Analysis of rotation of CoRoT dwarf stars

IRa01 – LRc01

Additional program P.I. F. Favata

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Sample selection criteria

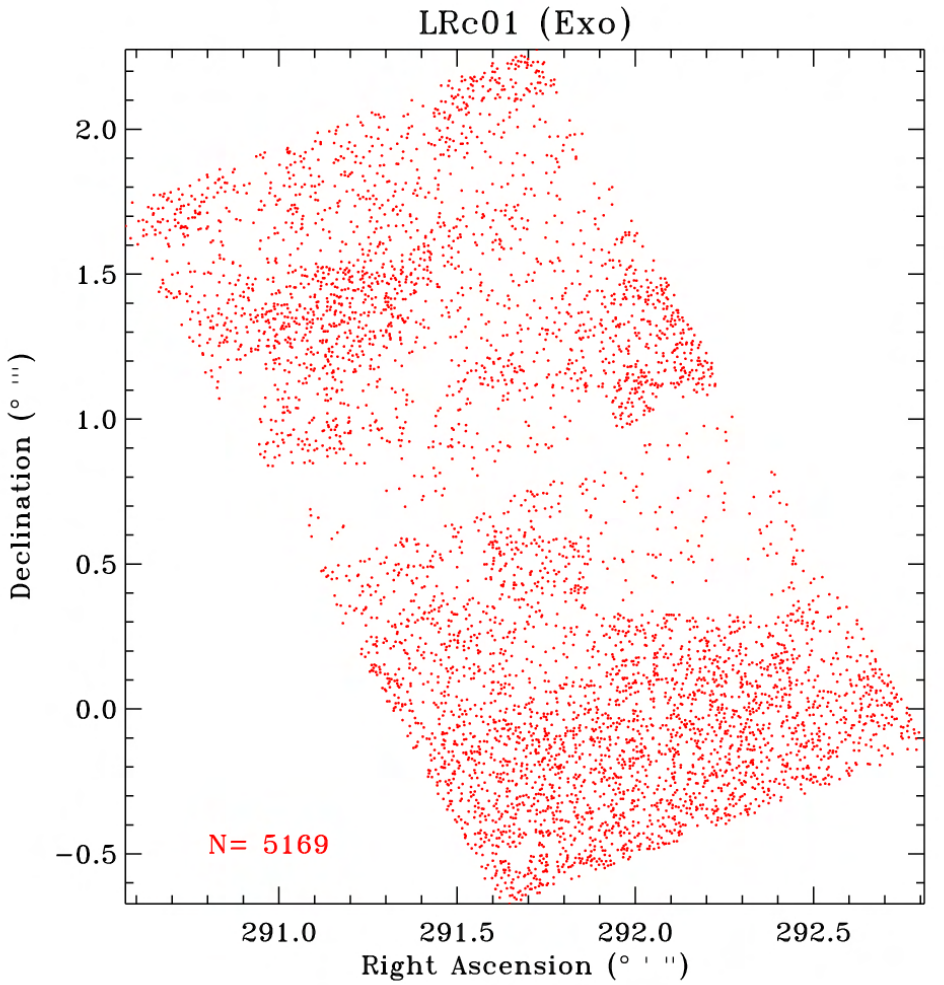
- From CoRot database (Exo)
  - luminosity class V
  - 0.44 < B-V < 1.4 (~F5-M0)

IRa01: 4993

LRc01: 5169

Total: 10162

3114 chromatic LCs
7048 white LCs



Analysis steps

- selection of valid flux data (no SAA fluxes)
- automatic separation of LCs in "initial" and "long" runs
- rebinning of the data to 2h ("correction" for the orbital period)
- detrend of LCs with polynomial fitting

- automatic selection of LCs without jumps
- Lomb - Scargle periodogram
- Folding with 1st and 2nd period
- Significance of the peaks (1000 LCs "resampled" for each target)

Selected LCs

Light curves without 'jumps'

