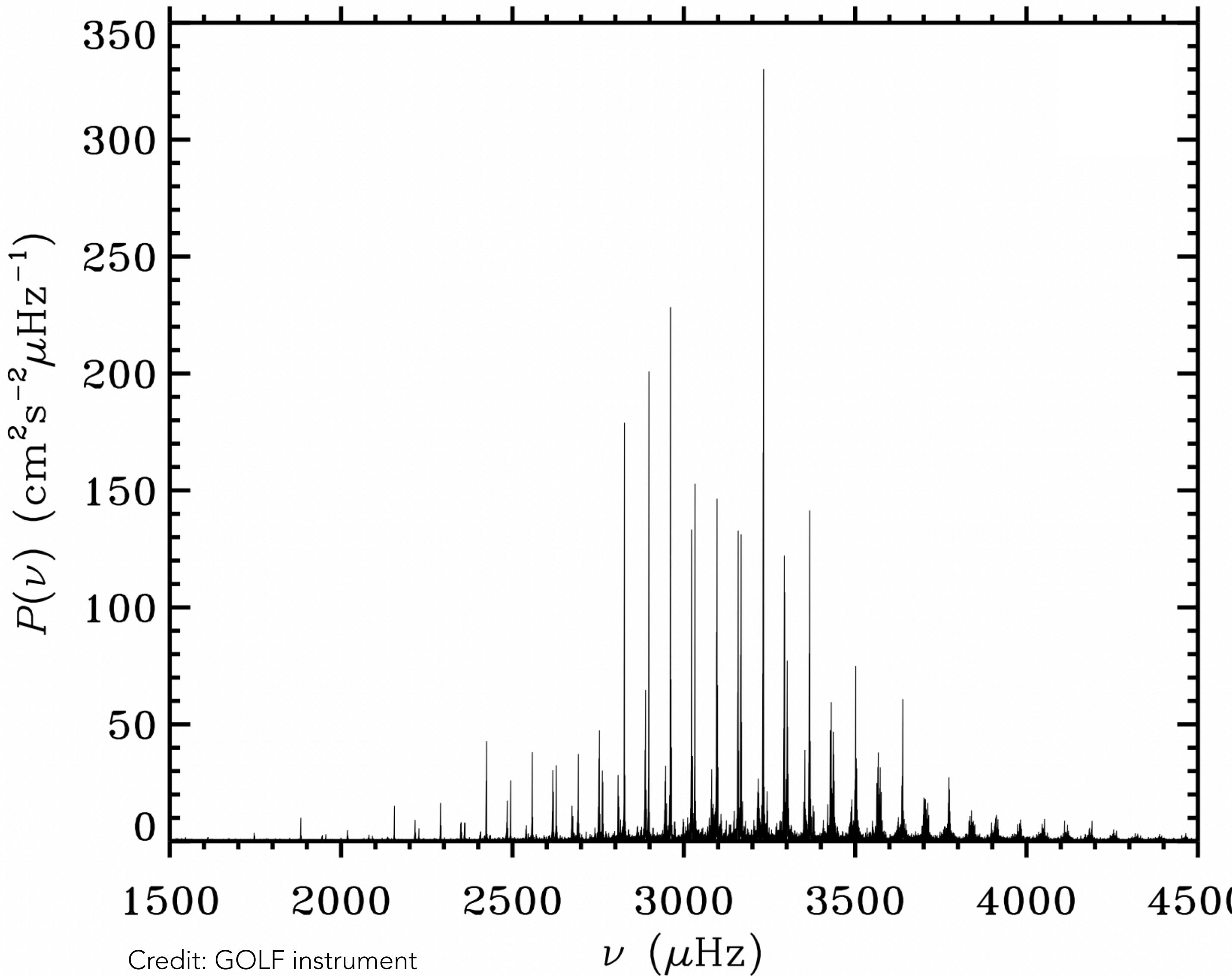


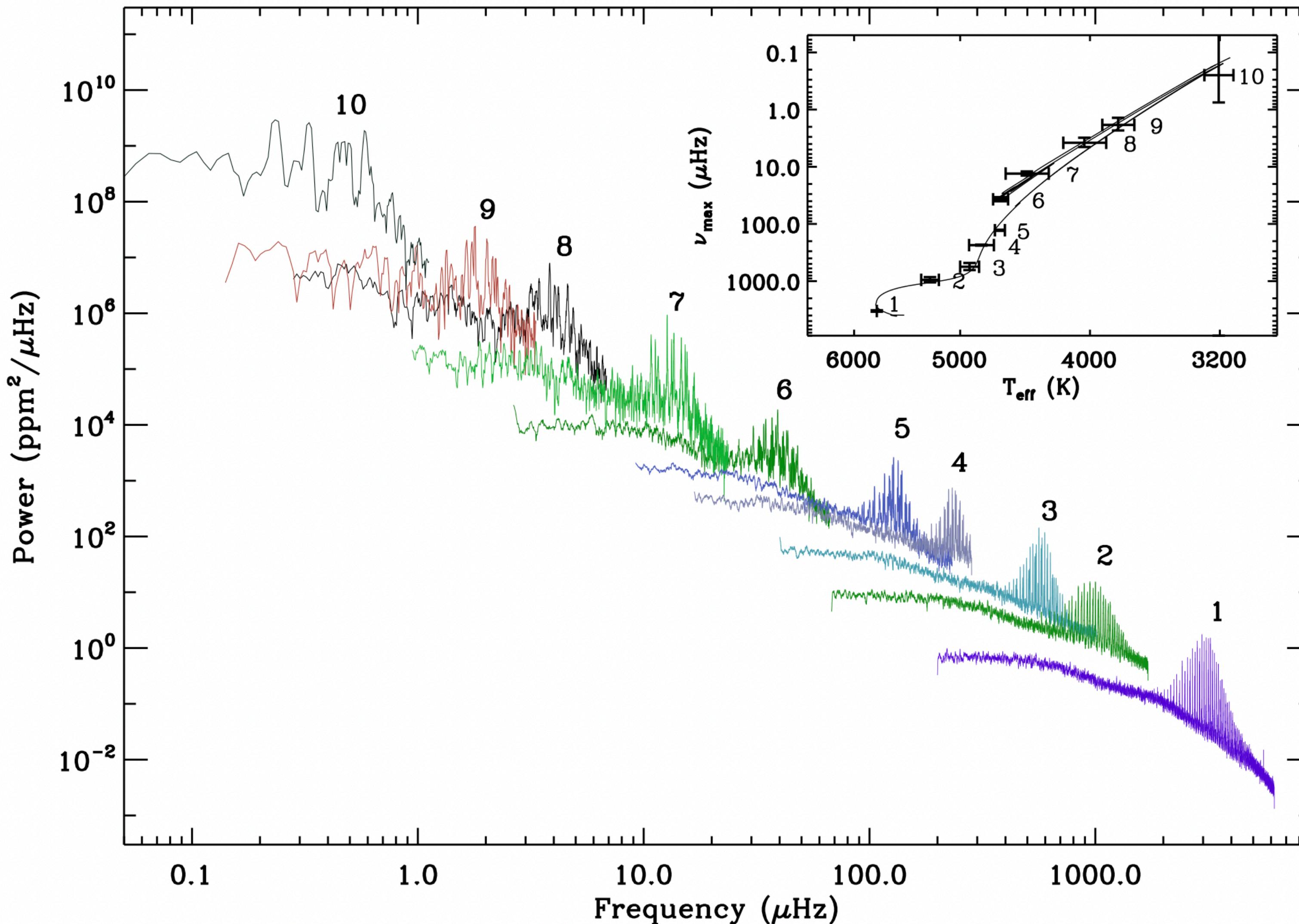
Oscillations in the Sun: helioseismology



- Fourier-like transform:
oscillation spectrum;
- Period of the oscillations: ≈ 5 min;
- Results: **BCE, internal rotation, corrections** to the EOS and κ, Y in the convective envelope, etc.



