



HIGHLIGHTS OF BRAZILIAN CONTRIBUTIONS TO CoRoT

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CoRoT 44th SC





👍 Brazil Space Agency - CNES
agreement for CoRoT in 2003

 Brazilian participation in CoRoT:

☀ -- Software



-- Alcântara ground station

👓 -- Science teams

Thanks to: CNPq, CAPES, INPE, AEB,
Universities...





Software engineering

- ◆ Characterization of CoRoT instrument (L.P. da Silva)
- ◆ System validation, PSF (V. Parro)
- ◆ PSF + jitter correction (F. Fialho, V. Parro)





SOFTWARE

◆ Characterization of CoRoT instrument (L.P. da Silva)

- 1. **Electronic Bias Level** (function of Temperature)
- 2. **Electronic Gain** (function of aging)
- 3. **PSF** (as a function of CCD position)
- 4. **Spontaneous Generation of e⁻** (function of Temperature)
- 5. Pixel Response: **Non-Uniformity**
- 6. **p⁺ Impacts** (as a function of Geo Position)
- ...etc...

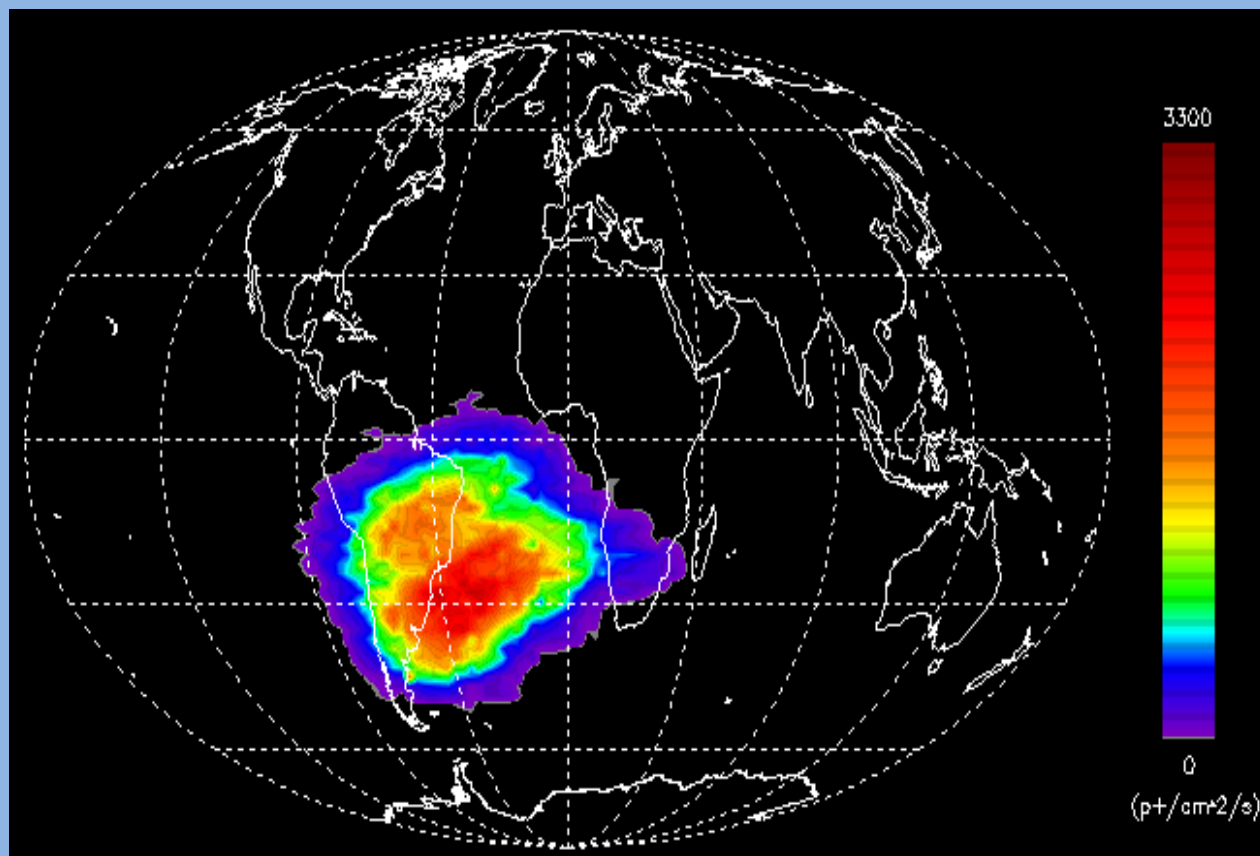
(da Silva et al. 2006; Auvergne et al. 2006)