Total: 10162

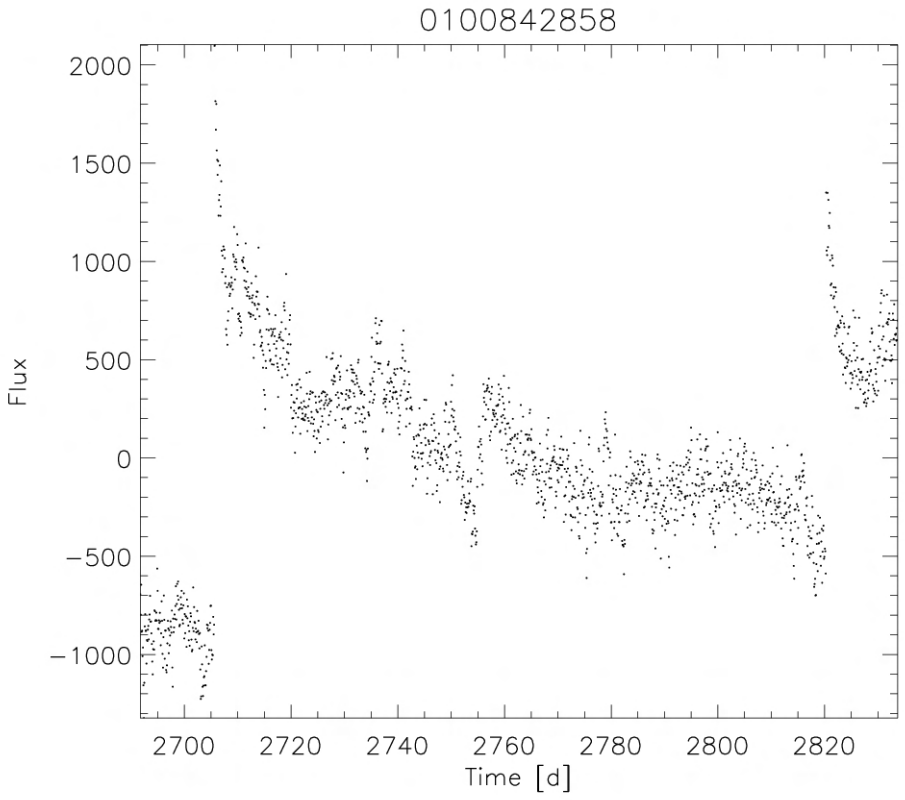
Selected LCs:

Short: 4348

Long: 3521

Tot sel: 7869

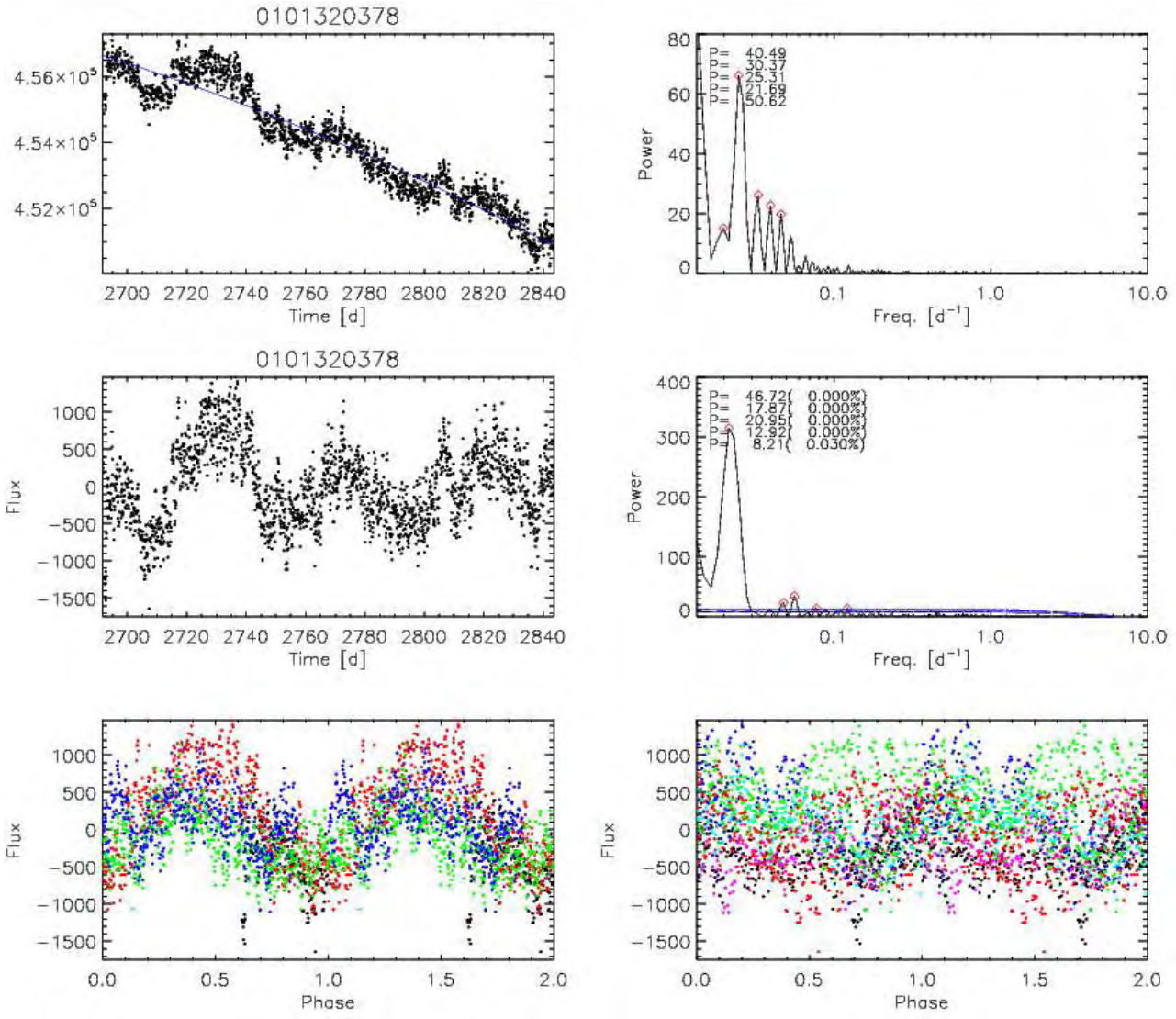
~ 23% rejected



Lomb - Scargle periodogram

Some examples obtained

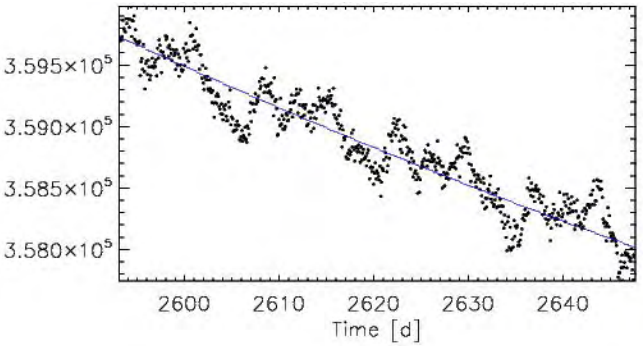
P_rot = 46.7 days

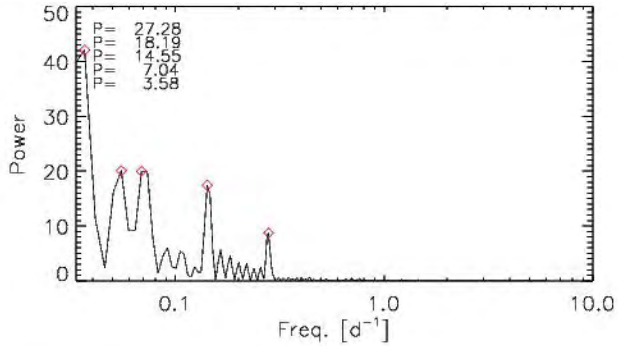


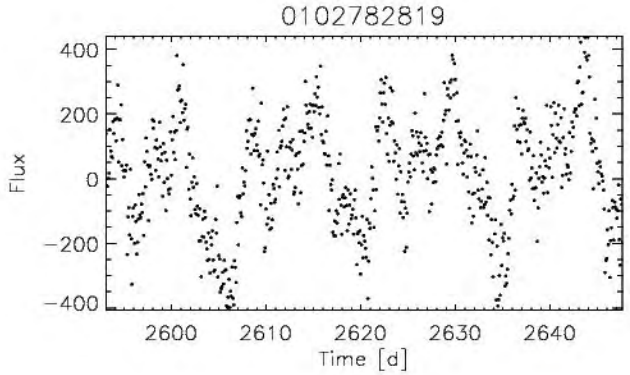