Solar-like oscillators

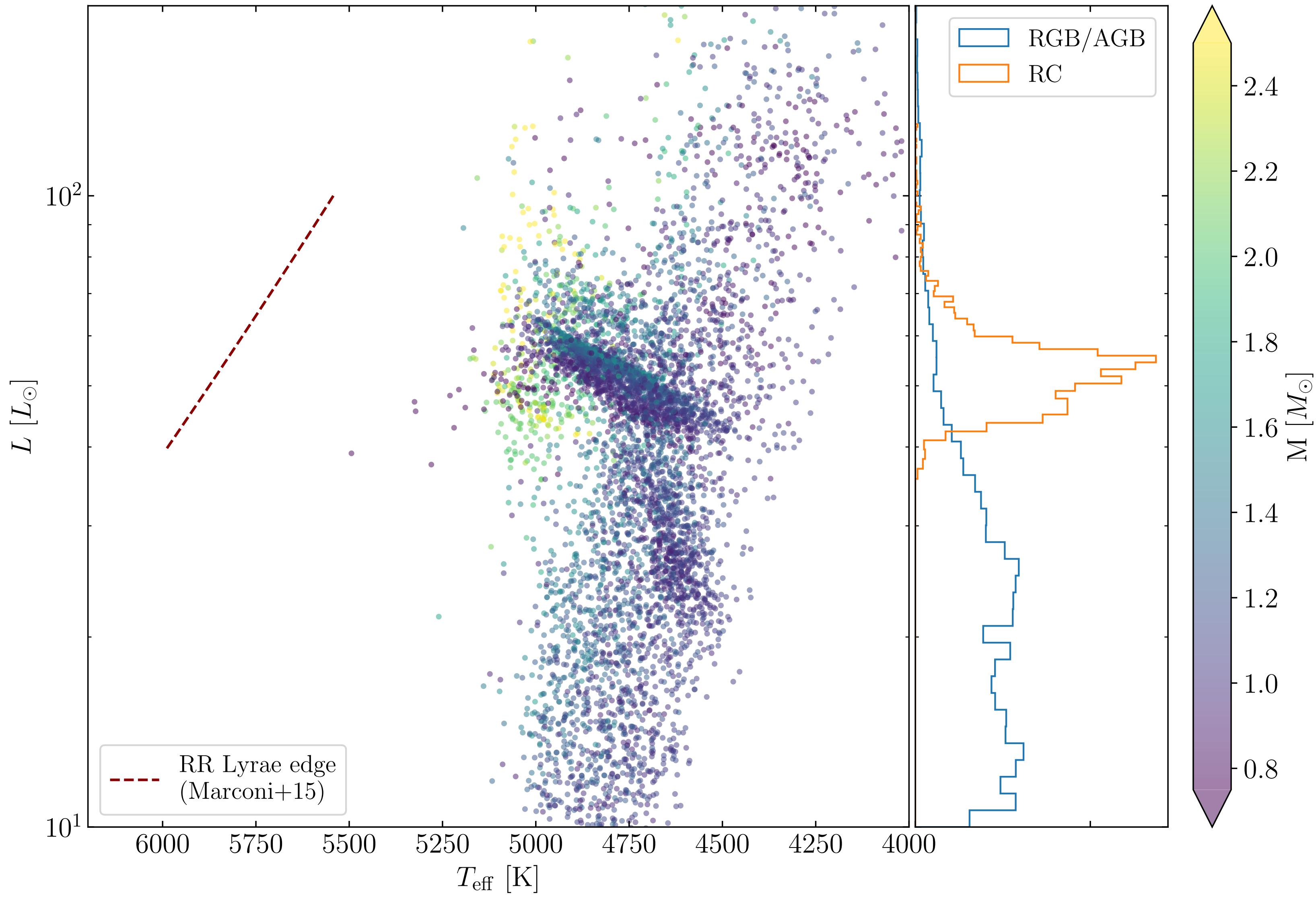


Credit: García et al. 2018

- Red giants: convective envelope;
- Periods: from hours to days;
- Background: faculae, granulation, star activity, photon noise.



