

# Asteroseismology: Science Vision for stellar structure

T.Appourchaux

Solar and Stellar Physics Department,  
Institut d'Astrophysique Spatiale, Orsay

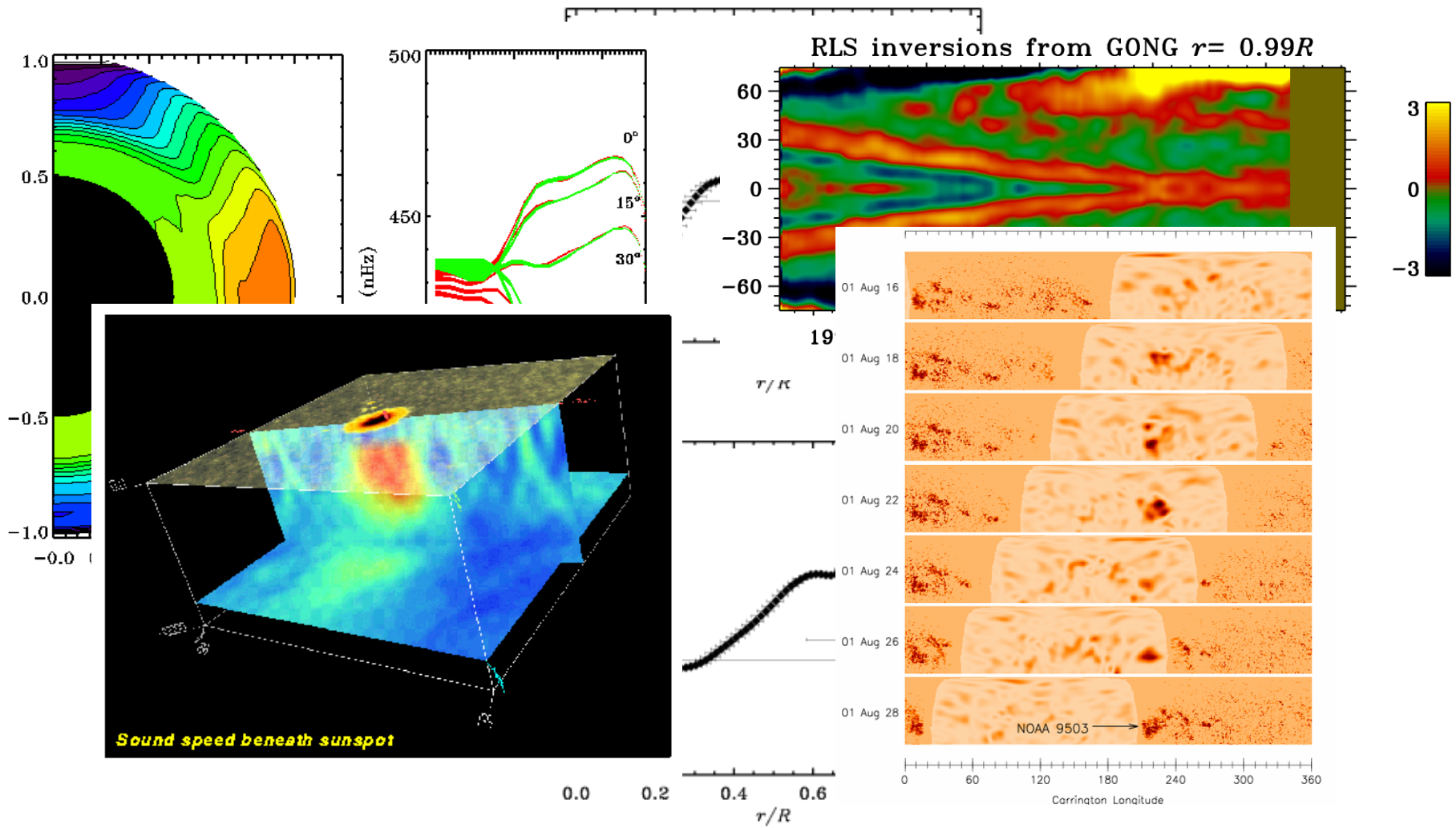
J.Christensen-Dalsgaard

Institut for Fysik og Astronomi

