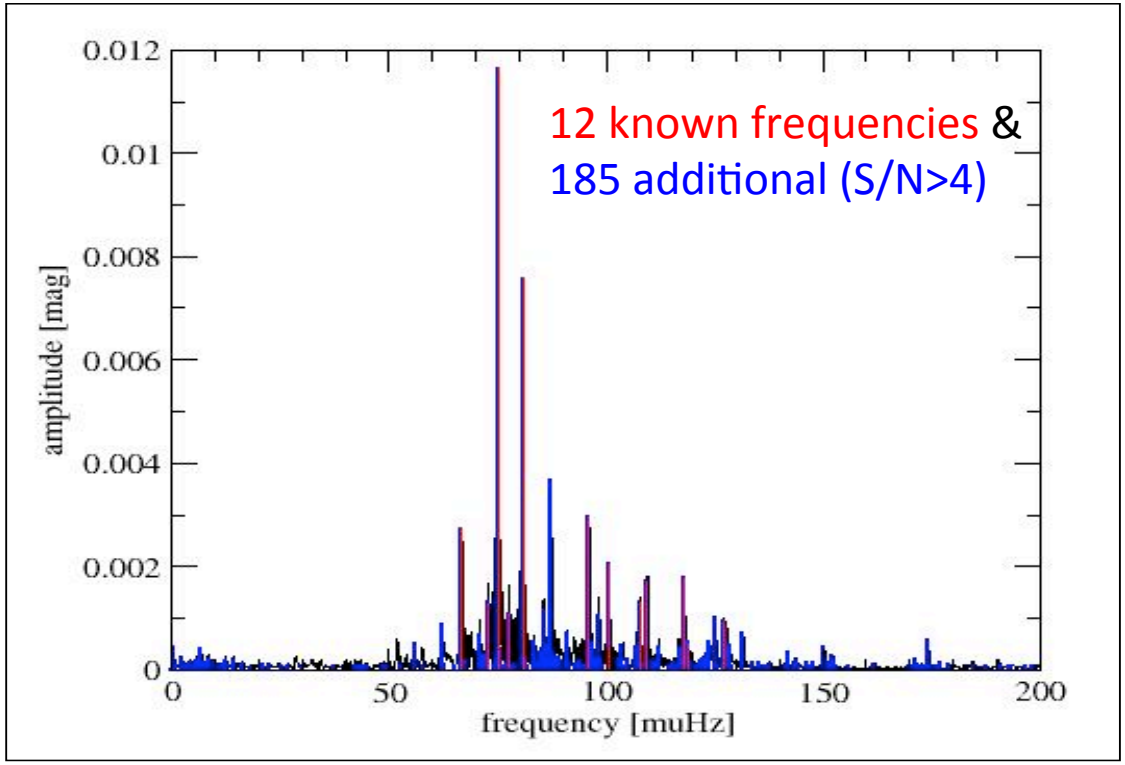
Zwintz et al. (2011)

5d subsets



Highlights from 2008 – pulsations

- V 589 Mon
  - Many frequencies
  - Granulation



Zwintz et al. (2011)

