



STAR WORKSHOP

ASTA

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**ASTROPHYSIQUE STELLAIRE THEORIQUE ET
ASTEROSISMOLOGIE**



Stellar Physics

Internal structure and evolution of stars

Modelisation

- Mass
 - Input physics (metallicity, opacity tables, ...)
 - Convection, transport processes
- age, radius, evolutionary state, ...



Asteroseismology

- Modelisation of oscillations
- Development of methods to probe the stellar interior

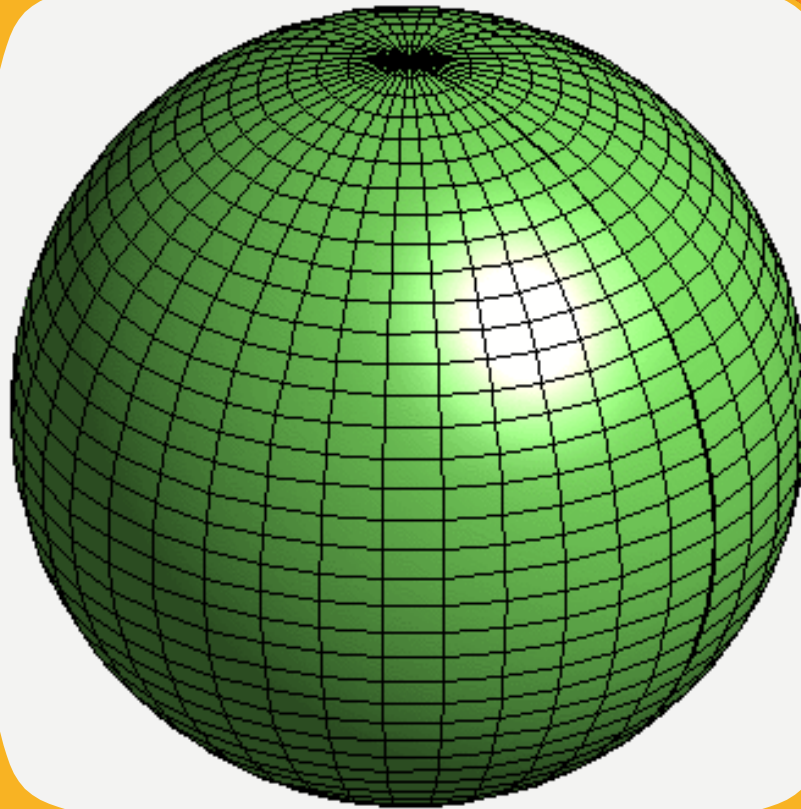
CLES, OSC, MAD

Stellar Physics

Internal structure and evolution of stars

Modelisation

- Mass
 - Input physics (metallicity, opacity tables, ...)
 - Convection, transport processes
- age, radius, evolutionary state, ...



Asteroseismology

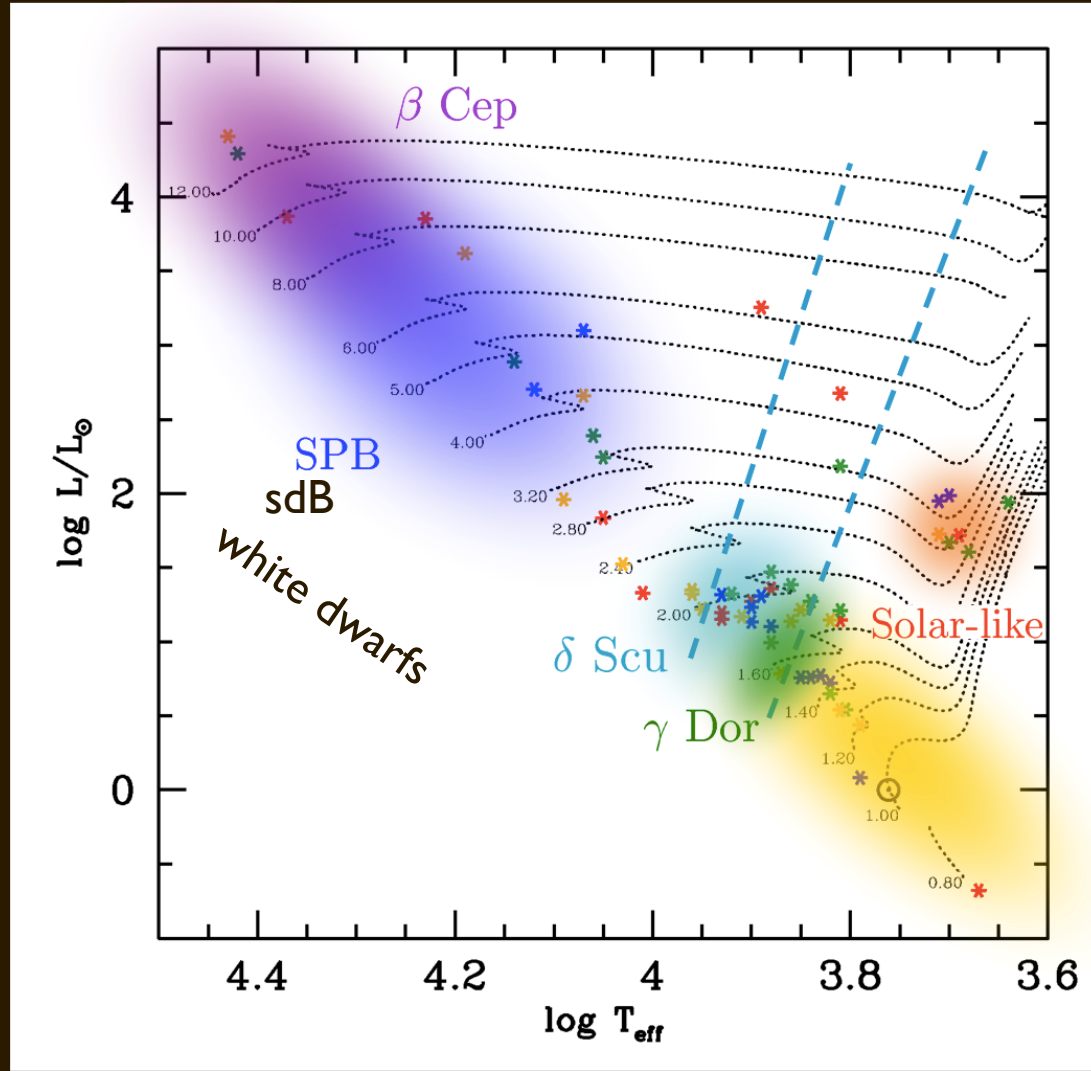
- Modelisation of oscillations
- Development of methods to probe the stellar interior