Kepler photometric data

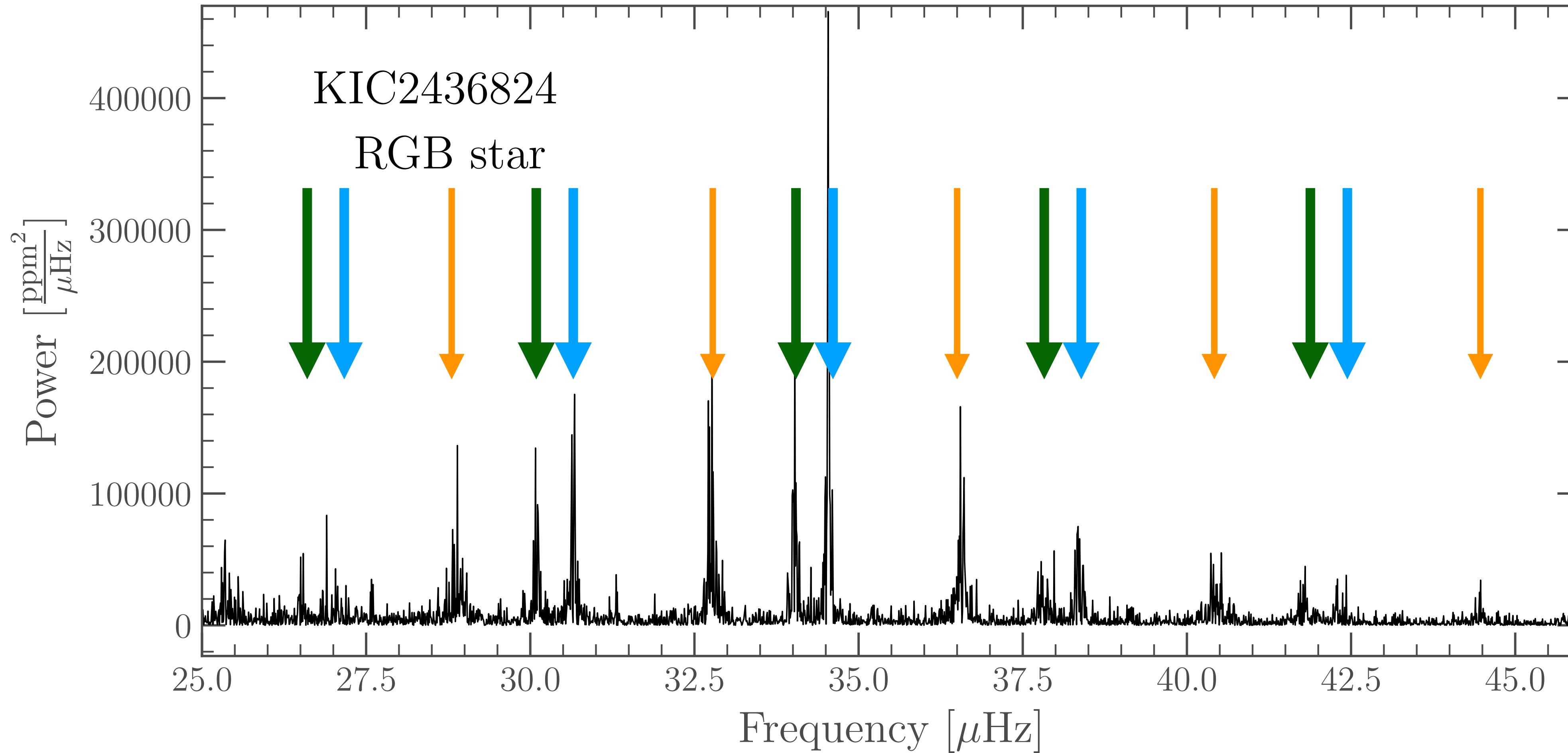


- $\approx 150,000$ stars observed simultaneously for ≈ 4 years;
- $\approx 20,000$ red-giant stars with solar-like detections (e.g. Hekker et al. 2011; Yu et al. 2018; Kallinger 2019);
- Precise M: **robust** inference of their **ages** (constrain the Milky Way evolution: e.g. Miglio et al. 2021; Montalbán et al. 2021).