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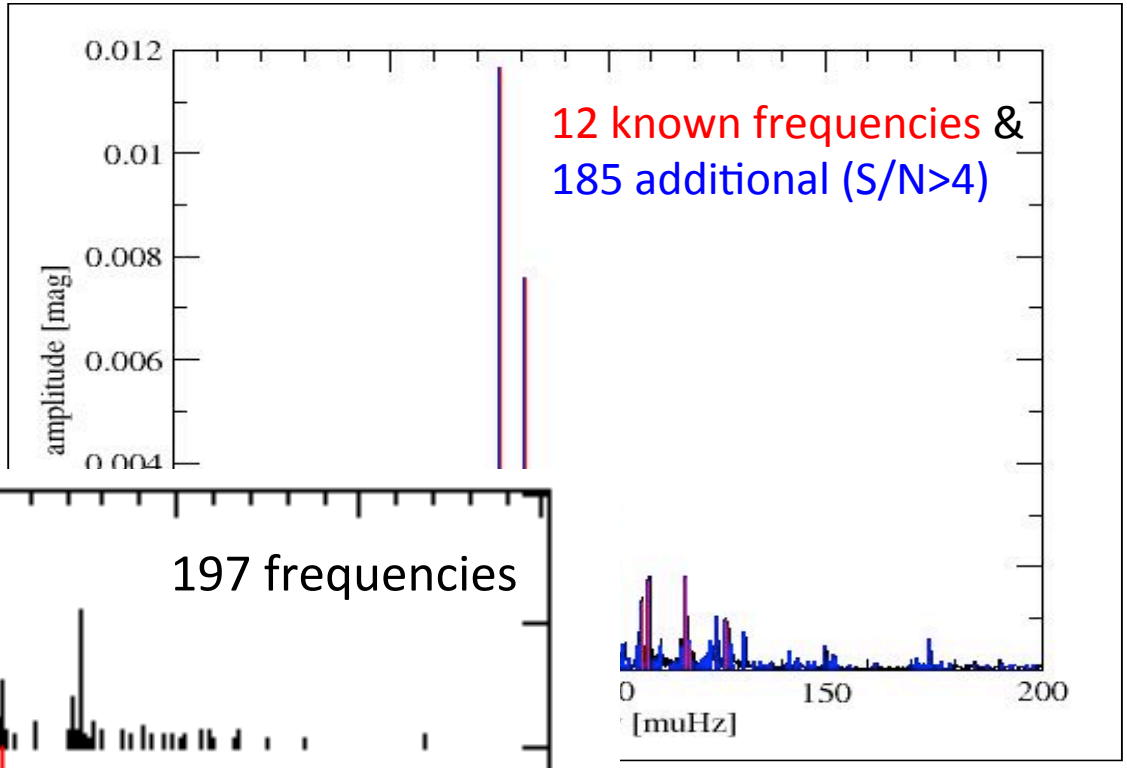
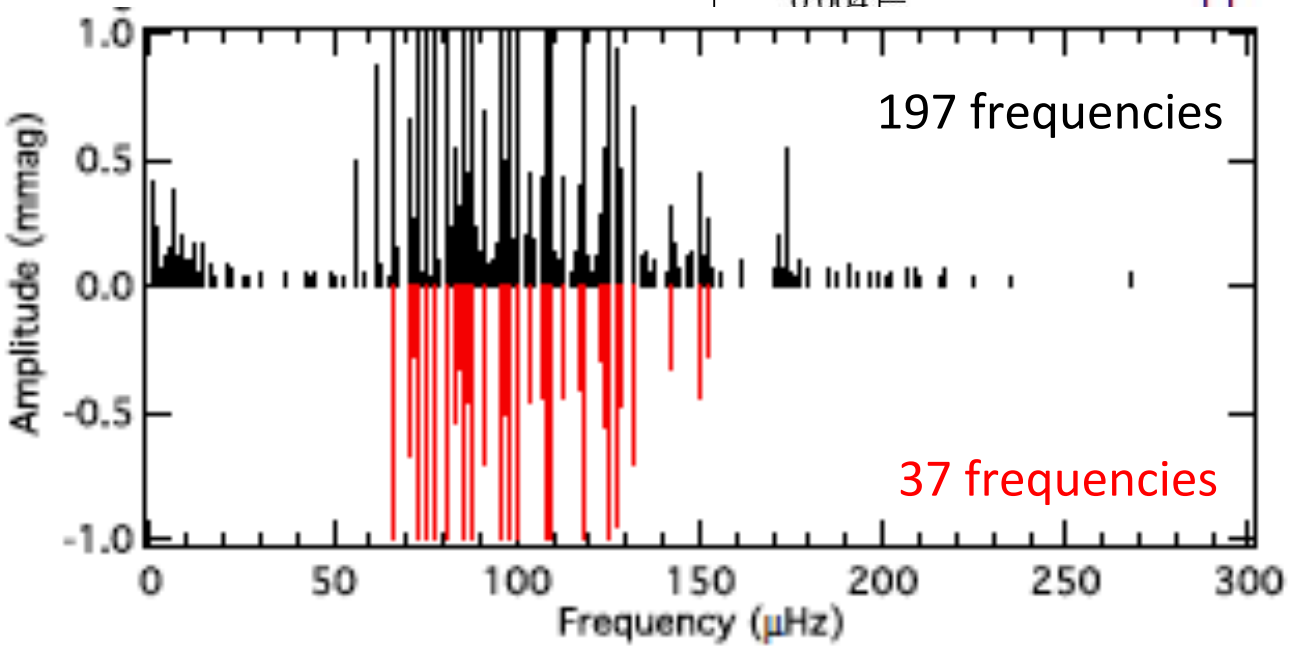
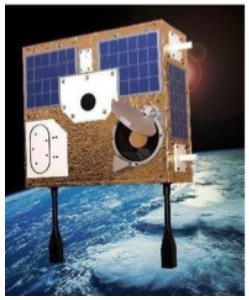
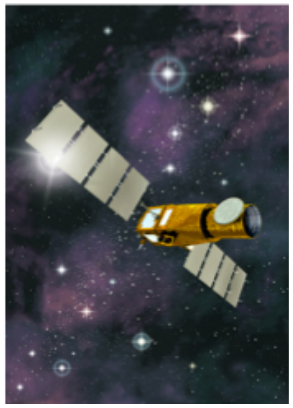


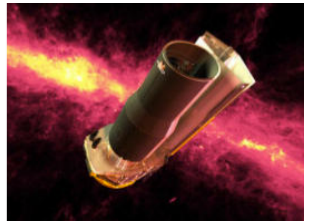


Zwintz et al. (2011)

Coordinated Synoptic Investigation of NGC 2264: "CSI2264"

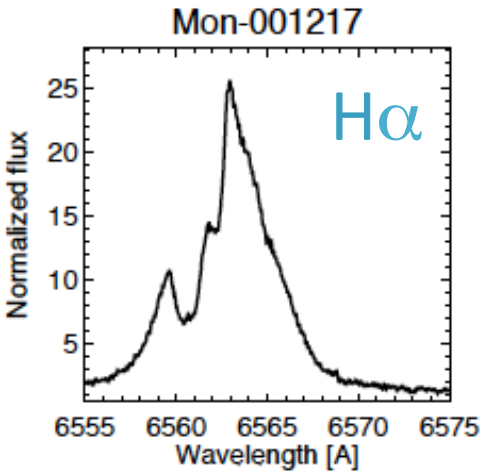






- **MOST**: 39 days (67 stars)
- **CoRoT**: 39 days (2560 stars)
- **Spitzer**: 29 days (~3000 stars)
- **Chandra**: 300ksec (~121 sources)
- VLT/Flames (20 epochs)
- CFHT/Espadons (8 hours for 12 pulsators)
- McDonald Observatory/Tull spectrograph (4 nights)
- Ground-based monitoring: U-K bands (3 months)
  - CFHT/MegaCam (14 nights)
  - Calar Alto 3.5m/Omega2000: J, H, K (30nights)