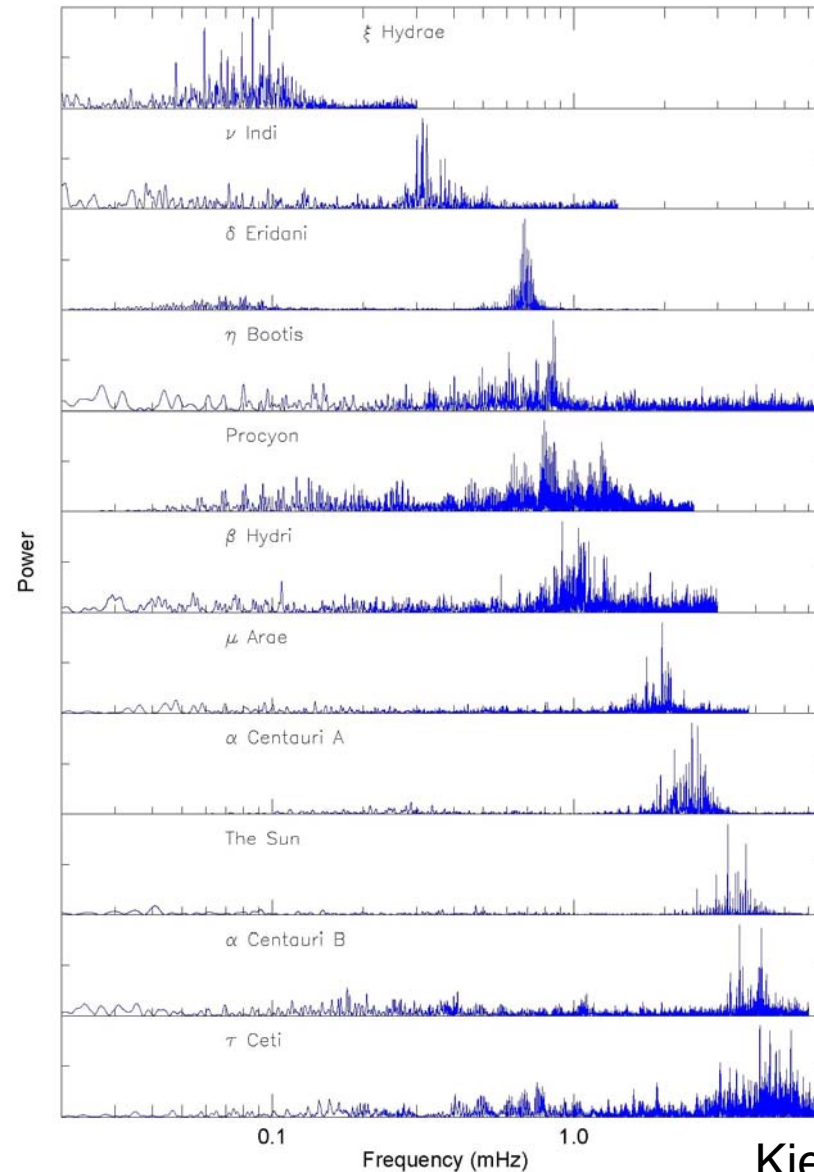
Aarhus Universitet

Dansk AsteroSeismologisk Center

# Helioseismology is Revolution !