Inversion techniques

COVERING ALL THE
MAIN SEQUENCE,
AND MORE..

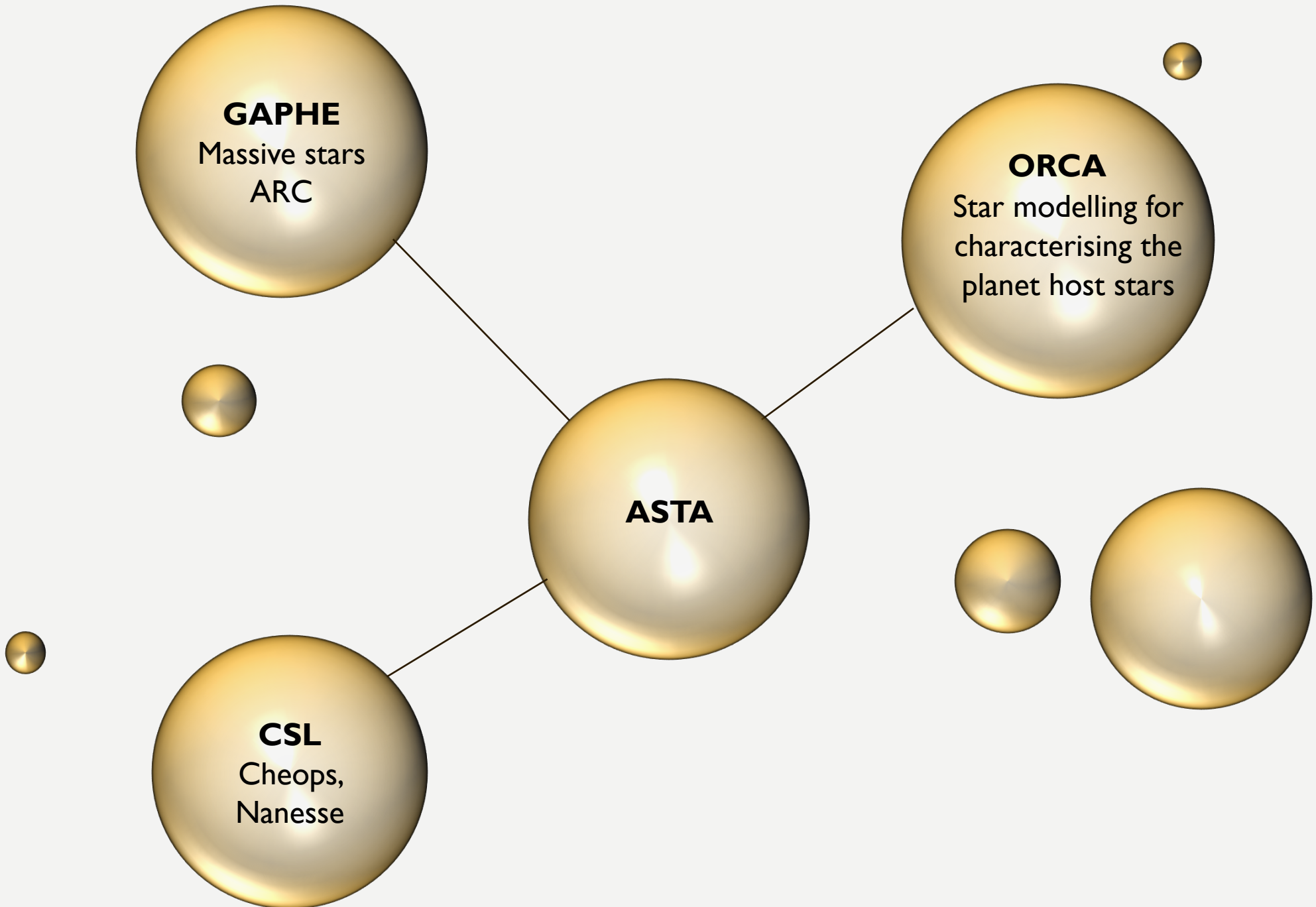
MASSIVE OB STARS
 β CEPH & SPB

SDB &
WHITE
DWARFS