Lomb - Scargle periodogram

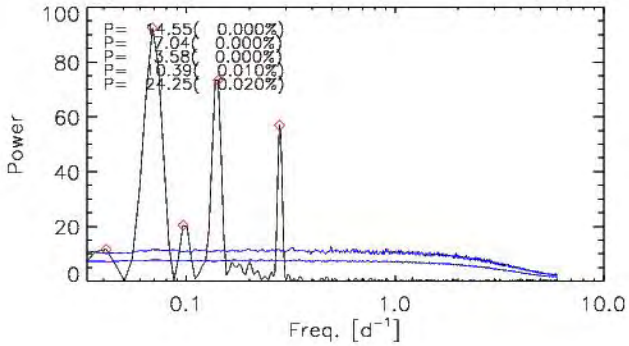
Some examples obtained

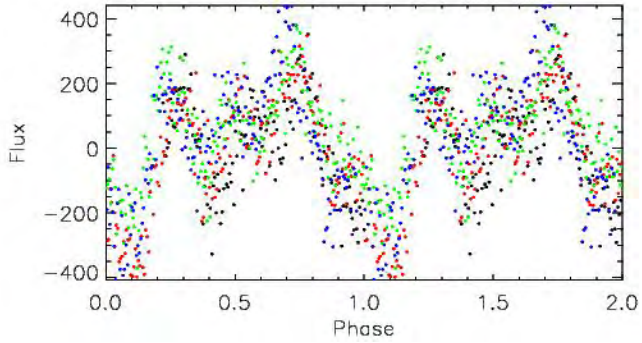
P_rot = 14.5 days

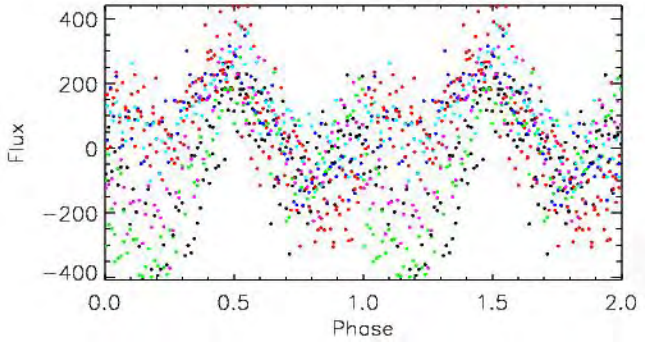












A test case: NGC 2264

Exoplanet CoRot database (SRa01)