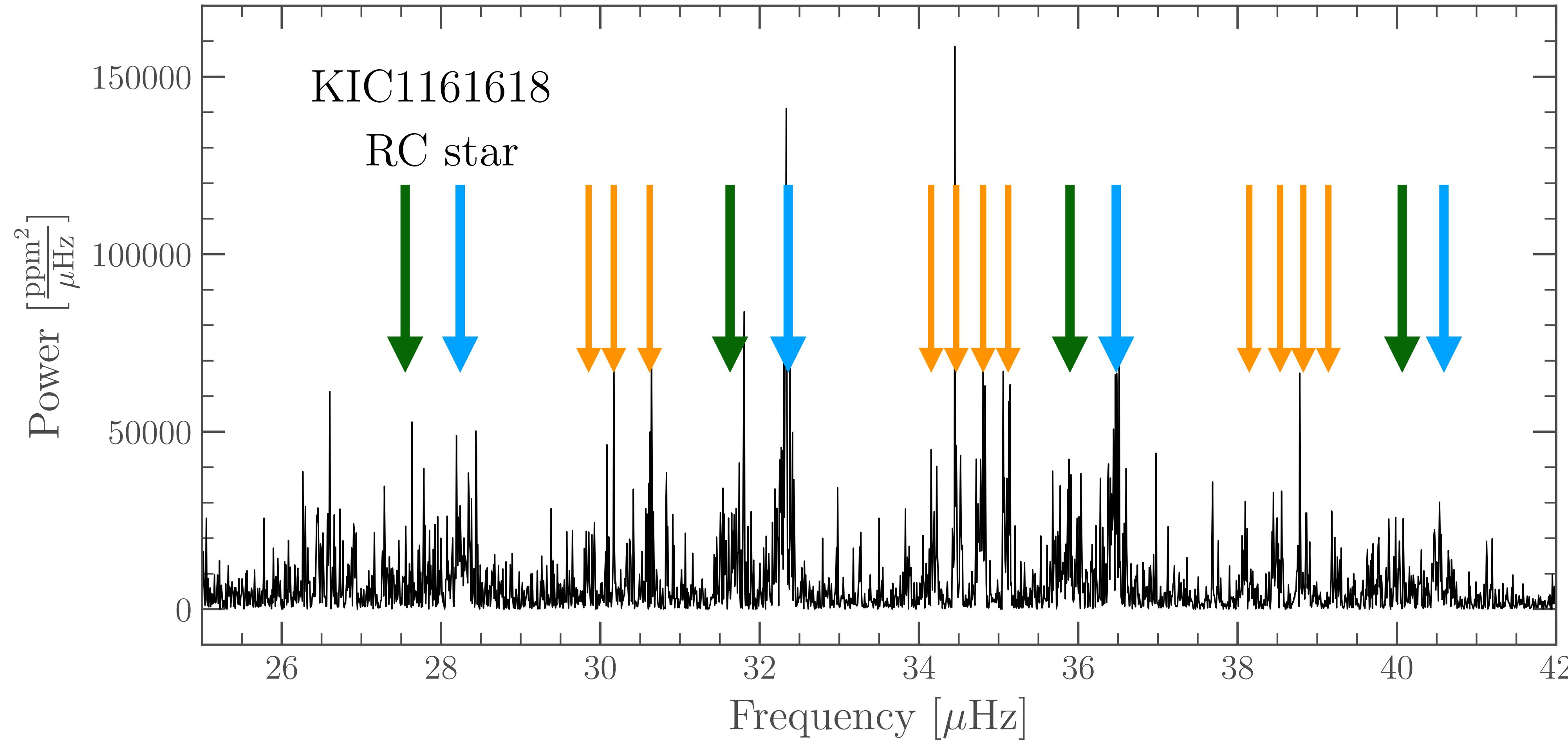
Red giant branch star spectrum