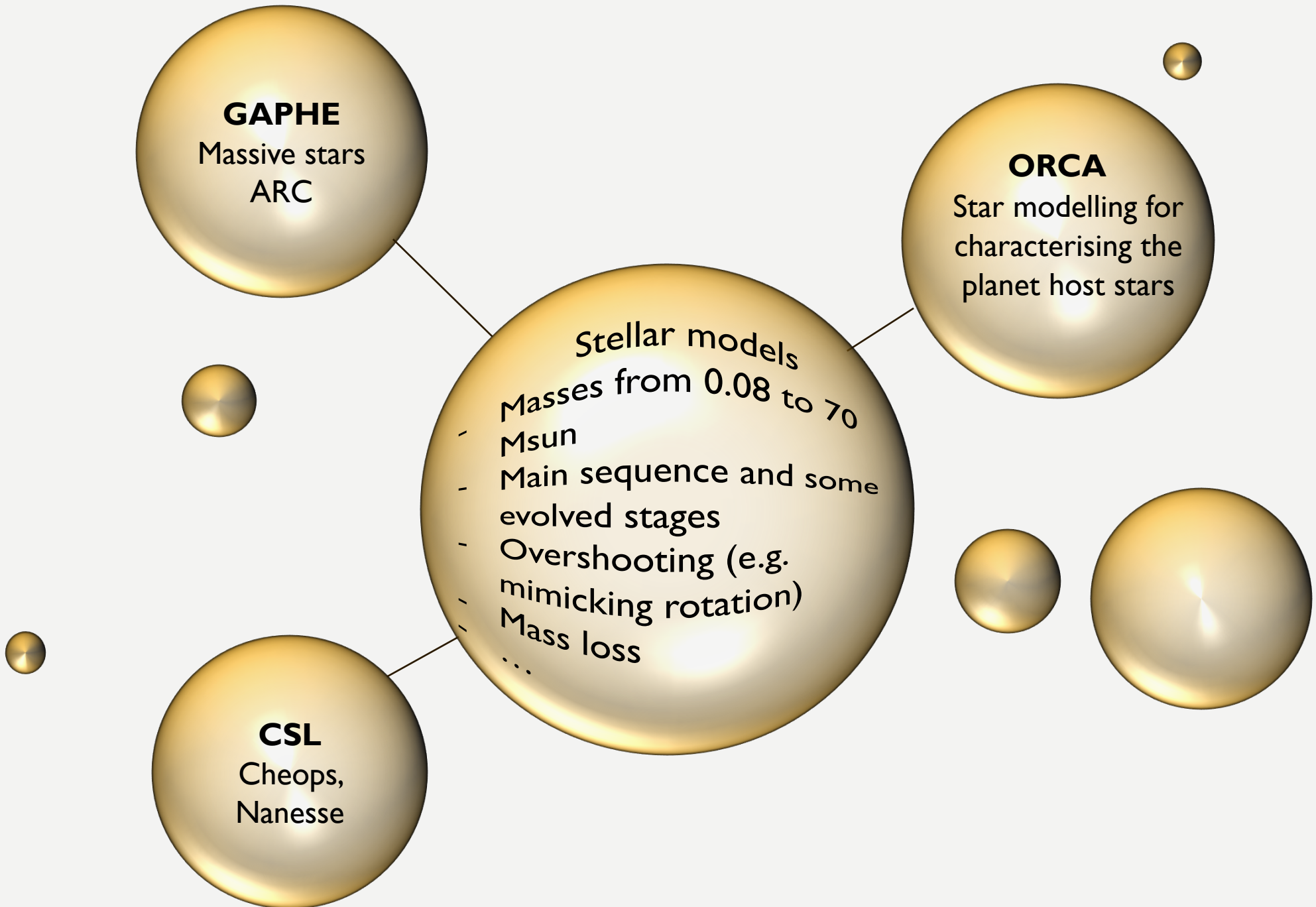


RED GIANT
STARS
 γ DOR
SUN &
SOLAR-LIKE
STARS

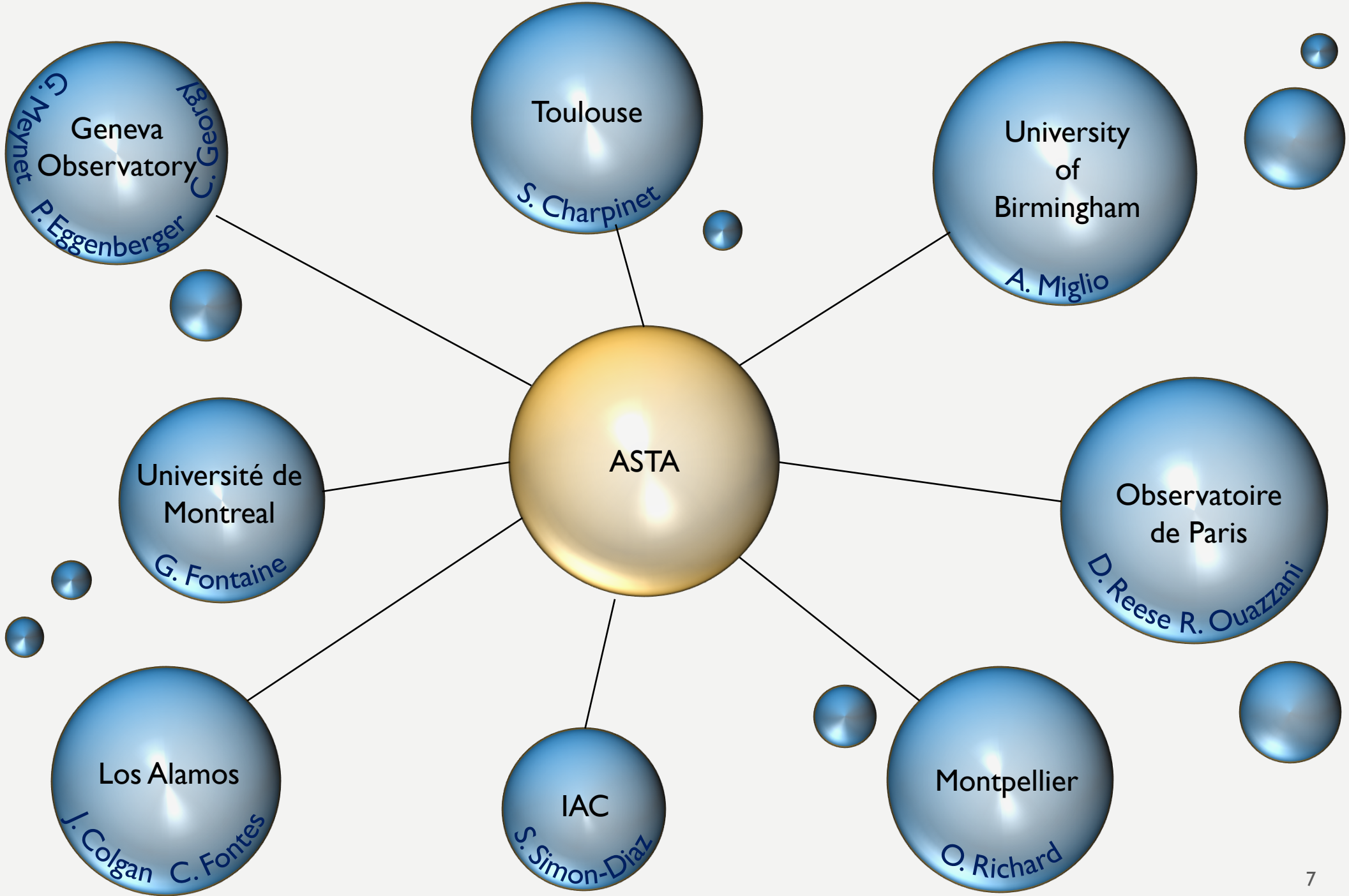
ULTRA COOL DWARFS



What we can provide!