8150 chromatic & white LCs

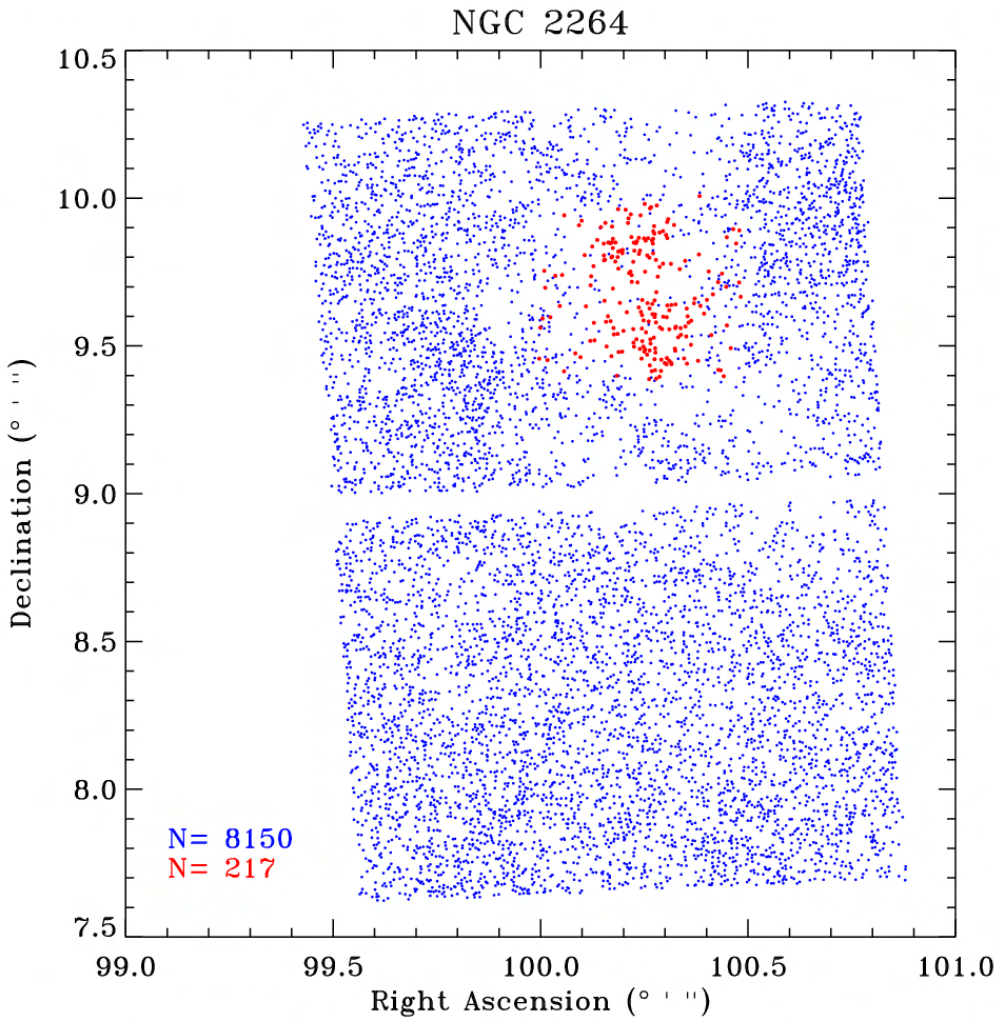
217 known members

(see P-XII 113 by Micela et al.)

catalogue periods for

156 members

(Lamm et al. 2004)