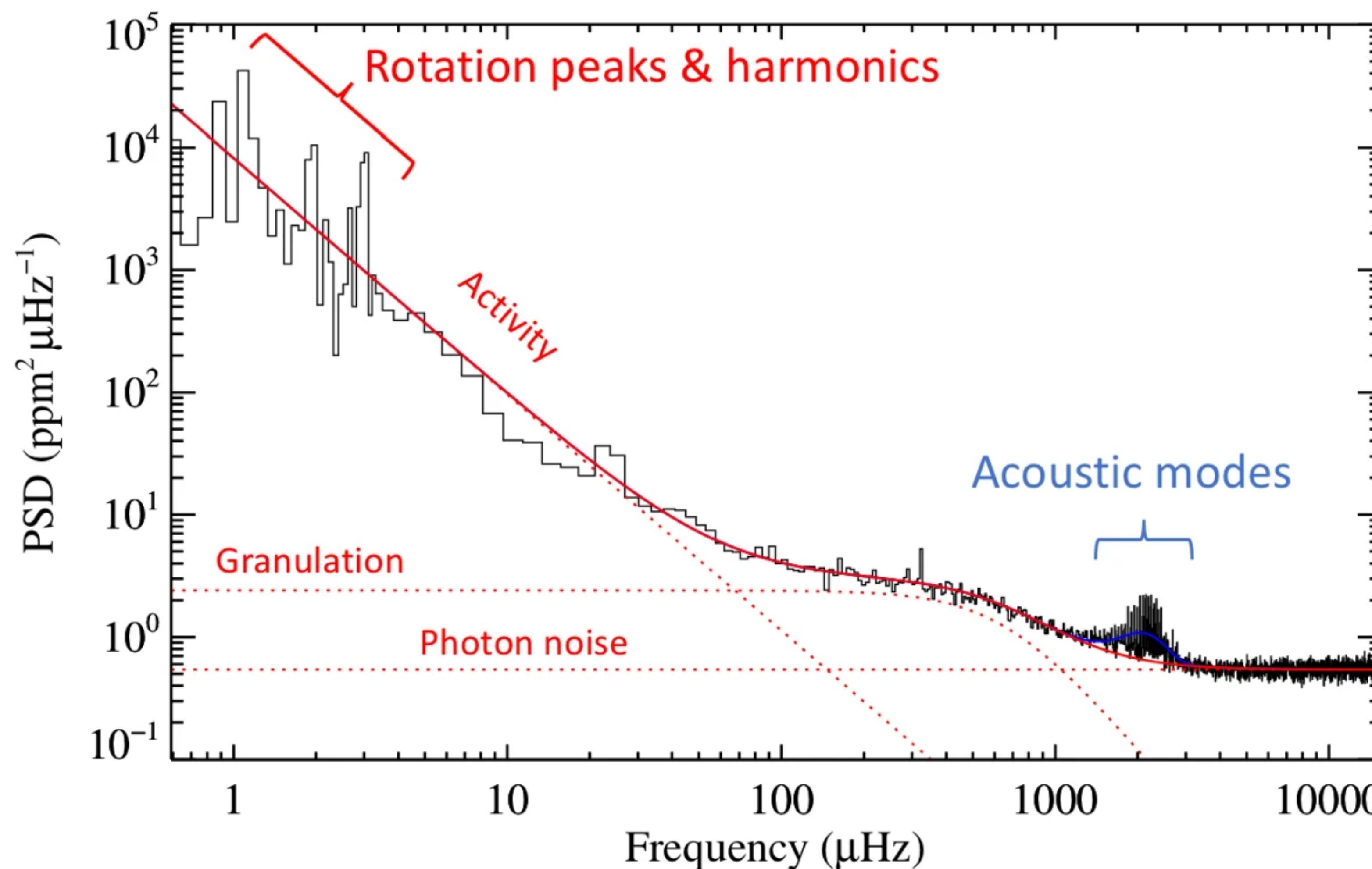
$\ell = 0, 1, 2$ modes visible (4-yr observations with Kepler)