International collaborations



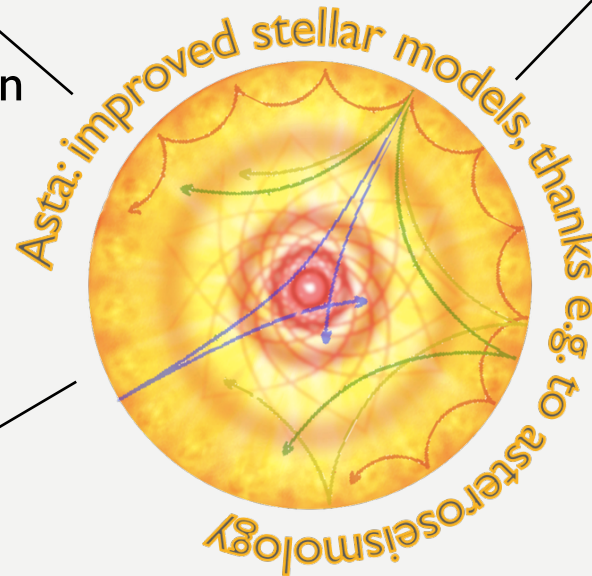
CHEOPS (launch 2018)

PLATO (launch 2026)

For exoplanets



Stellar characterization
(mass, radius,
age, habitability)



Stellar ages

GAIA (2013-...)

For the Galaxy



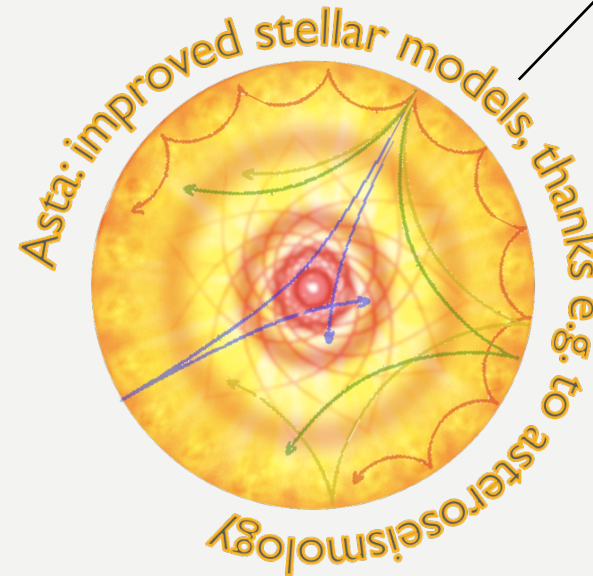
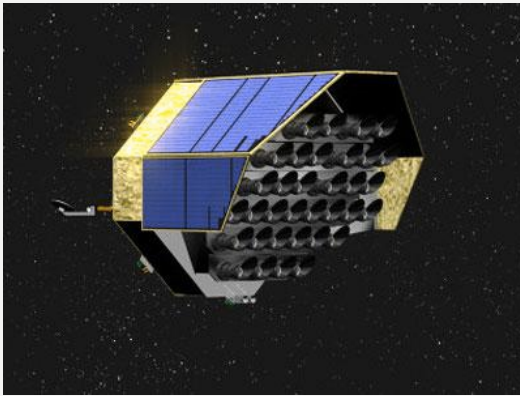
SPECULOOS (ongoing)

KEPLER (2008- 2017)

Planetary Transits and Oscillations of stars

PLATO (launch 2026)