A test case: NGC 2264

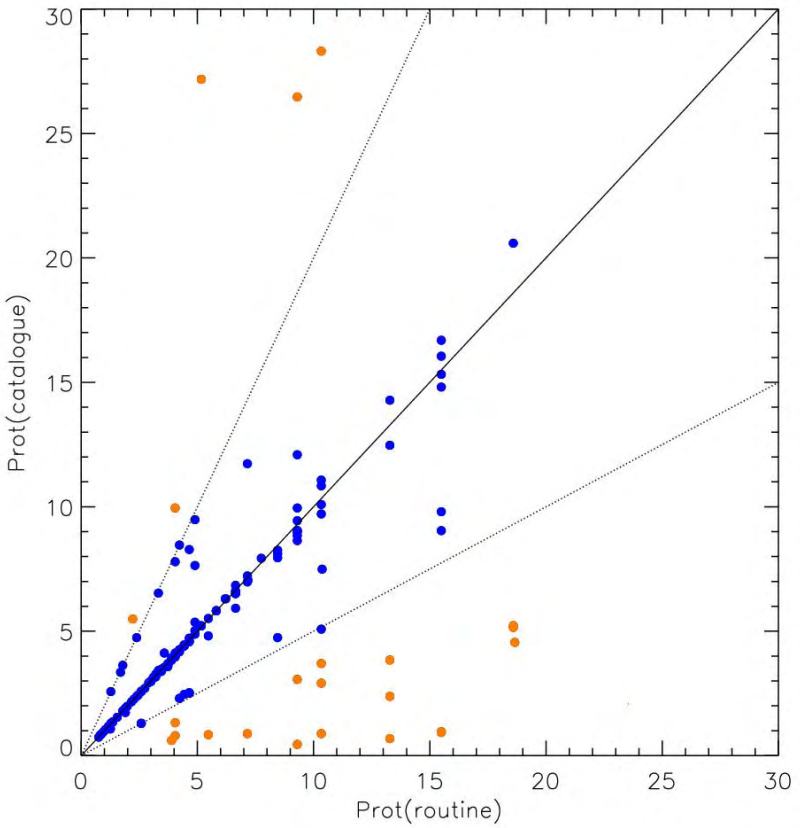
Check:

Prot(routine) vs Prot(catalogue)

(Lamm et al. 2004)

156 LCs

(150 selected, 6 rejected)