SOFTWARE

p^+ flux in the focal plane (“orbitography”)



Mapping of the

**South Atlantic
Anomaly**

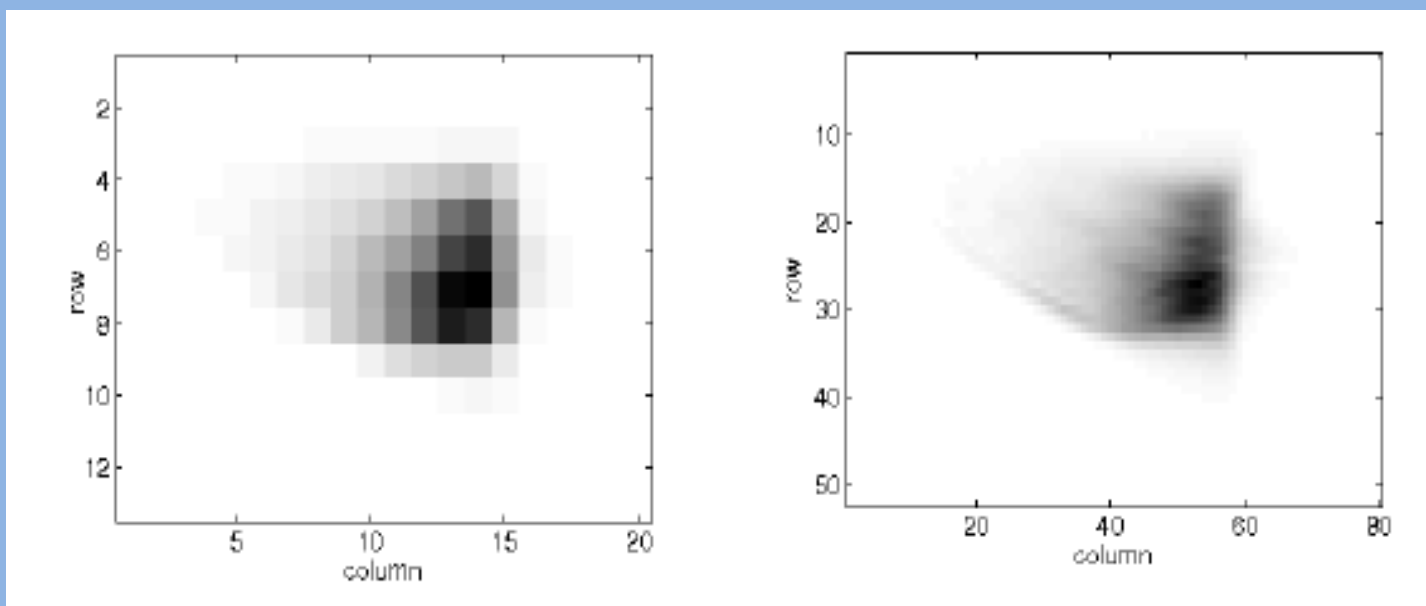
(da Silva et al. 2008)