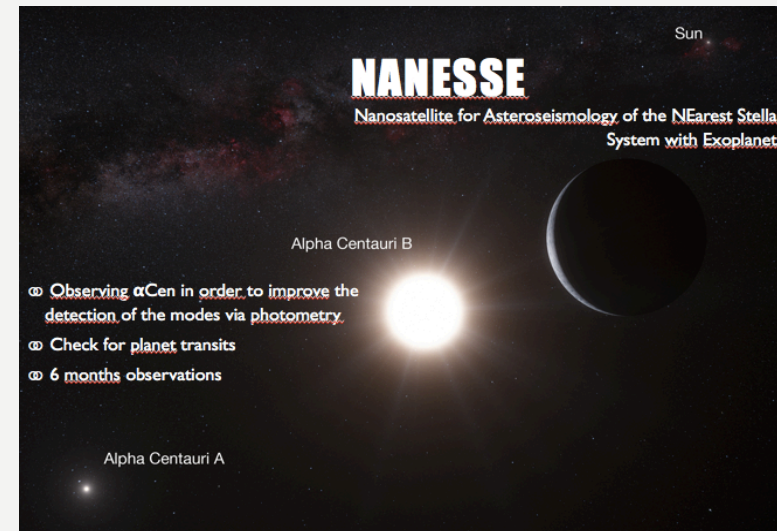
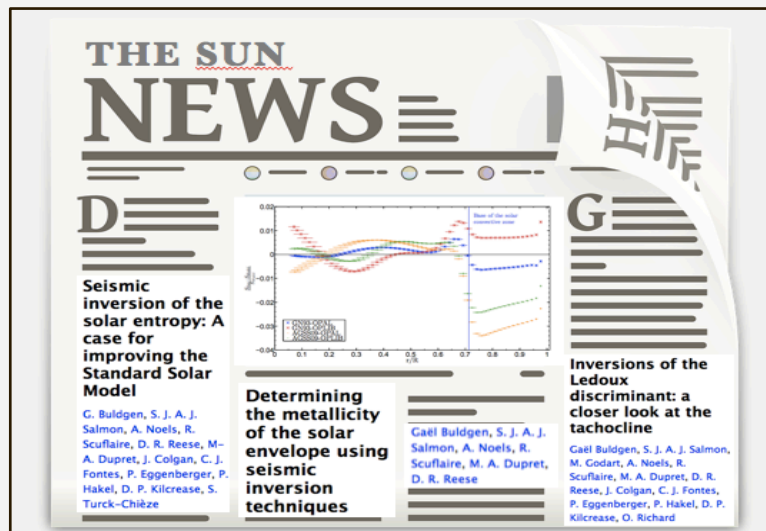
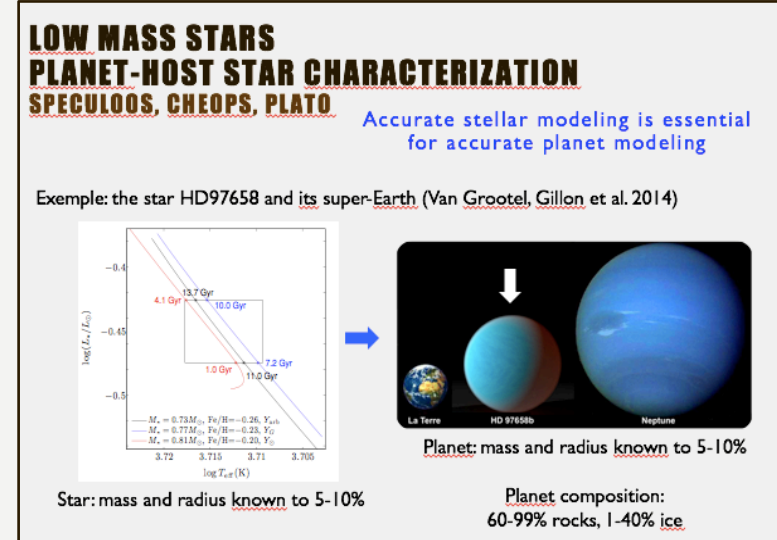
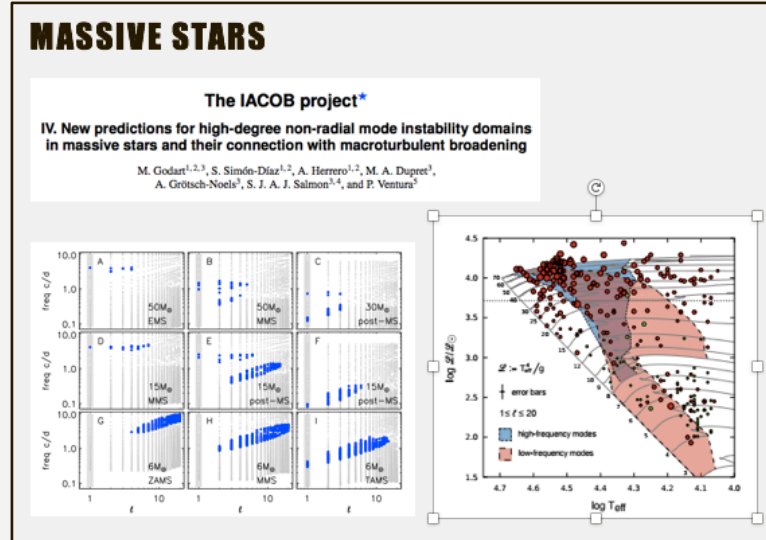
- ❖ find and study a large number of extrasolar planetary systems



- ❖ emphasis on the properties of terrestrial planets in the habitable zone around solar-like stars