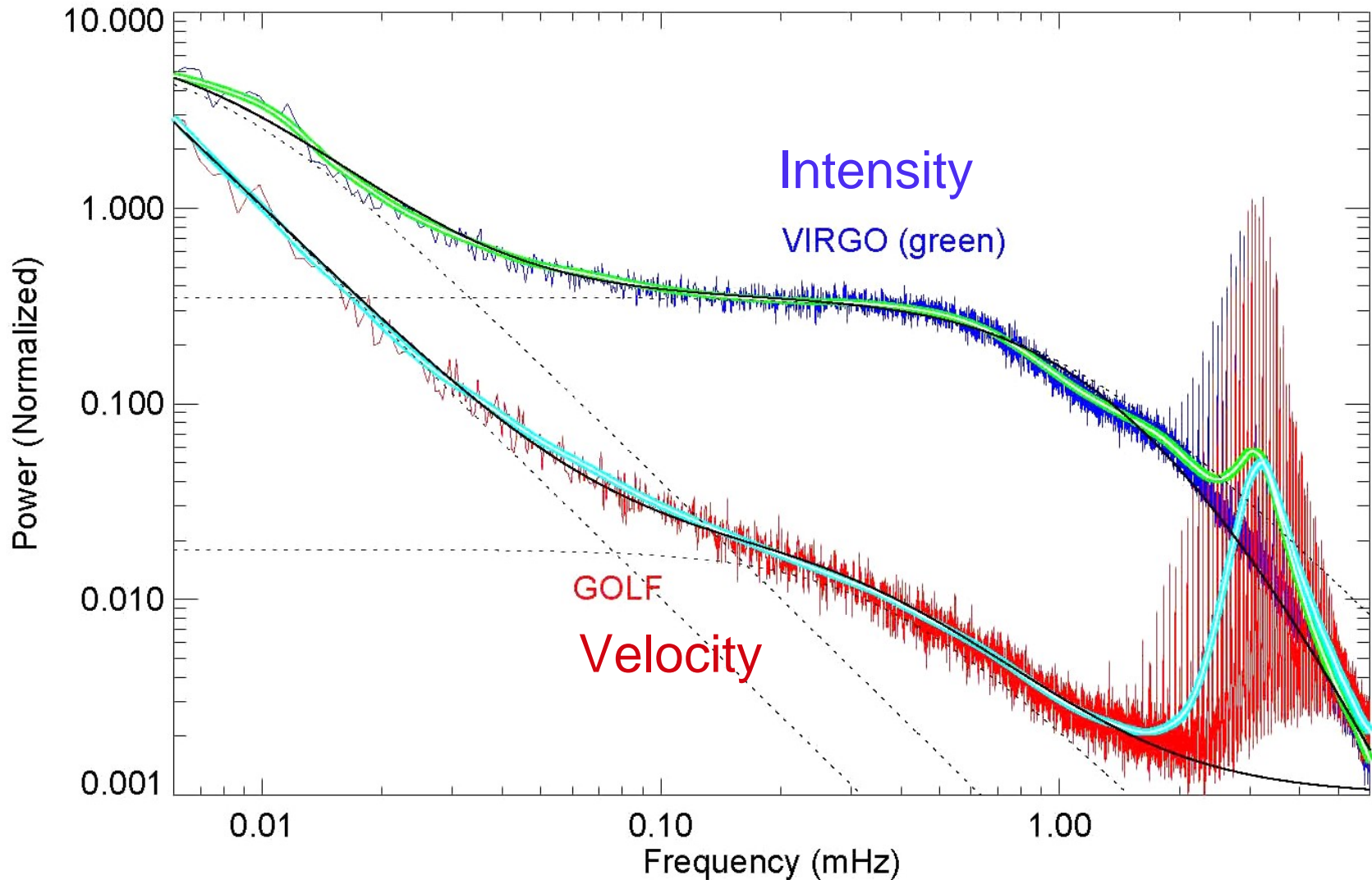


# Stars do oscillate!

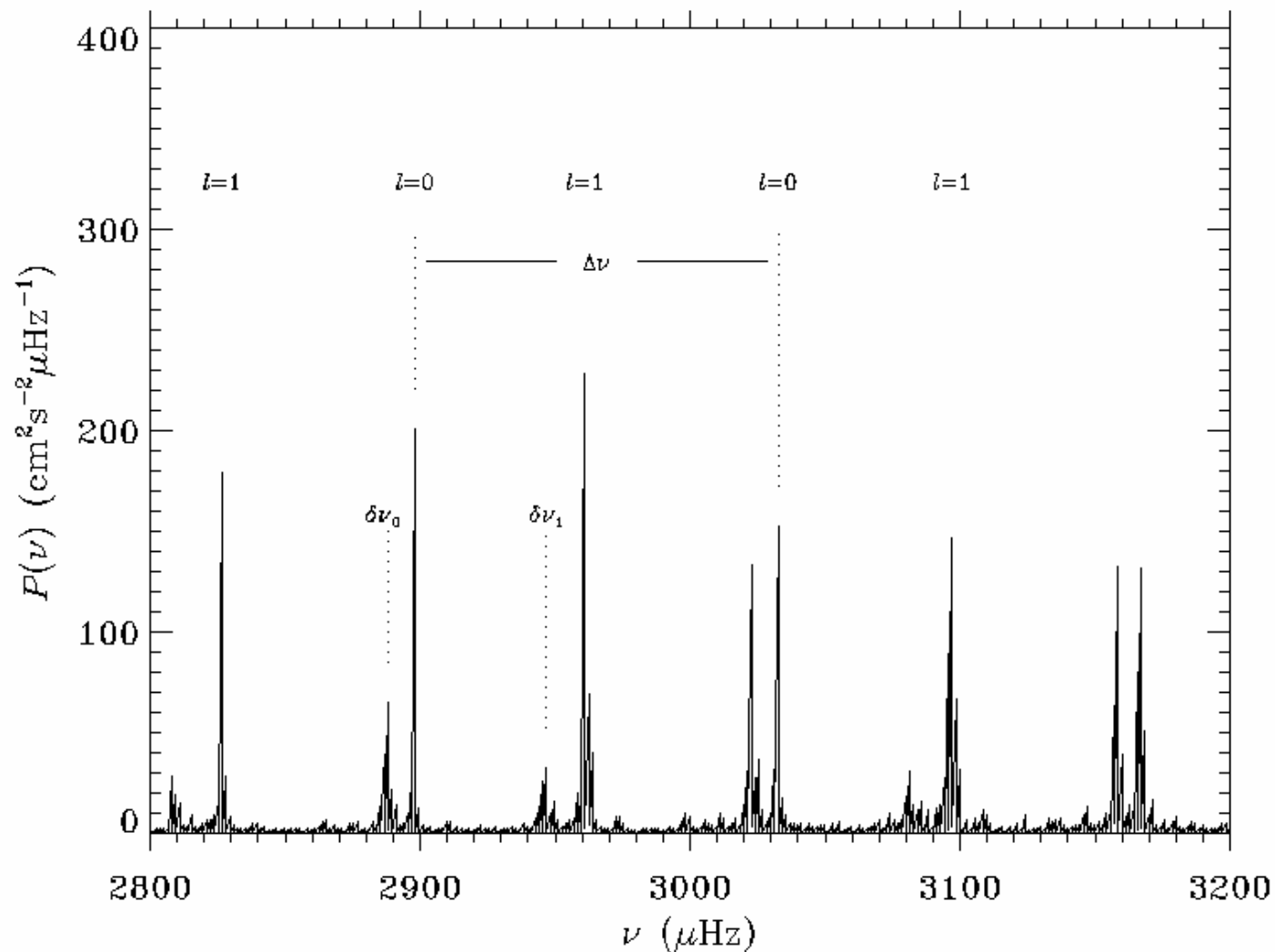


Kjeldsen & Bedding (2005)