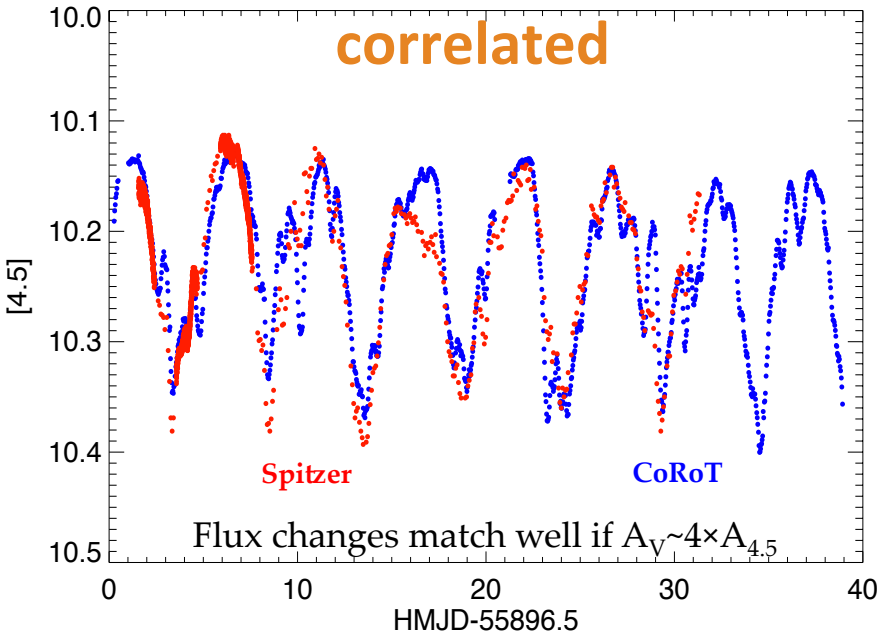
Stochastic Accretor T Tauri Stars

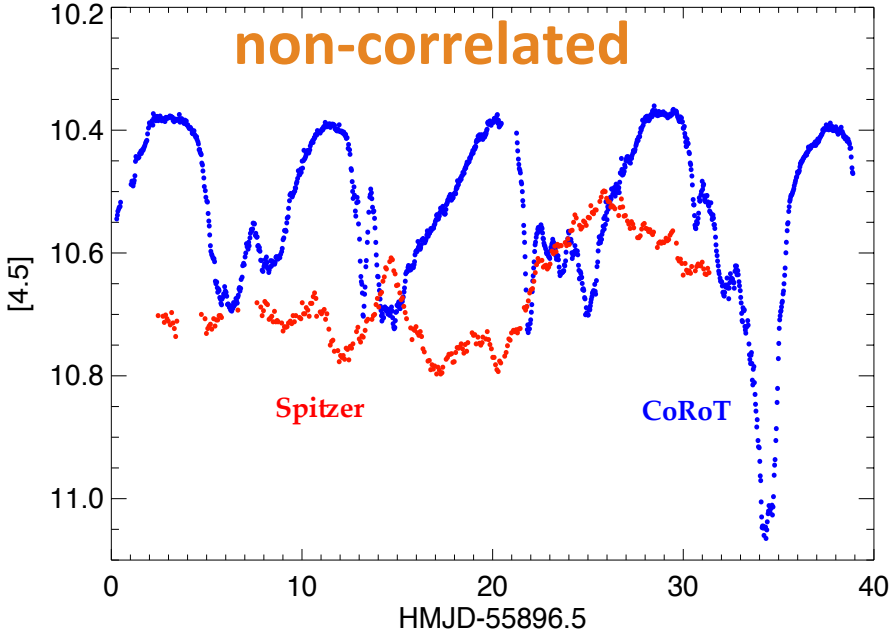


Stauffer et al. (in prep.)

- Brief brightenings: 1 hour to 1 day
- Amplitudes: 5 – 50% of quiescent phase
- Typically ~12 events in 30 days
- Large UV excesses
- Centrally peaked, lumpy Hα emission profiles
- Kelvin-Helmholtz or Rayleigh-Taylor instabilities at boundary of magnetosphere and inner circumstellar disk
- More numerous than spot modulated T Tauri stars