- ❖ investigate seismic activity in stars, enabling the precise characterisation of the planet-host star, including its age.

RECENT ACTIVITIES

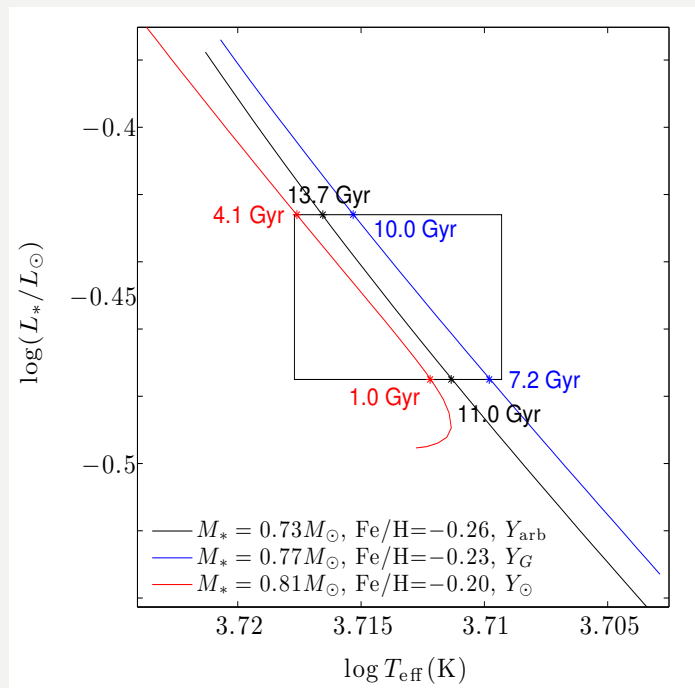
Massive stars -- Low mass models --
The Sun -- Nanosatellite