Red clump star spectrum

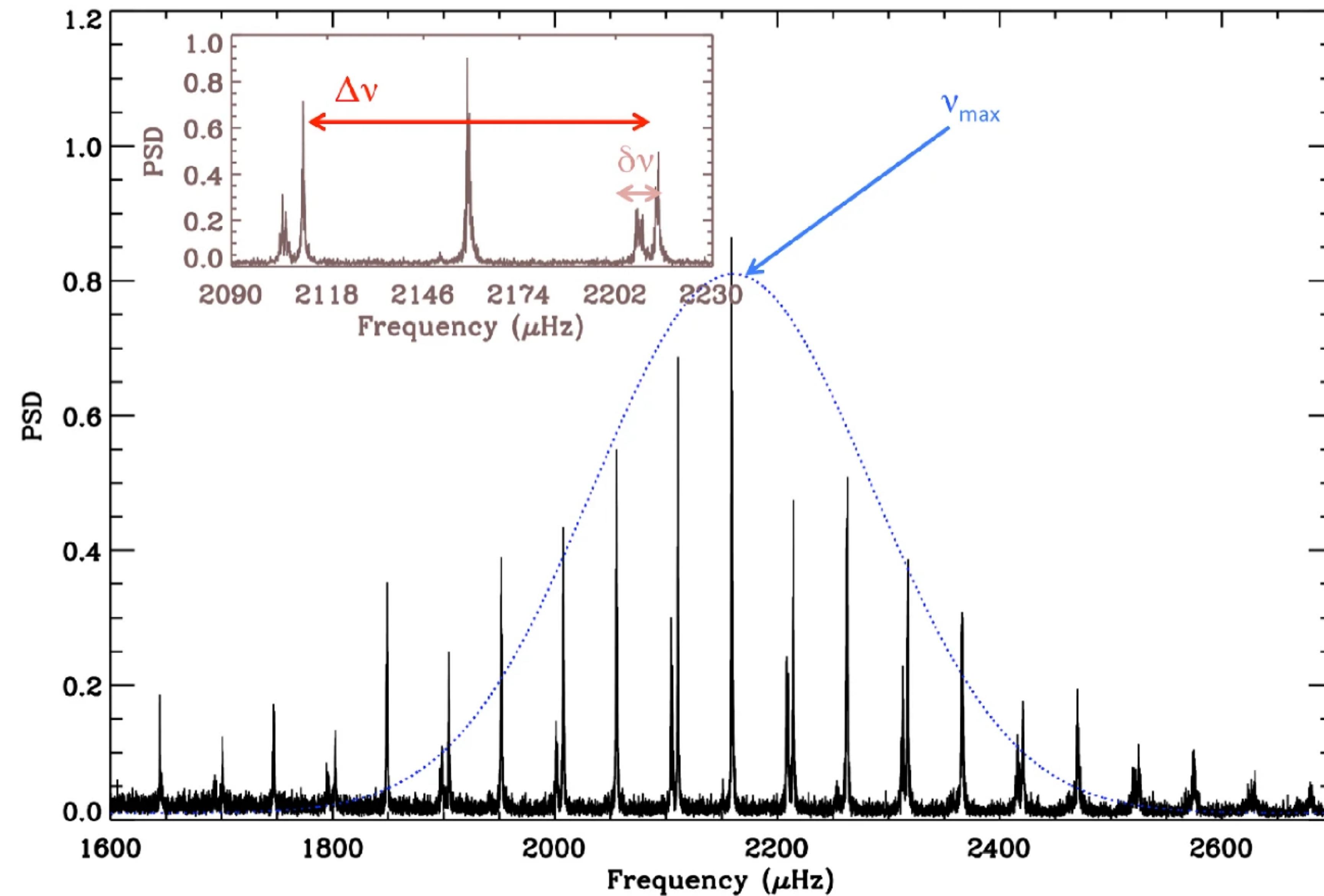
$\ell = 0, 1, 2$ modes visible (4-yr observations with Kepler)





Credit: García et al. 2019





Credit: García et al. 2019