(Non)Correlation of optical and IR

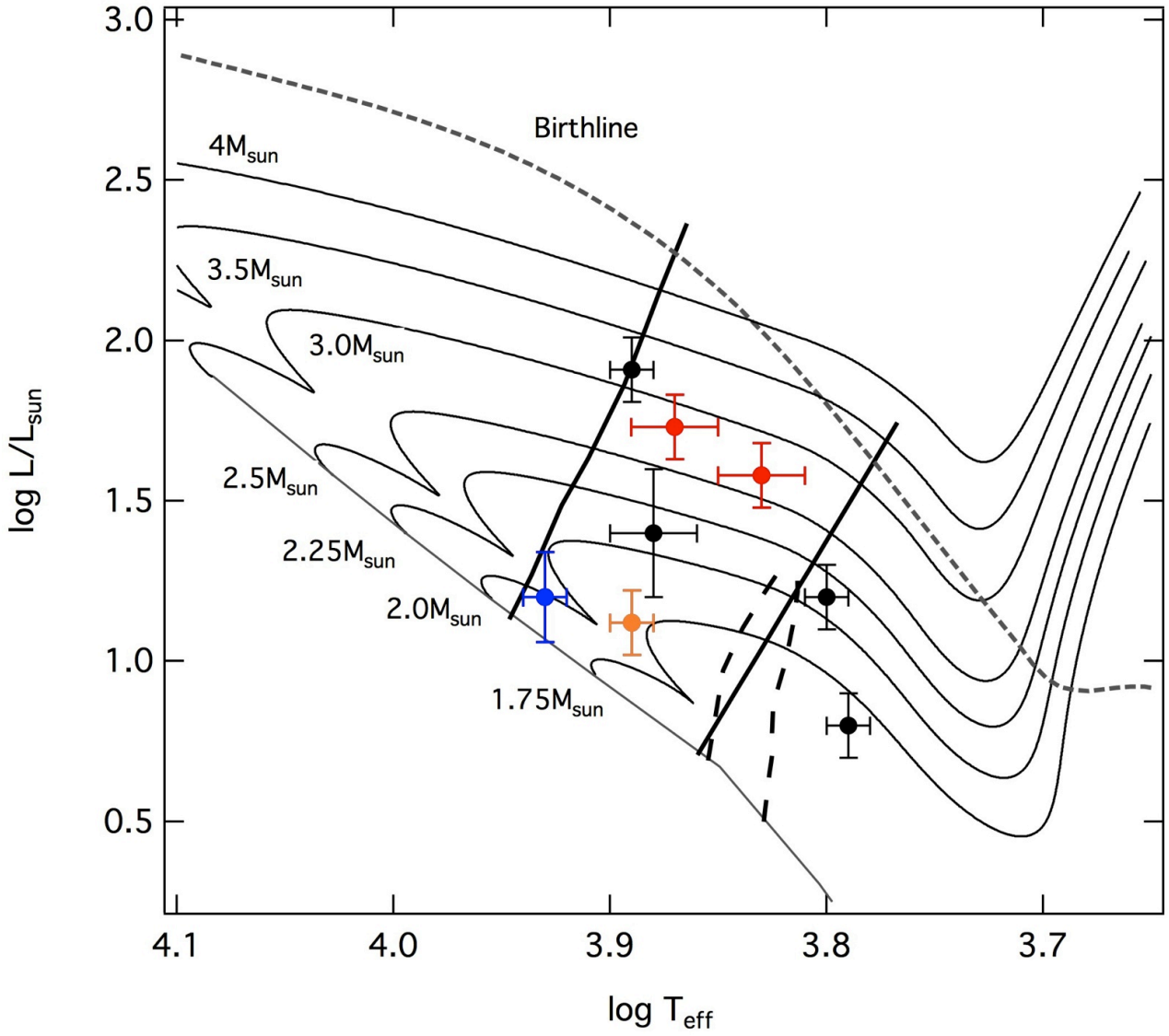




- Longitude & latitude of hot spot
- View to the system
- Alignment of stellar and disk rotation angles
- Detailed structure of inner disk

Stauffer et al.
(2013, in preparation)