SOFTWARE

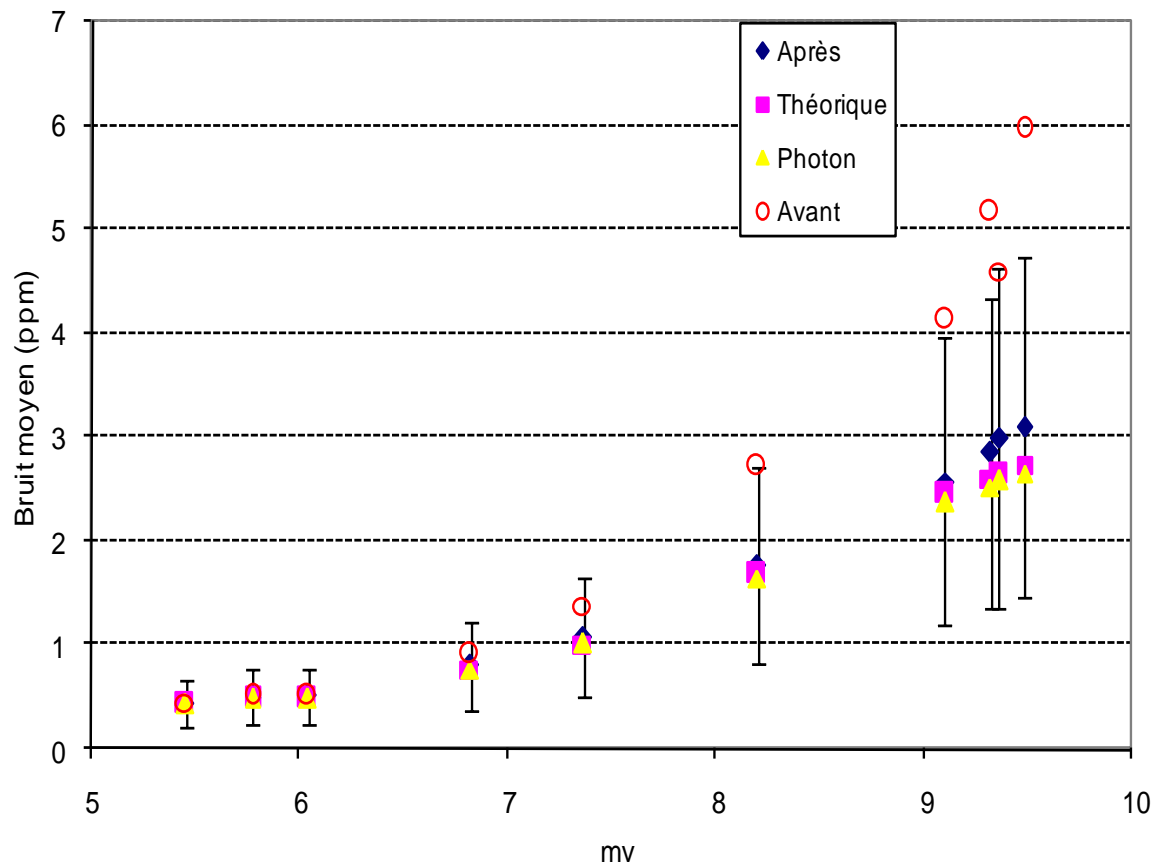
Signal processing and instrument modeling for ground segment (PSF +Jitter; Parro & Fialho) (Parro et al. 2010)