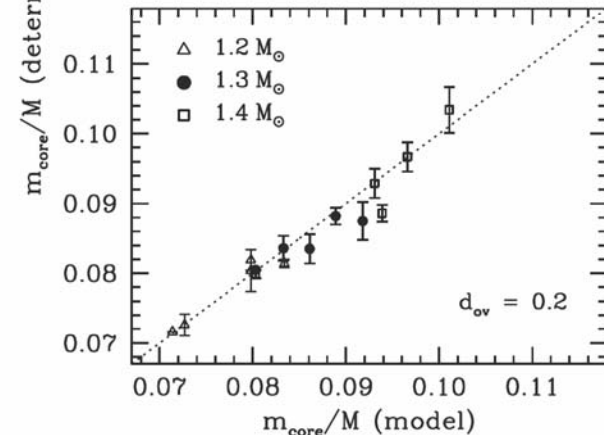
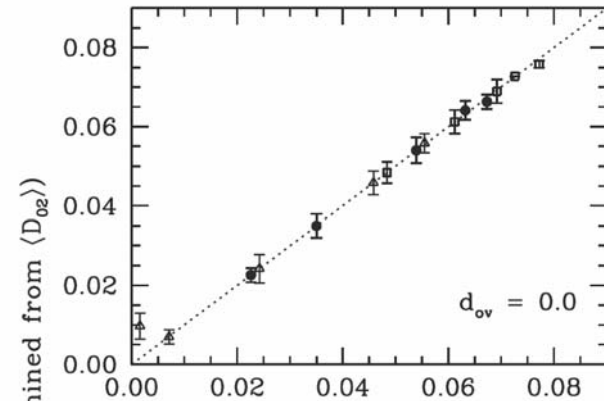
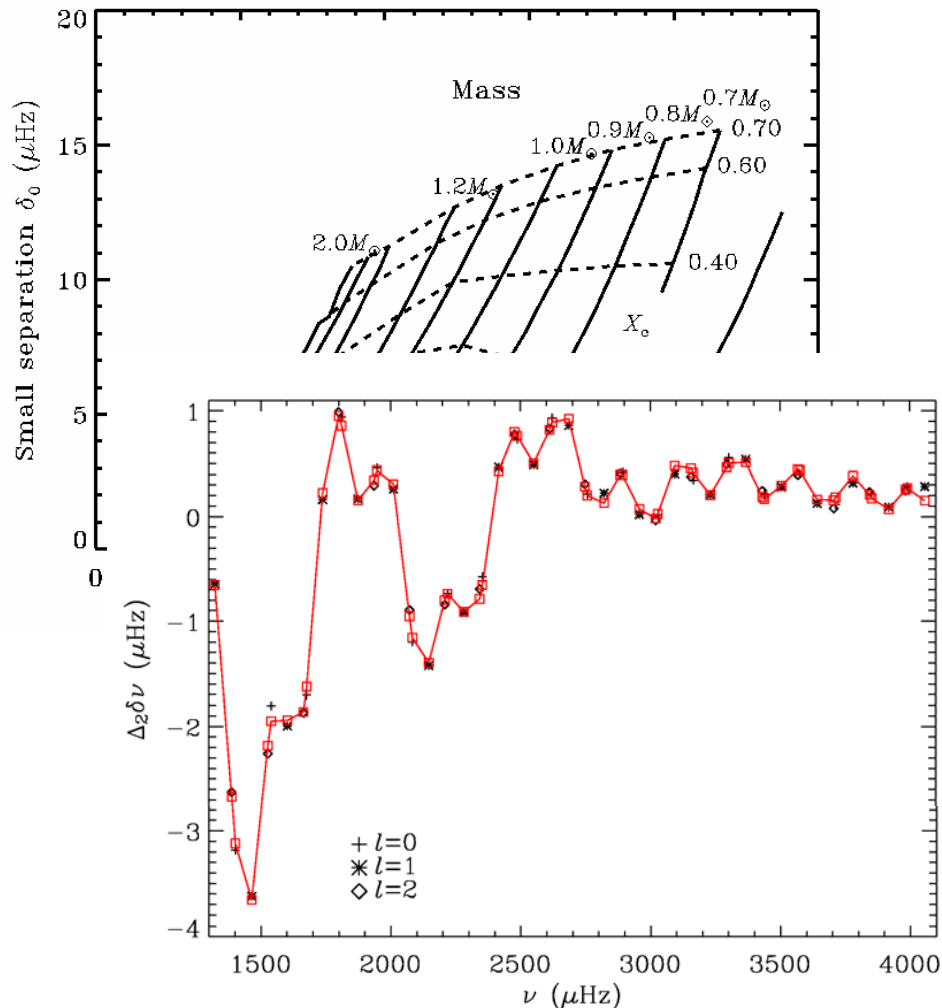
# Helioseismology with SOHO