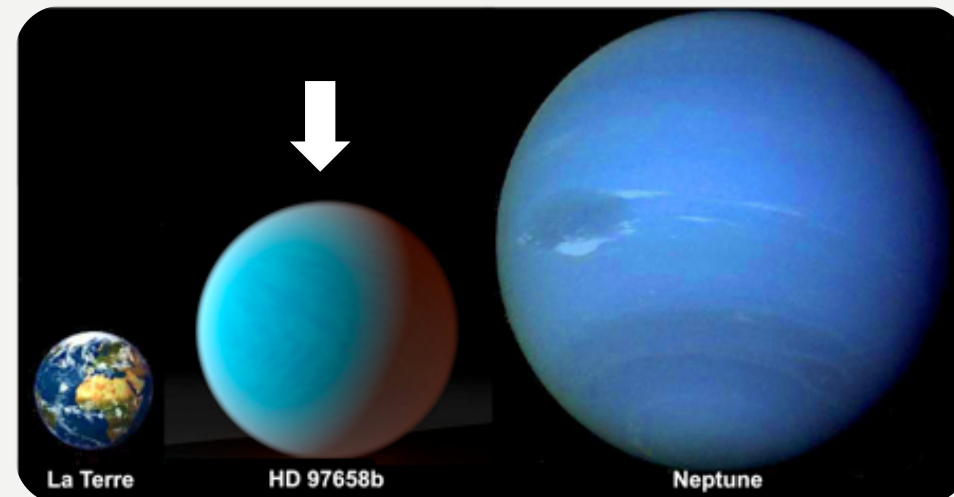
LOW-MASS STARS PLANET-HOST STAR CHARACTERISATION SPECULOOS, CHEOPS, PLATO

Accurate stellar modelling is essential
for accurate planet modelling

Exemple: the star HD97658 and its super Earth (Van Grootel, Gillon et al. 2014)



Star: mass and radius known to 5-10%



Planet: mass and radius known to 5-10%

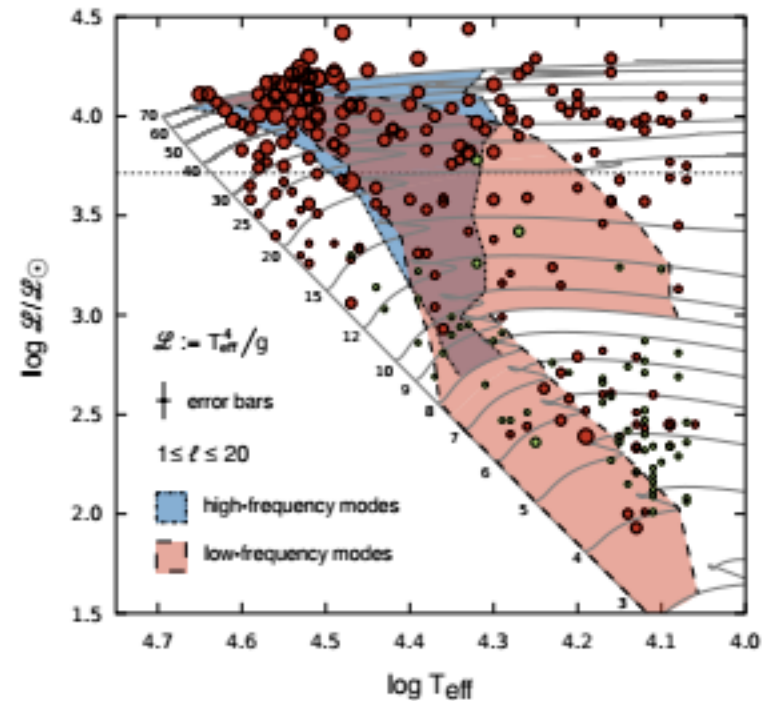
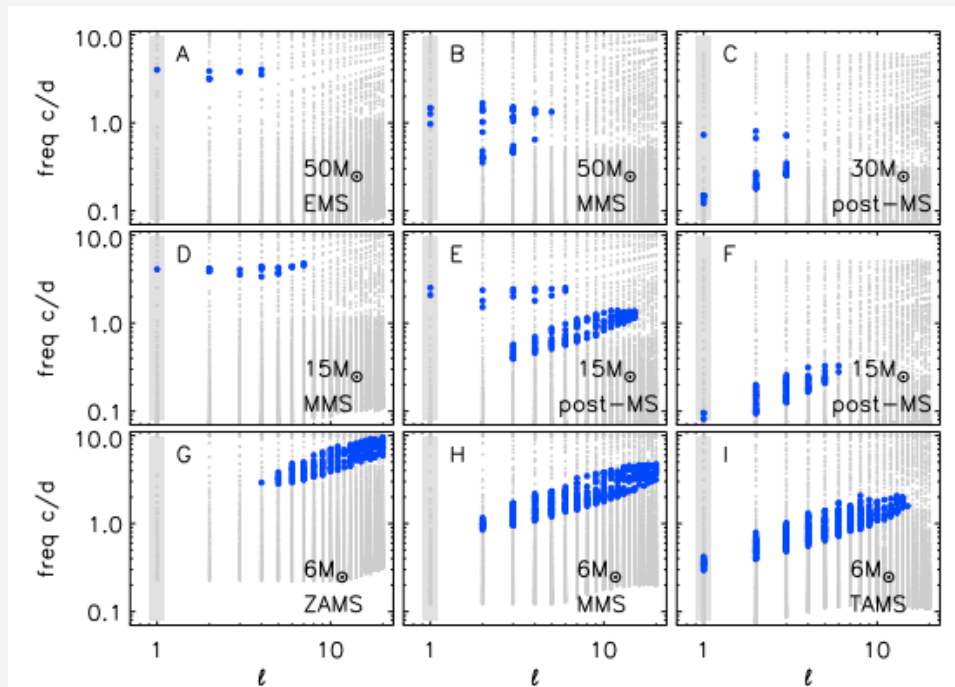
Planet composition:
60-99% rocks, 1-40% ice