SOFTWARE

Noise correction



CoRoT team

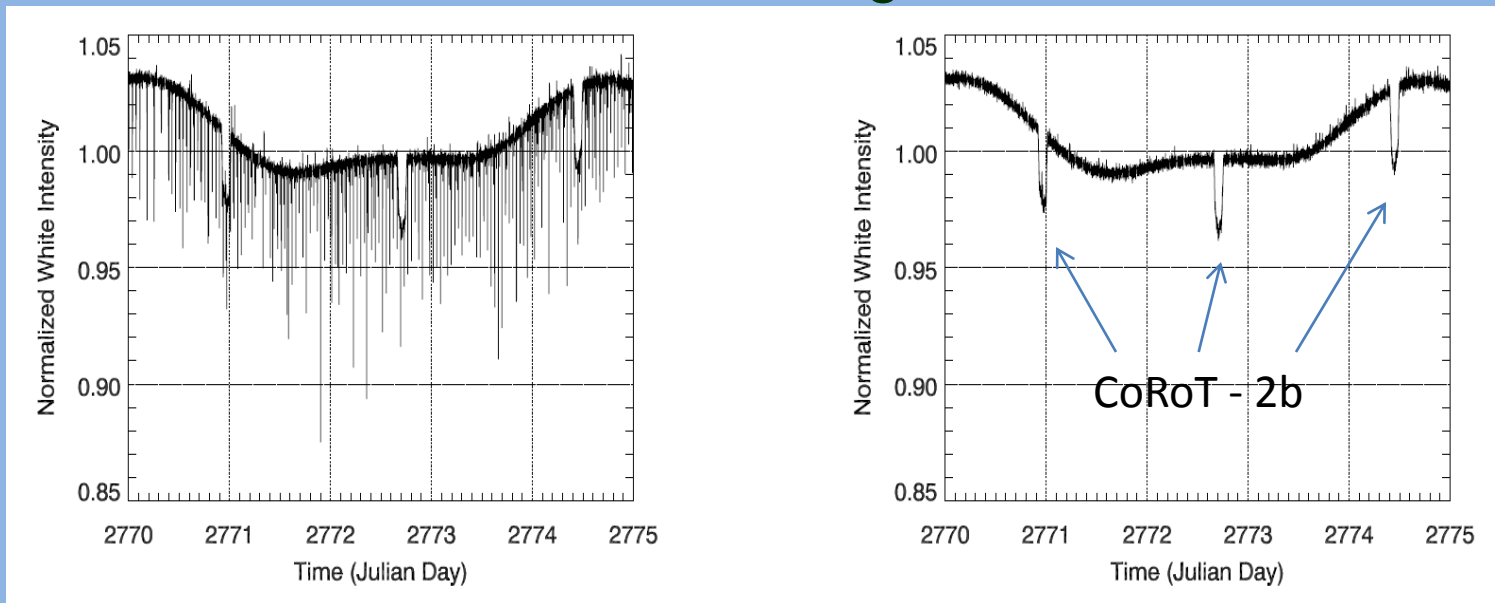




SOFTWARE

Signal processing and instrument modeling for ground segment (PSF +Jitter; Parro & Fialho) (Fialho et al. 2009)

Jitter correction for CoRoT-2a light curve.





Science participation

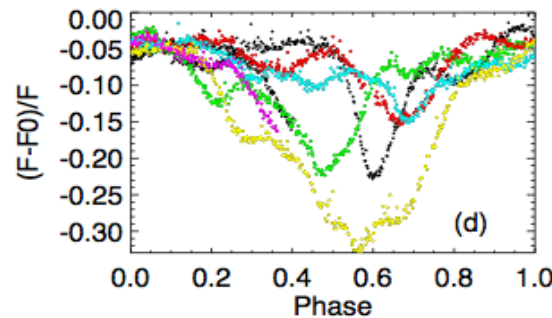
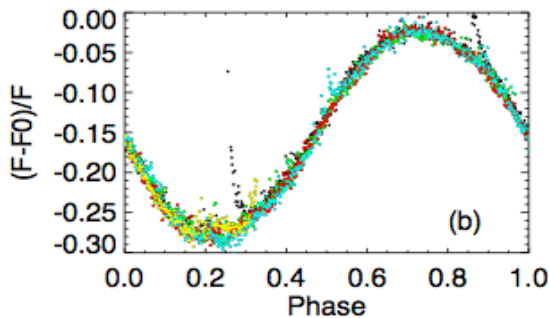
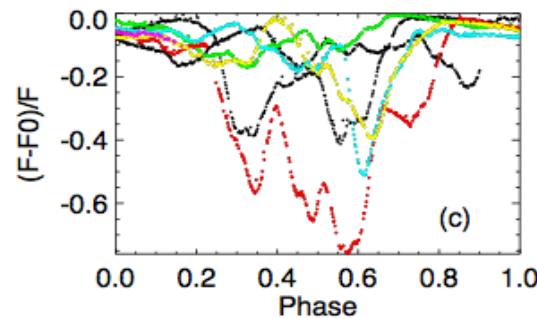
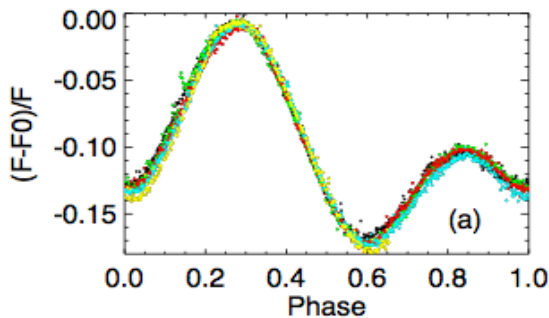
- 👁️ Pre-launch observations (La Silla + Brazil)
- ★ Young stars in NGC 2264 (Alencar et al.)
- ★ Dynamics of exoplanets (Ferraz-Mello et al.)
- ★ Stellar seismology (Janot-Pacheco et al.)
- ★ Stellar rotation (Medeiros et. al.)
- ★ Physics of spots (Silva-Valio et al.)
- ★ . . .



Young stars in NGC 2264 (star-disk interaction: CTTs) (Alencar et al.)