# Seismic diagnostics



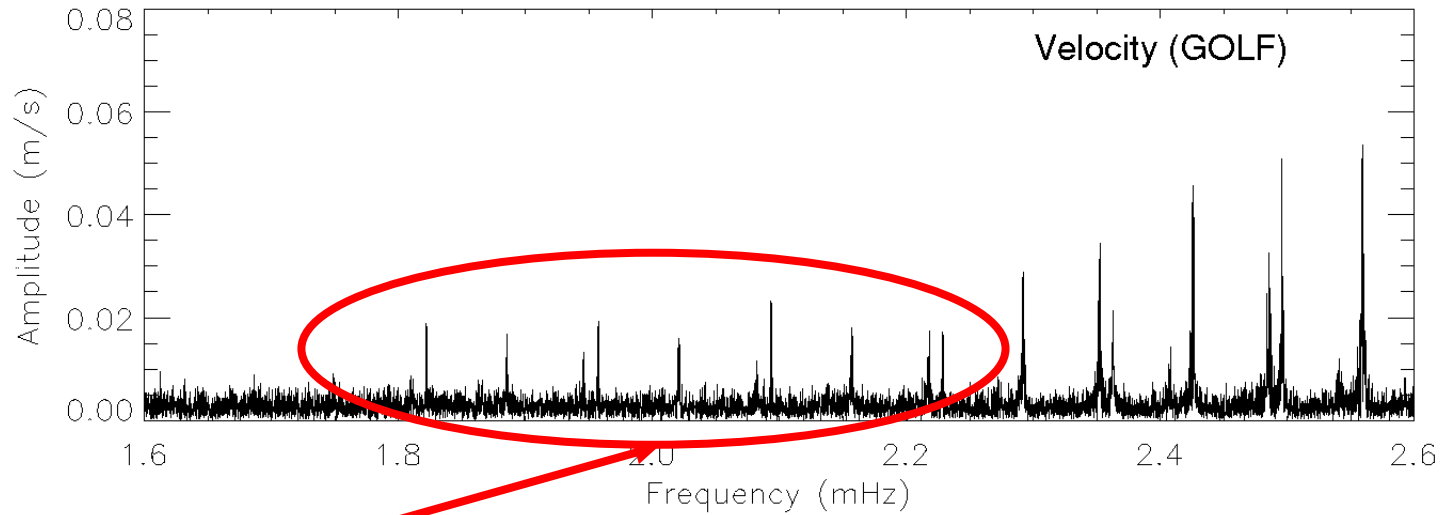
# Asteroseismology is Revolution !



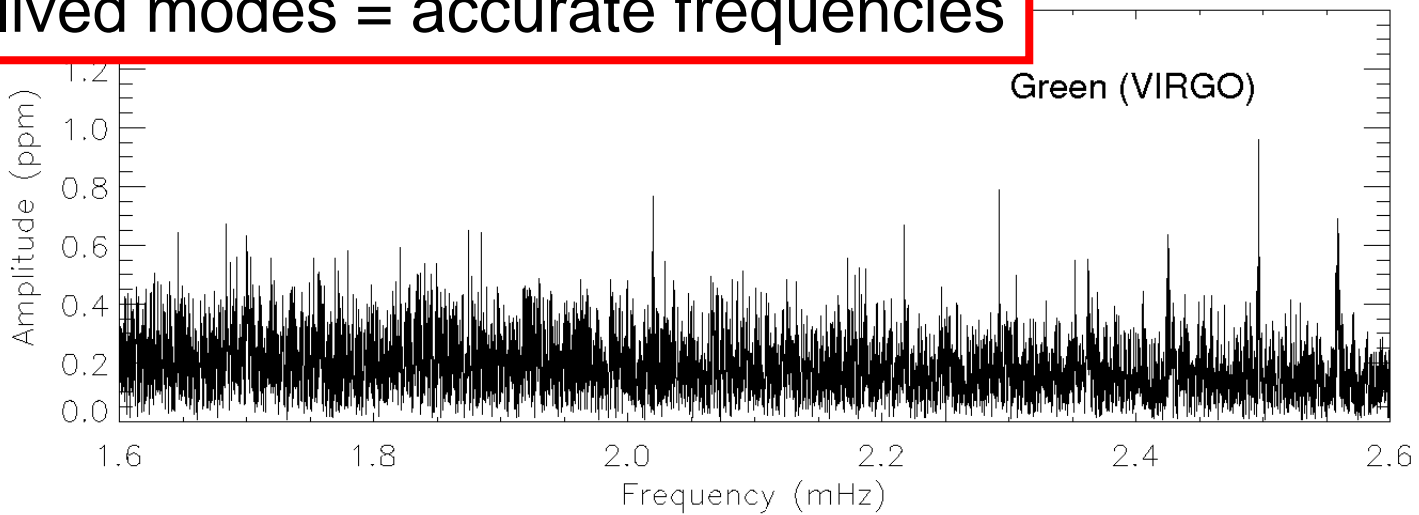
# Scientific objectives

- Age determination: binaries, evolved stars
- Composition, etc... : clusters (age common)
- Stellar radii (impact for exoplanet radii)
- Diagnostic of convective cores
- Depth of convection and of second Helium ionization zones
- Rotation and internal structure
- Excitation mechanisms (convection)
- If images: tomography of differential rotation (interferometry)