NGC 2264 intermediate mass stars



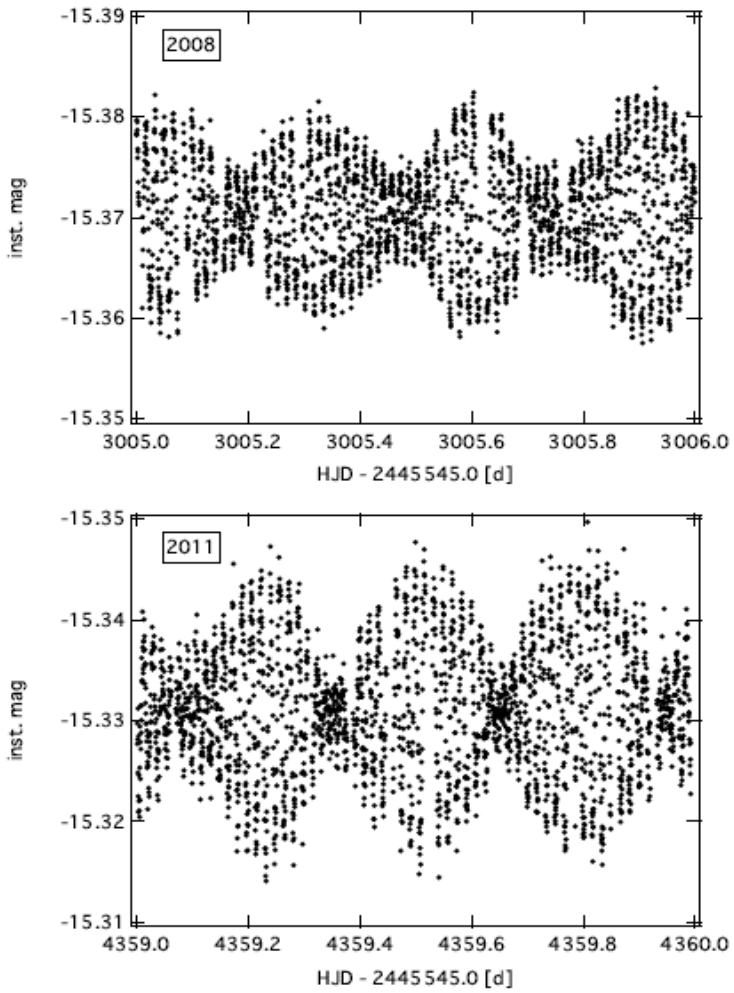
V 588 Mon
V 589 Mon
only 2008 data

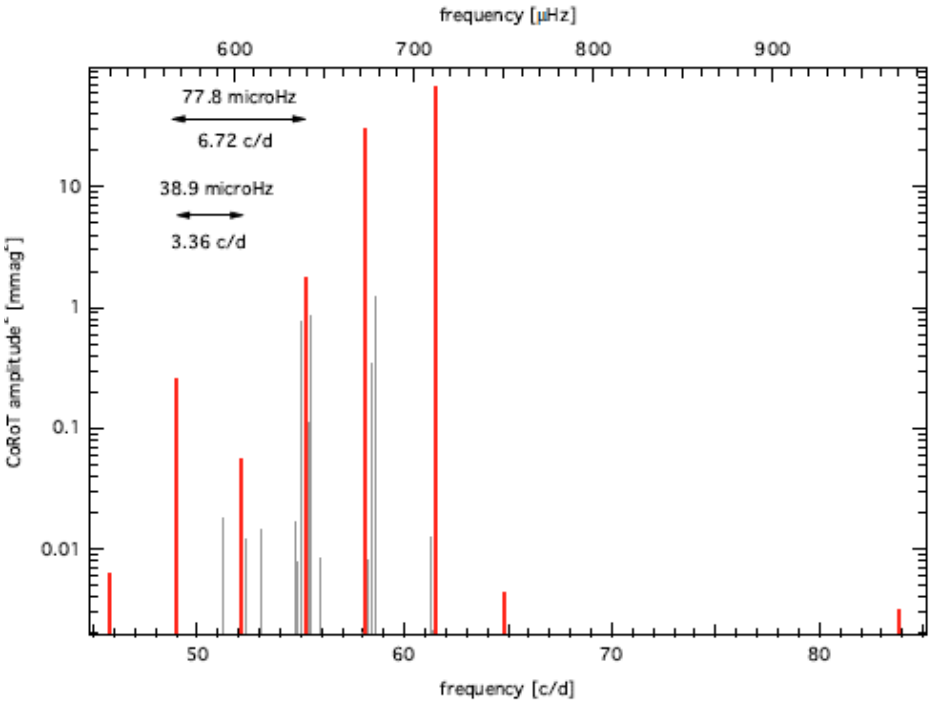
HD 261711
2008 & 2011/12 data

NGC 2264 104
only 2011/12 data

HD 261711:

Regular frequency patterns



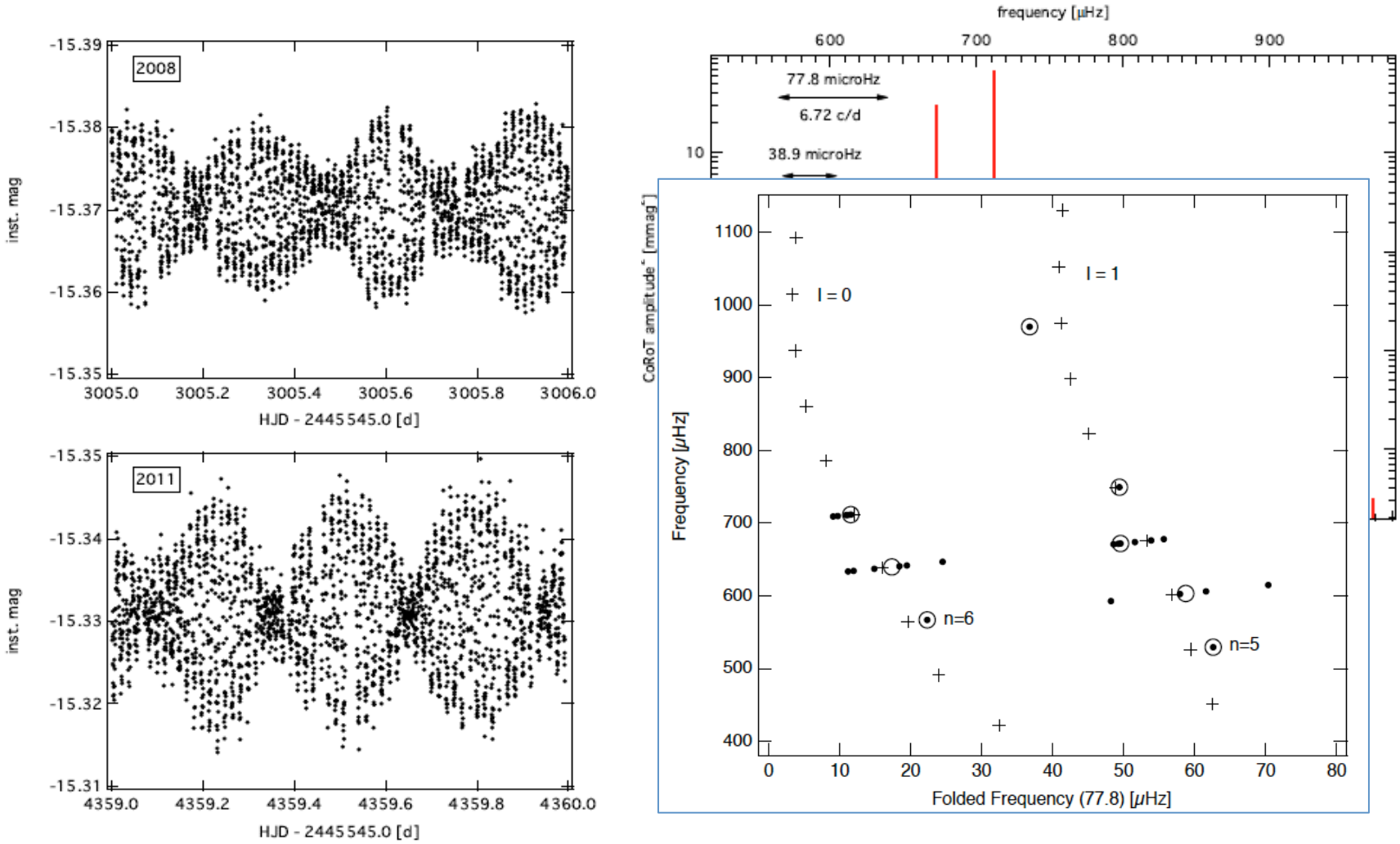


25 pulsation frequencies in
8 distinctive groups

Zwintz et al. (2013b)

HD 261711:

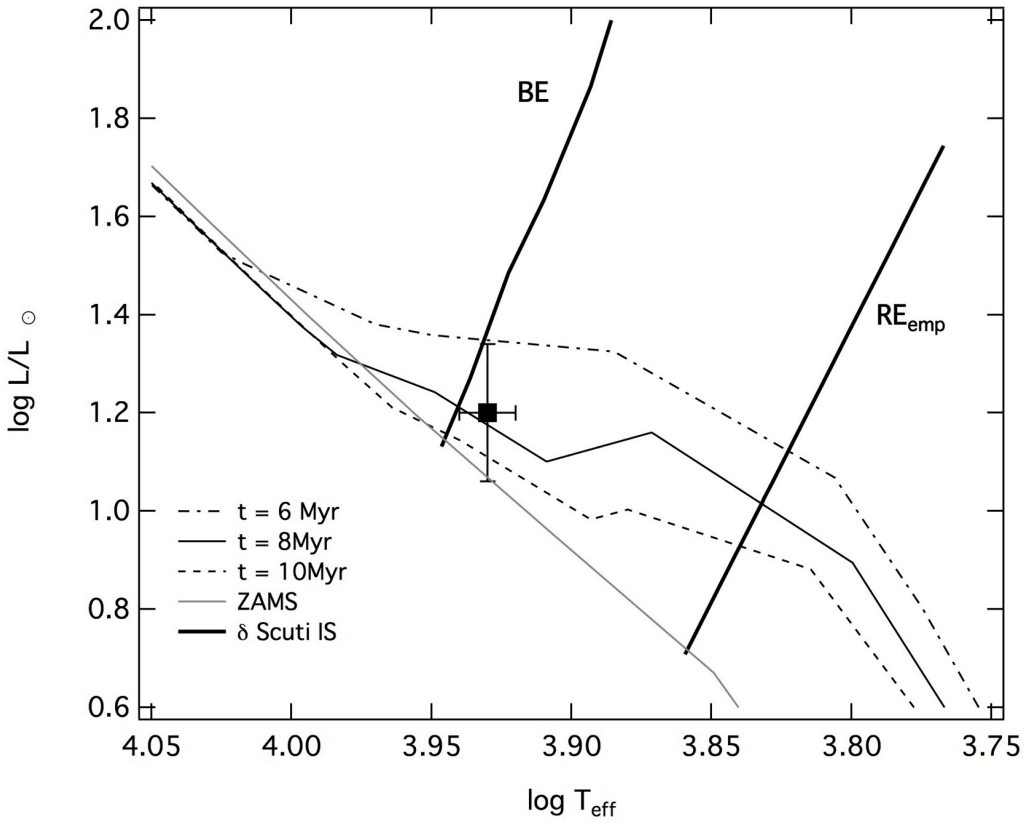
Regular frequency patterns



Zwintz et al. (2013b)