Spot-like

AA Tau-like



Bouvier et al. 2007;
Alencar et al. 2012

Fig.2. The four periodic LCs from Fig. 1 folded in phase. Different colors correspond to different cycles.



SCIENCE

Young stars in NGC 2264 (star-disk interaction) (Alencar et al.) (cont)

--Is an inner disk warp a common feature in CTTs ? **Yes, 28% of the observed CTTs exhibit AA Tau-like light curves.**

-- Is the dynamical star-disk interaction with a timescale of few rotational periods common among CTTs ? **Yes!**

-- Is there really dust in the inner disks of the AA Tau-like systems ? **Yes, all the AA Tau-like systems all have dust in their inner disk ($\alpha_{\text{IRAC}} > -2.86$).**





SCIENCE

Dynamics of exoplanets (Ferraz-Mello et al.)

-- Co-I ☒ CEST

-- **Orbit & mass determination** from analysis of radial velocity (CoRoT 7b & c: improvement + CoRoT 14b, 16b, 20b, 22b, 23b, 24b & c)

-- Tides: determination of **shape** of planets & of **tidal locking**.

-- analysis of transits **time and duration**

(Ferraz-Mello 2011; 2011; 2011; 2012; 2012)

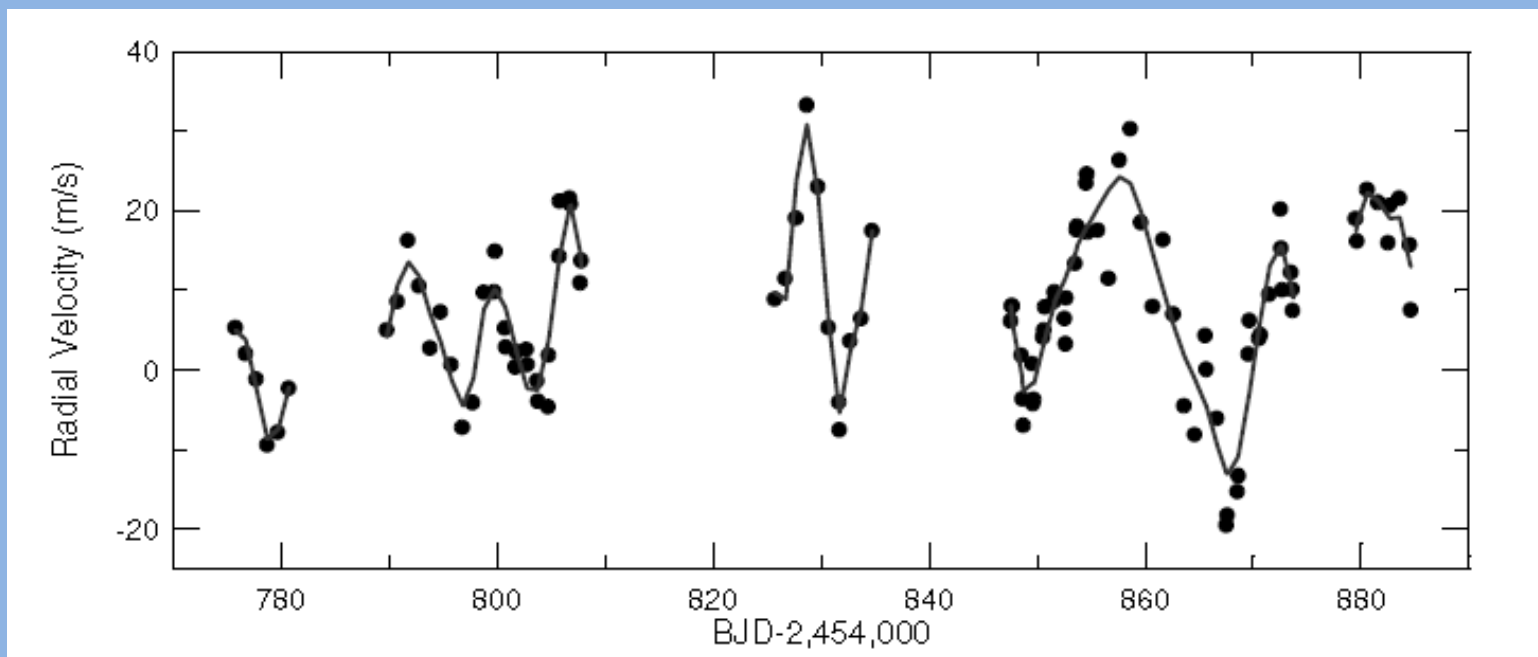




SCIENCE

Dynamics of exoplanets (Ferraz-Mello et al.)