# Intensity vs Velocity: the solar case



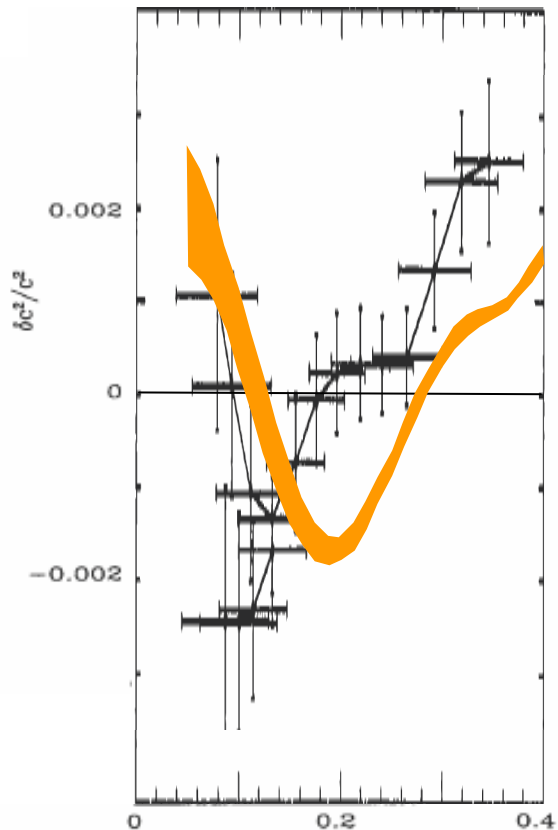
Long-lived modes = accurate frequencies



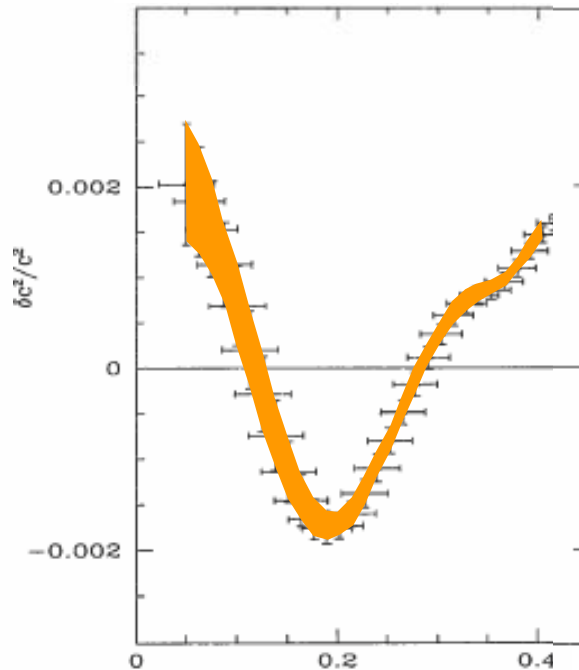


# The impact on inversions

VIRGO / Intensity



GOLF / Velocity



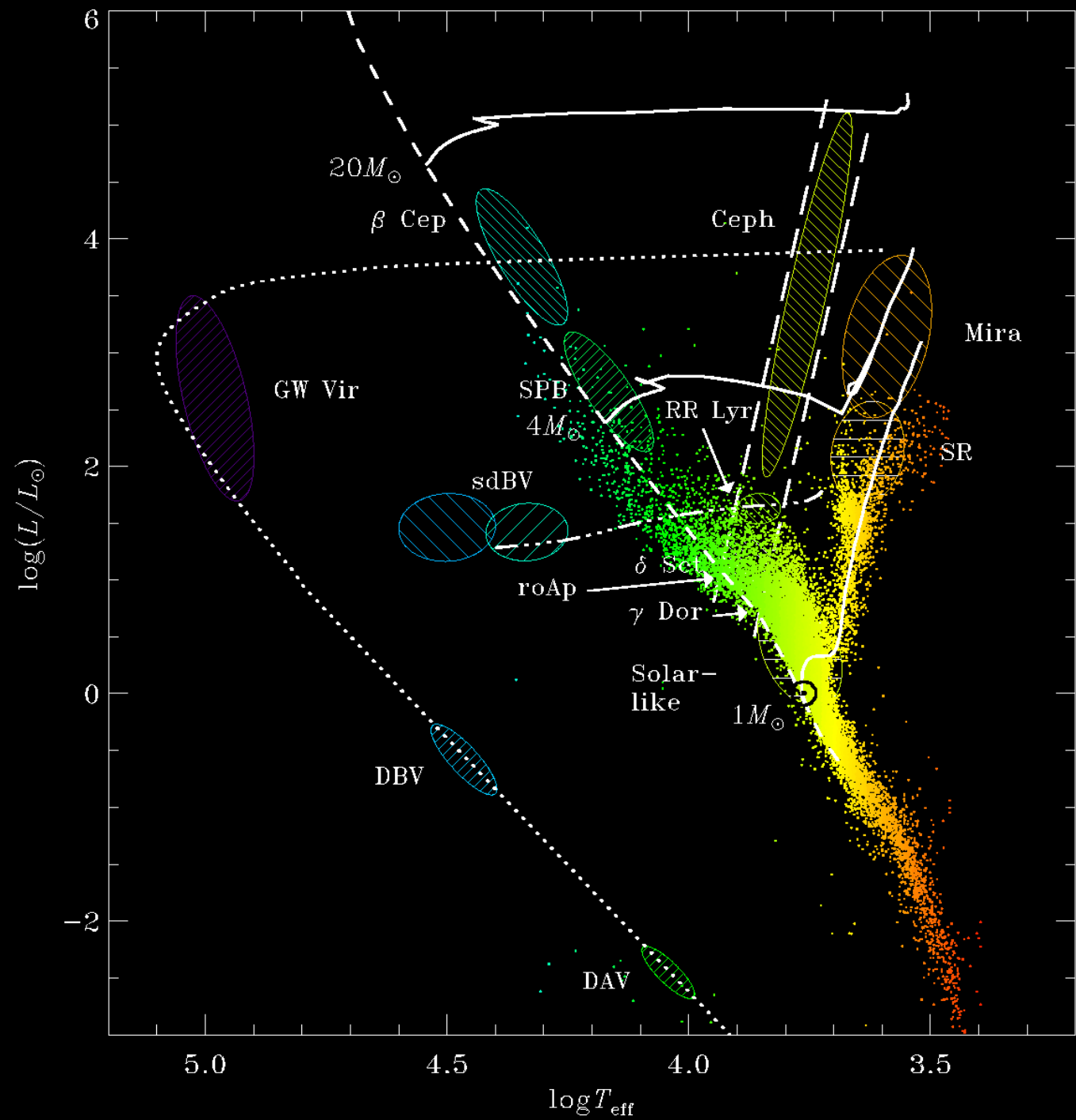
Adapted from Appourchaux et al and Gabriel et al (1996)

# What do we need?

- Long observations ( $> 3$  months to years)
- Spectroscopy (stellar radial velocities)
- Good sky coverage (network, Antarctica)
- Limited day-night interruptions (space, Antarctica)
- Stars with good parallaxes, good characteristics determination (Hipparcos and GAIA stars, binaries, open clusters)
- Images of stellar surfaces

# Asteroseismology: a road map

- Intensity observations:
  - Multi-objects (CoRoT)
  - Cluster, multi-objects, faint objects (Kepler, PLATO)
- Stellar radial velocities:
  - Bright objects (Dedicated network, single site instrument in Antartica)
- Stellar images:
  - Interferometry leading to precise inversion for stellar structure and dynamics, rewarding like the Sun!
- Supported by GAIA !



# Intensity vs Velocity: the solar case