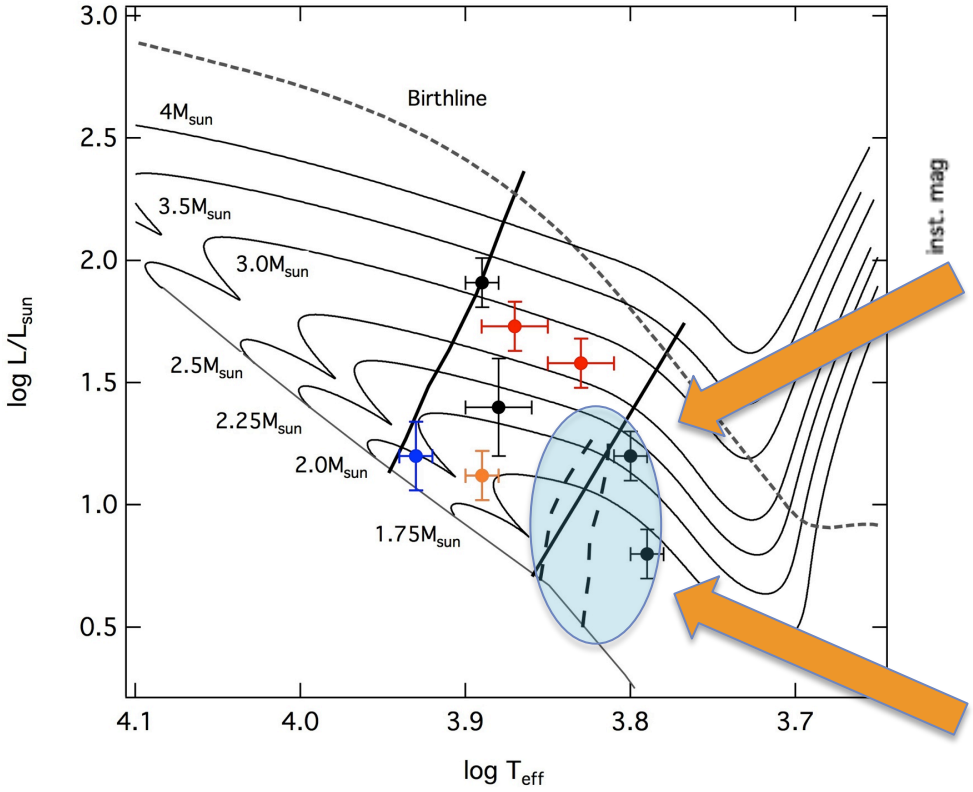
HD 261711: best solution

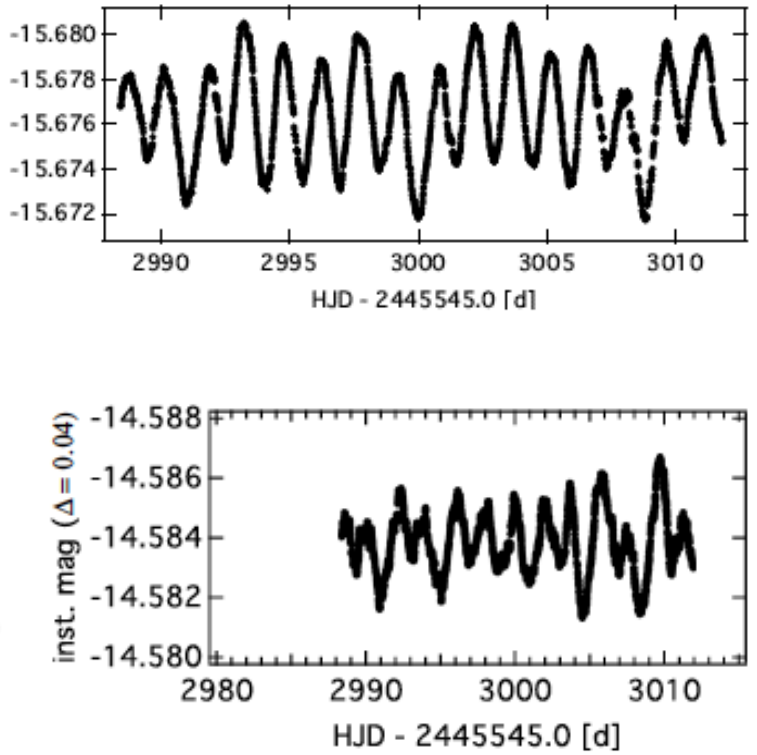
- Spectroscopy
  - T_{eff} = 8600 ± 200 K
  - log g = 4.1 ± 0.2
  - v sin i = 53 ± 1 km/s
  - cluster abundances
- Best fitting model
  - l = 0 & l = 1 p-modes
  - M = 1.9 ± 0.1 $M_\odot$
  - R = 1.65 $R_\odot$
  - Age ~ 10 Myr



Zwintz et al. (2013b)

Discovery of PMS γ Dor stars





Zwintz et al. (2013a)

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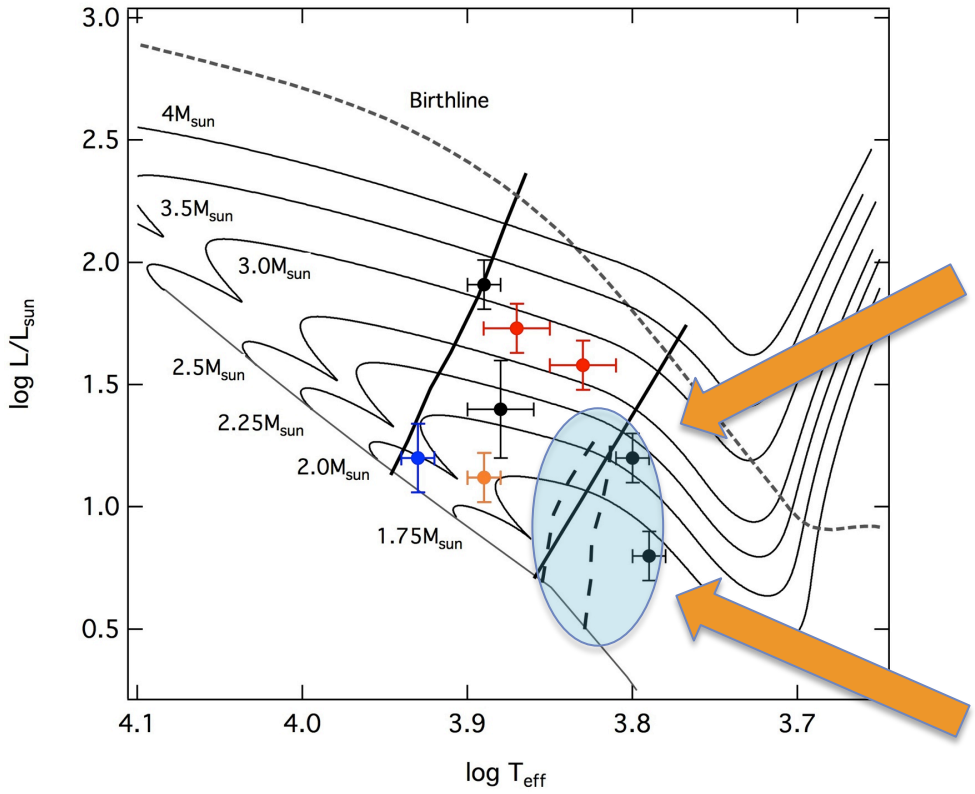


NGC 2264 VAS 20

- 10 frequencies
- T_{eff} = 6380 ± 150K
- log g = 4.0 ± 0.2
- log L/L$_{sun}$ = 1.2 ± 0.1
- v sin i = 42 ± 2 km/s