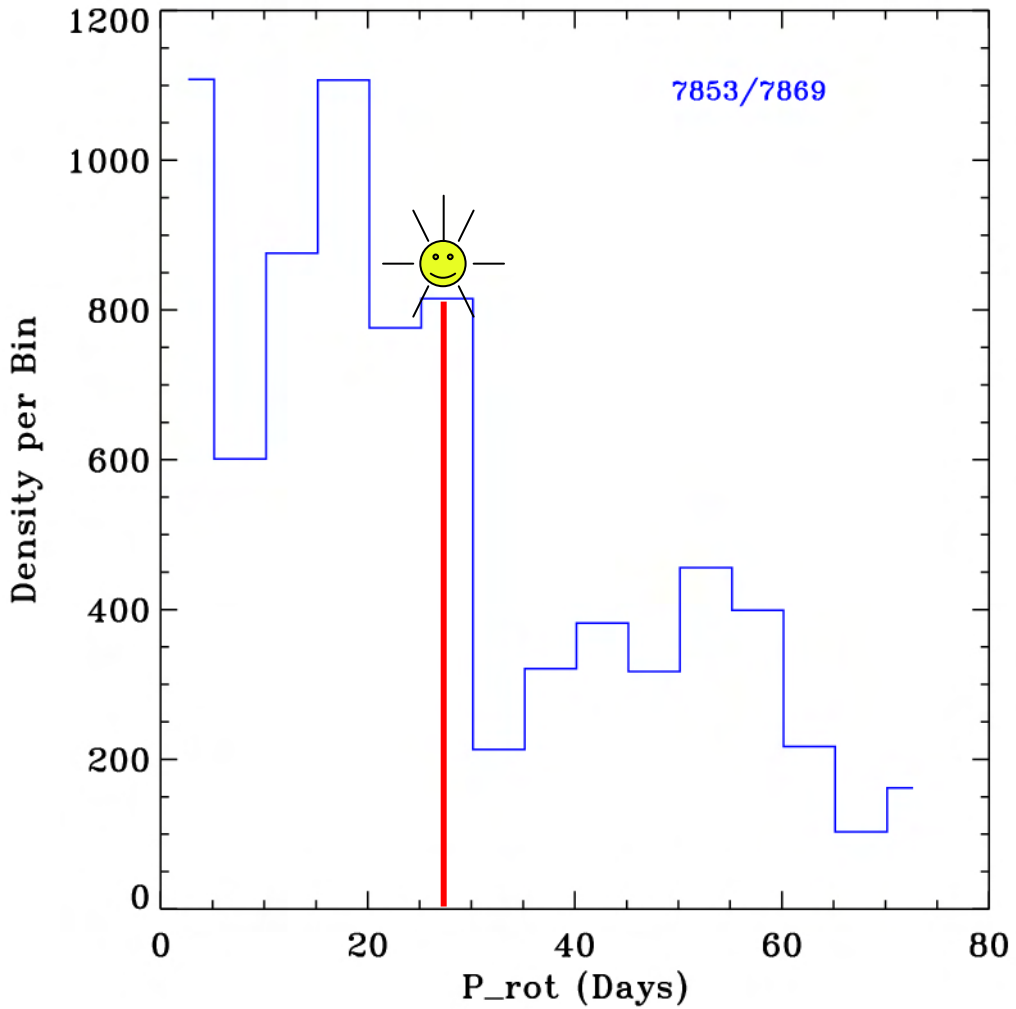


derived periods well agree with published ones (within a factor 2)

Rotational Periods

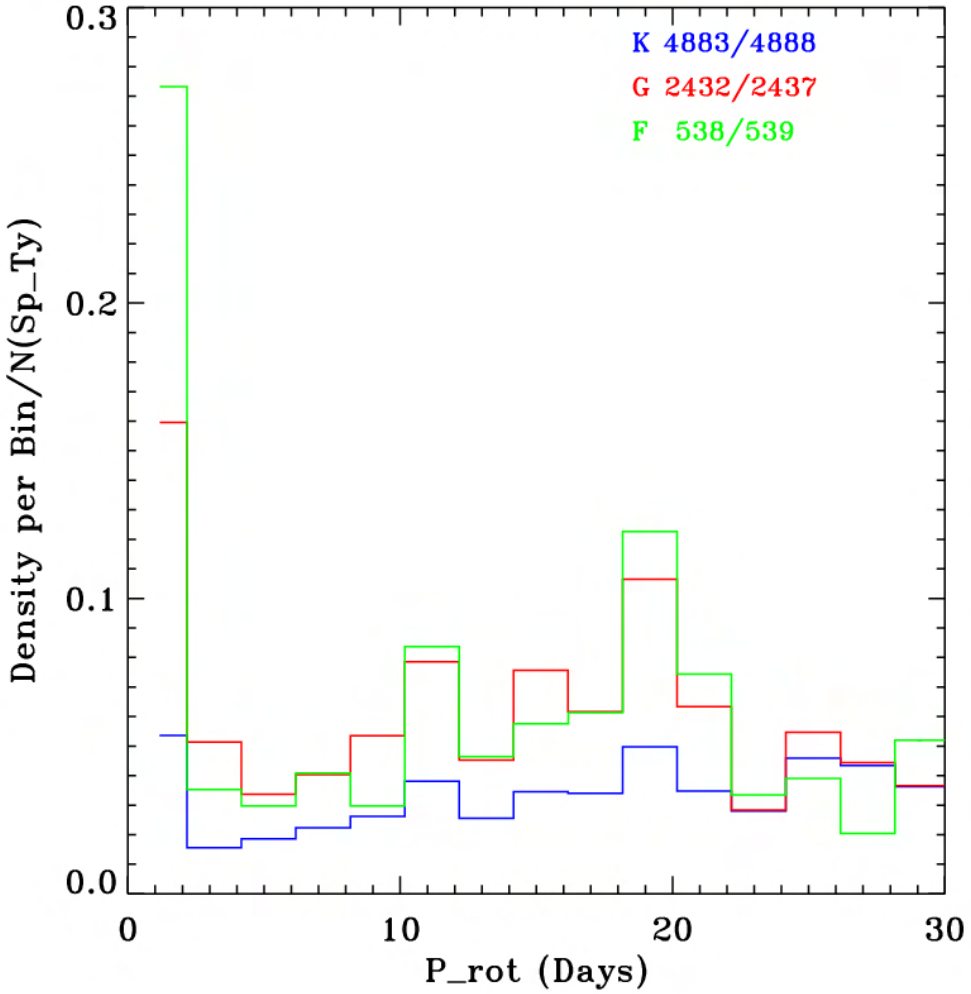
Scientific goal: Selection of fast rotating stars