CoRoT 7b radial velocity curve (HARPS) (Queloz et al. 2009)



(~ 100 nights; orbital period: ~20h)

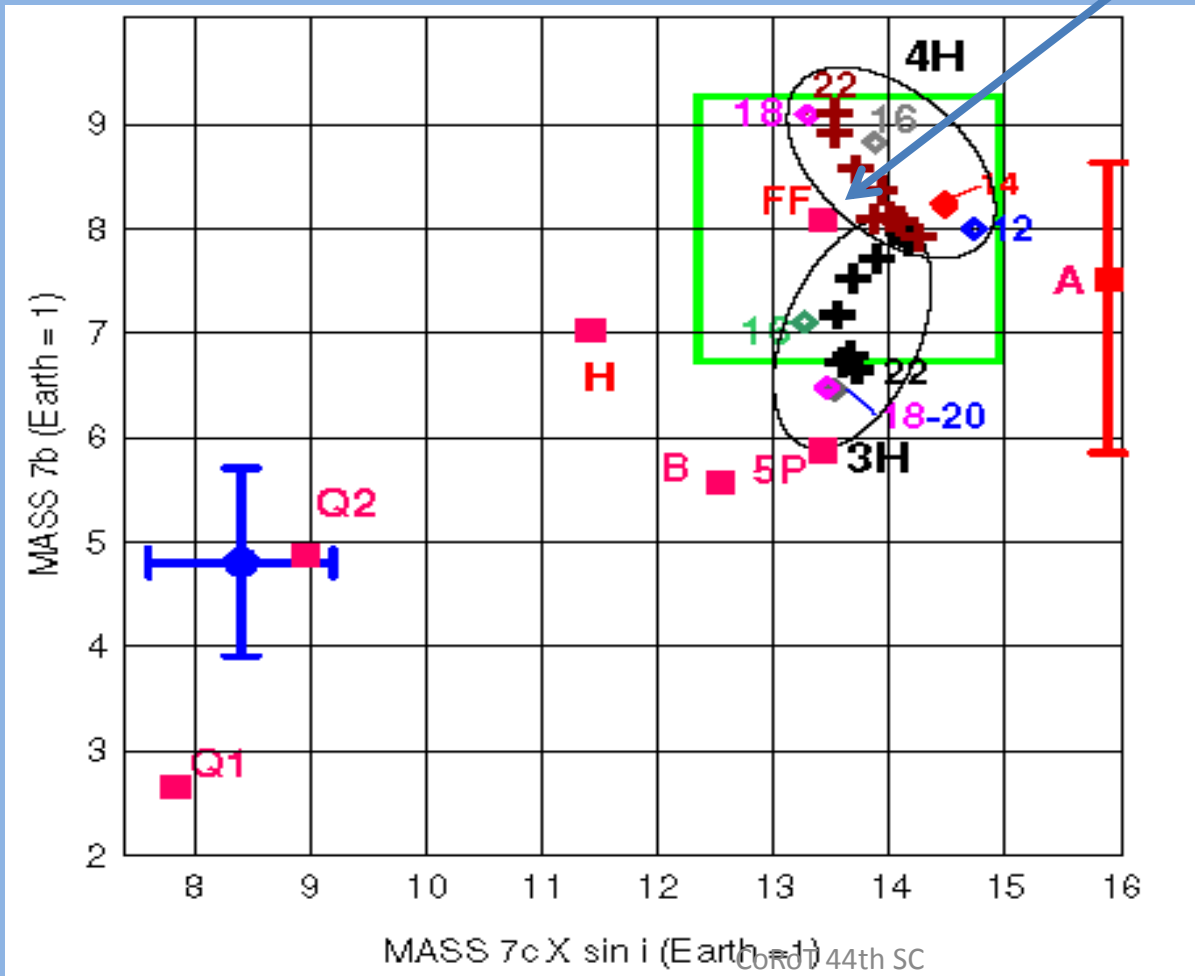




SCIENCE

Dynamics of exoplanets (Ferraz-Mello et al.)

CoRoT 7b&c: all results put together





SCIENCE

Stellar seismology (Janot-Pacheco et al.)