MASSIVE STARS

The IACOB project[★]

IV. New predictions for high-degree non-radial mode instability domains in massive stars and their connection with macroturbulent broadening

M. Godart^{1,2,3}, S. Simón-Díaz^{1,2}, A. Herrero^{1,2}, M. A. Dupret³,
A. Grötsch-Noels³, S. J. A. J. Salmon^{3,4}, and P. Ventura⁵

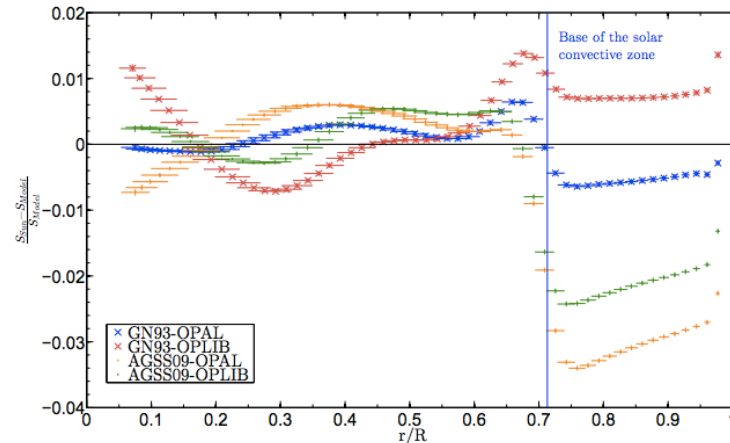


THE SUN NEWS

D

Seismic inversion of the solar entropy: A case for improving the Standard Solar Model

G. Buldgen, S. J. A. J. Salmon, A. Noels, R. Scuflaire, D. R. Reese, M.-A. Dupret, J. Colgan, C. J. Fontes, P. Eggenberger, P. Hakel, D. P. Kilcrease, S. Turck-Chièze



Determining the metallicity of the solar envelope using seismic inversion techniques

Gaël Buldgen, S. J. A. J. Salmon, A. Noels, R. Scuflaire, M. A. Dupret, D. R. Reese

G

Inversions of the Ledoux discriminant: a closer look at the tachocline

Gaël Buldgen, S. J. A. J. Salmon, M. Godart, A. Noels, R. Scuflaire, M. A. Dupret, D. R. Reese, J. Colgan, C. J. Fontes, P. Eggenberger, P. Hakel, D. P. Kilcrease, O. Richard



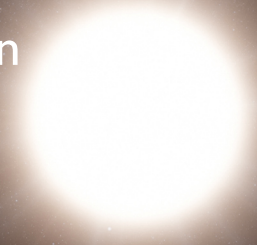
Sun

NANESSE

Nanosatellite for Asteroseismology of the NEarest Stellar System with Exoplanets



Alpha Centauri B



- ⌚ Observing α Cen for improving the detection of the modes via photometry
- ⌚ Check for planet transits
- ⌚ 6 month observations

Alpha Centauri A