Young stars → Recent star formation history in the solar neighborhood



Rotational Periods

~53% F-type ~50% G-type ~19% K-type with P_rot < 15 days



Rotation-Age Calibration

(Gyrochronology Relations)

We assume:

1. constant star formation rate in 10^{10} years
2. rotation = f(age)

$$P(B-V,t) = f(B-V)g(t)$$

$$f(B-V) = a[(B-V)_0 - c]^b$$

$$g(t) = t^n$$

Parameter	Value
a.....	0.407 ± 0.021
b.....	0.325 ± 0.024
c.....	0.495 ± 0.010
n.....	0.566 ± 0.008

(Barnes 2007; Mamajek & Hillenbrand 2008)

Rotation-Age Calibration

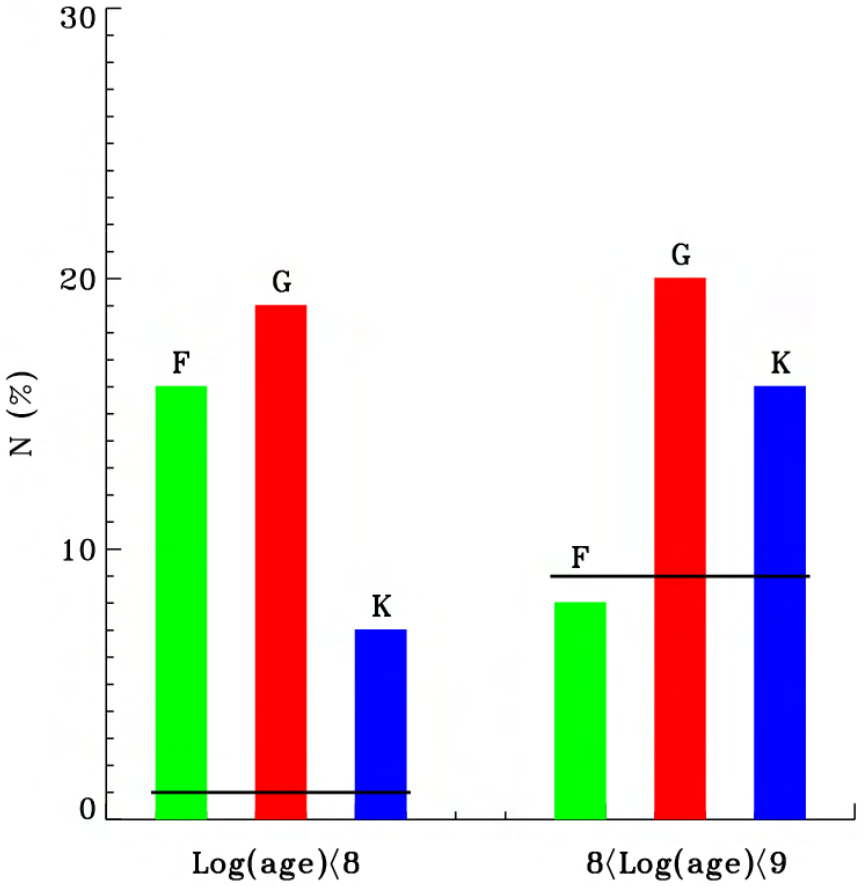
(Gyrochronology Relations)

We assume:

1. constant star formation rate in 10^{10} years
2. rotation = f(age)

excess of F, G and K-type stars with ages $t \leq 10^8$ years

excess of G and K-type stars with ages $10^8 < t \leq 10^9$ years



burst of star formation?
in agreement with X-ray surveys results!

Next steps

Spectroscopic follow-up observations of candidate young stars with P_{rot} < 15 days are needed

Spectroscopic analysis:

Lithium abundance

Metallicity

Radial velocity

to disentangle tidally locked binaries from young stars amongst fast rotators