Pulsation analysis of hot stars (Be, β Cep) and solar-like stars ($M > 1.3 M_{\text{sun}}$) + comparison with CESAM & FILOU codes $\rightarrow\rightarrow$

$\rightarrow\rightarrow$ Diagnosis of **stellar structure** and internal **rotation profile**

(Andrade et al. 2012; Janot-Pacheco et al. 2012)





SCIENCE

Stellar seismology

CLEANEST spectrum of CoRoT light-curve

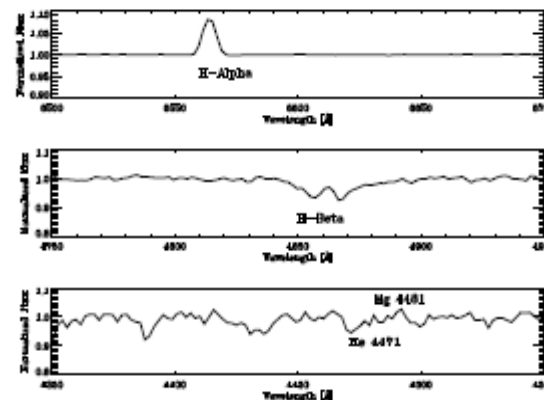
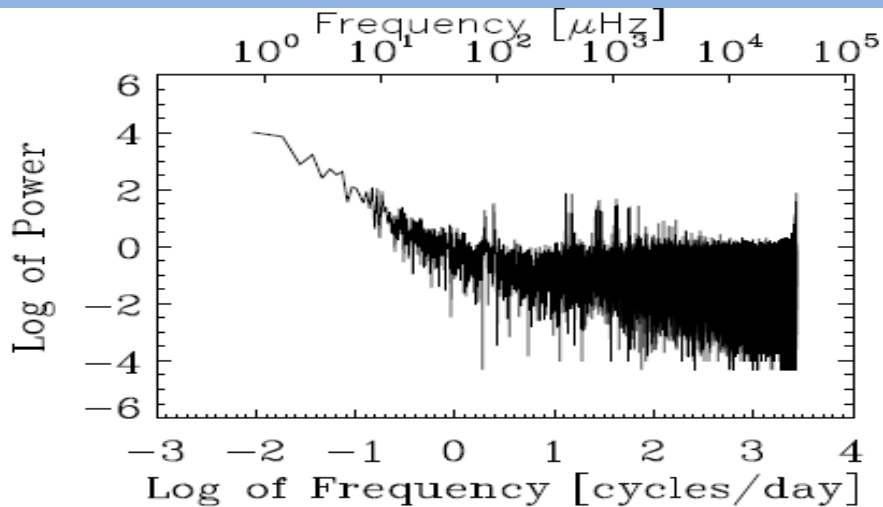


Fig. 8. Close-ups of interesting spectral regions. From top to bottom: H α , H β , He 4471 Å/Mg 4481 Å

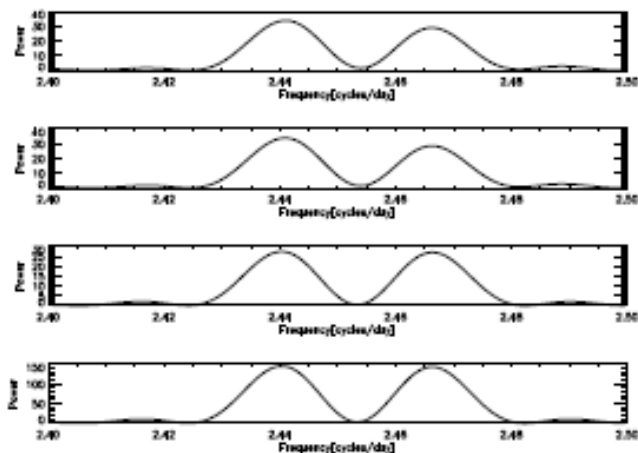


Fig. 6. Cleanest Spectra between 2.4 and 2.5 c d^{-1} , from top to bottom: the light curve (lc), lc without orbit perturbations, lc with interpolated gaps, reconstructed time series.

CoRoT ID 102761769 → →

- Physical parameters: $V= 13$ B5-6 IV-Ve, $V\text{sin}i = 120$ km/s
- Frequency spectrum
- 2 dominant frequencies \boxtimes NRP multiplet

(Emilio et al. 2011;
Andrade et al. 2012)





SCIENCE

Stellar rotation (de Medeiros et. al.)