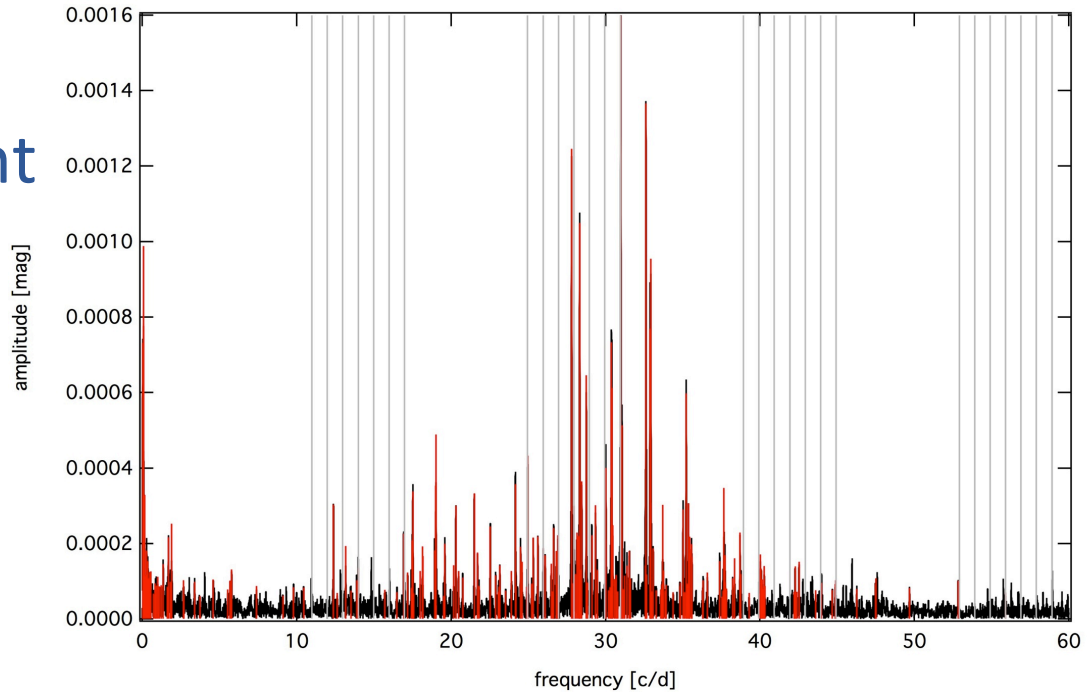
NGC 2264 VAS 87

- 14 frequencies
- T_{eff} = 6220 ± 150K
- log g = 3.8 ± 0.2
- log L/L$_{sun}$ = 0.8 ± 0.1
- v sin i = 18 ± 1 km/s

Zwintz et al. (2013a)

NGC 2264 104

- Only 2011/12 data
- 192 formally significant frequencies
- Similar to V 588 Mon and V 589 Mon
- Spectroscopy
  - T_{eff} = 7800 ± 200K
    log g = 4.0 ± 0.2
    v sin i = 100 km/s
- Work in progress...



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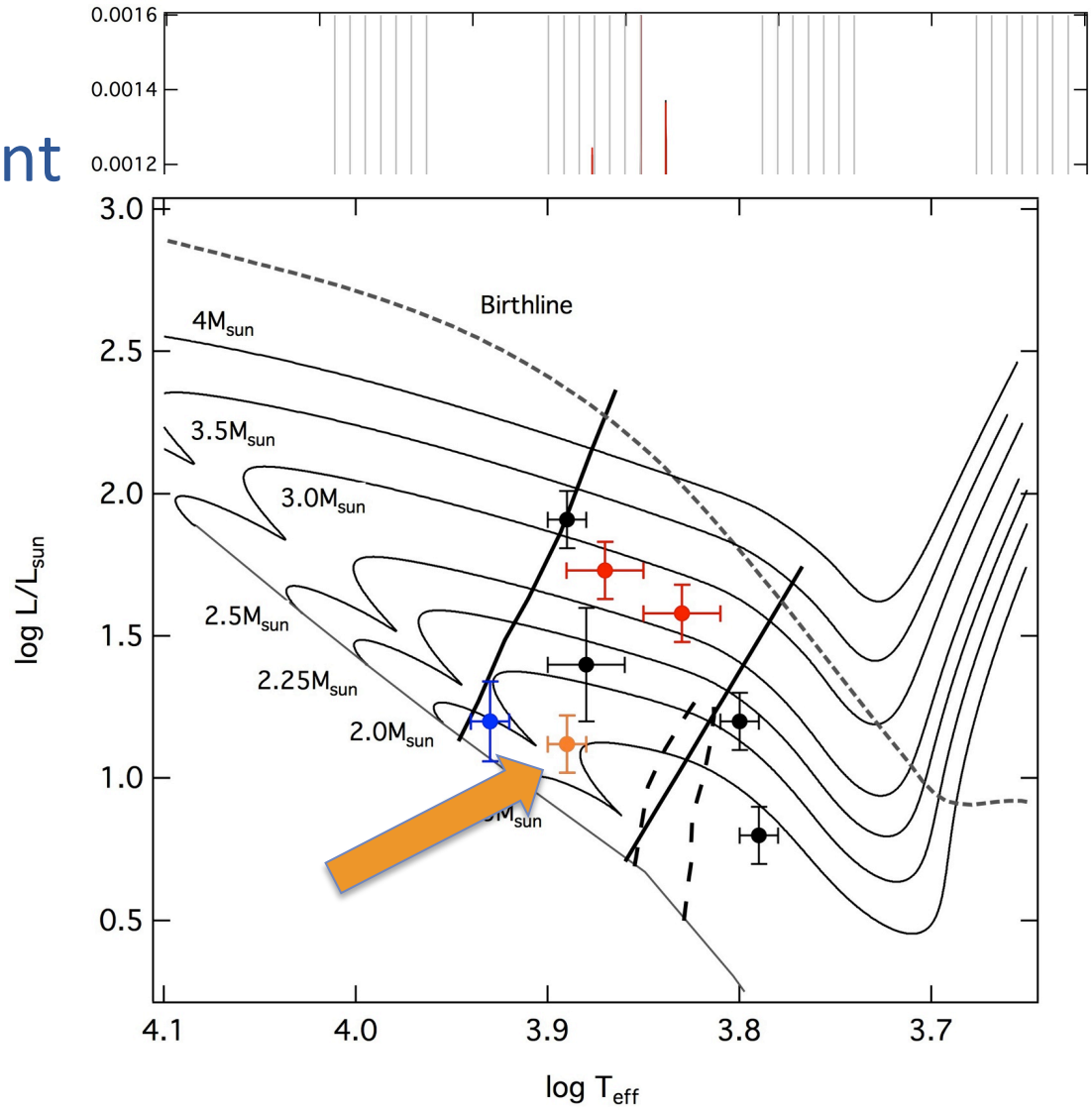

CoRoT "Repair Mission"?

Thanks to the CoRoT Engineers!