Semi-sinusoidal variability in the light curves

⊠ ⊠ **rotation periods** ?

Distribution of stars in $P \times$ color diagram depends strongly on **reddening correction**

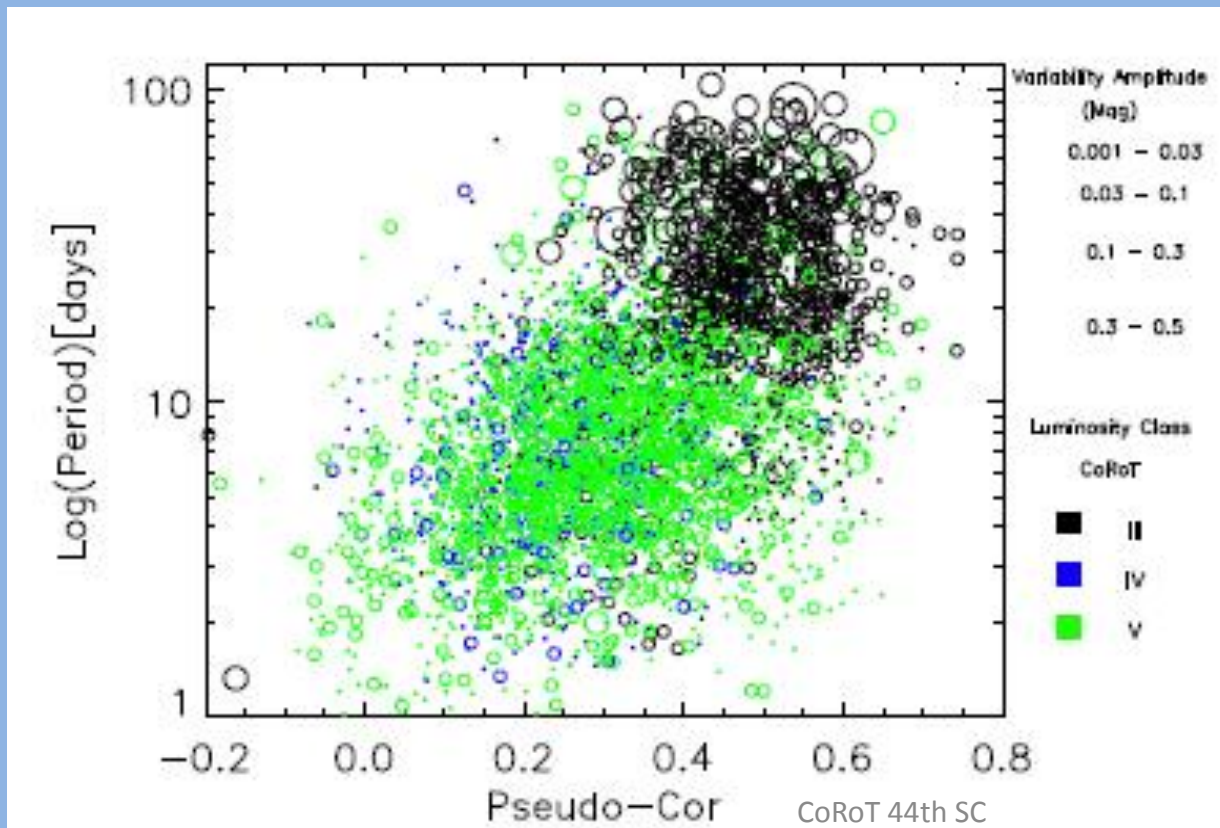




SCIENCE

Stellar rotation (Medeiros et. al.)

Period - reddened corrected color (size of circle \propto period)



de Medeiros et al.
A&A submitted





SCIENCE

Physics of stellar spots (Silva-Valio et al.)
(planet eclipses spot during transit)

◆ Spot characteristics: (Silva 2003)

-- **Size** (area coverage); **Intensity** – temperature;

Location (long & lat)

◆ Stellar properties from multiple transits

-- **Rotation period** (Silva-Valio 2008)

-- **Differential rotation** (Silva-valio et al. 2010; Silva-Valio & Lanza 2011)

-- **Exomoons** (Tusnski & Valio, 2011)

-- **Activity cycle**



THANK YOU !