Spanish proposals for planet and star science with the E-ELT

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on behalf of the Spanish Astronomy community met in Madrid in April 16th -17th
http://riastronomia.es/opencms/opencms/Workshops/R_20090323.html

Outline:

- Planet research:
  - Introduction
  - List of proposals submitted in April 16th -17th
- Star research.

Exoplanets

Brief current observational status:

- ~340 planets in 270 planetary systems detected with high precission RV and microlensing.
- Mayor et al. 2009: planets with mass ~ Earth and in HZ of its parent star.

Reasons for exoplanet science:

- Contrast theories of planet formation.
- Role played by planetary environments.
- How typical is the Solar system?
- Are there other Earths?

→ and if so, atmosphere? Life/ bio-markers?

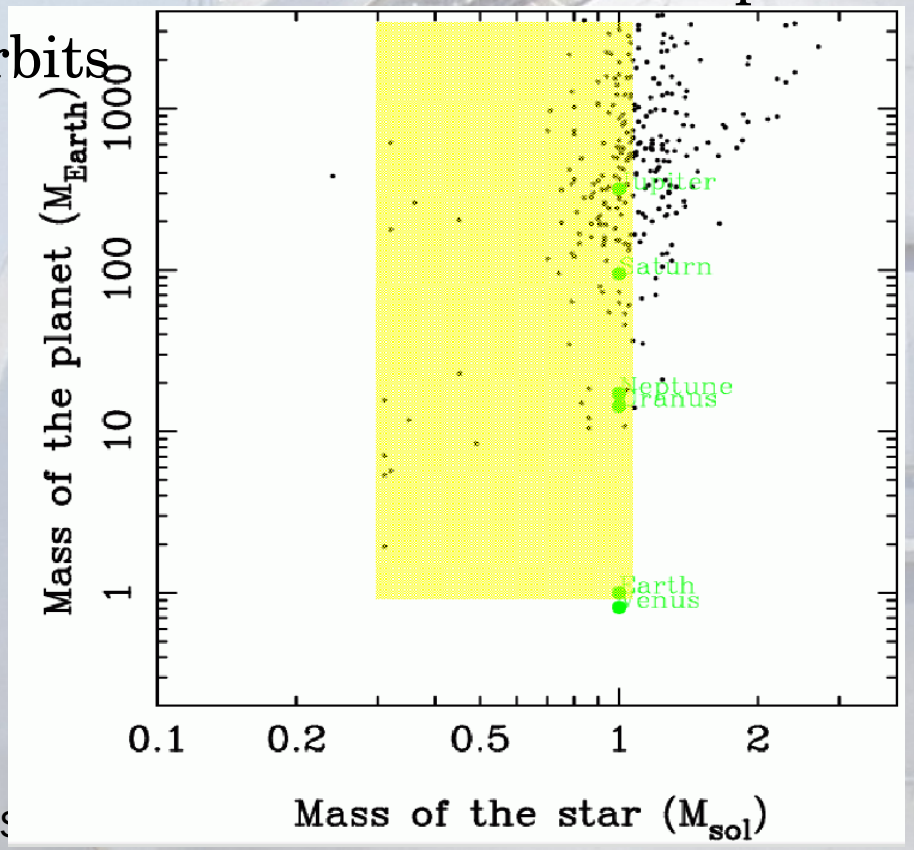
P1. The architecture of planetary systems with age

P.I. M.R. Zapatero Osorio (IAC)

Goal: understanding the planet mass-star mass relationship & evolution of planetary orbits

High-accuracy RV studies of ~400 stars in open clusters:

- Pleiades: 125 Myr, 120 pc.
- Hyades: 625 Myr, 45 pc.



Well controlled and homogeneous samples

- Requirements:
  - High-accuracy Rvs: ~cm/s in the optical, < 1m/s in NIR
    - CODEX, SIMPLE instruments proposals
  - Statistically significant large sample ~400 targets
    - 300 hours of E-ELT time.

- Targets selected from detections achieved with:
  - HARPS-NEF @ WHT
  - ESPRESSO @ VLT
  - GAIA (mas astrometry on mV ≤13)

P2. Characterizing the atmospheres of transiting rocky planets within M-star HZs

P.I. E. Pallé (IAC)

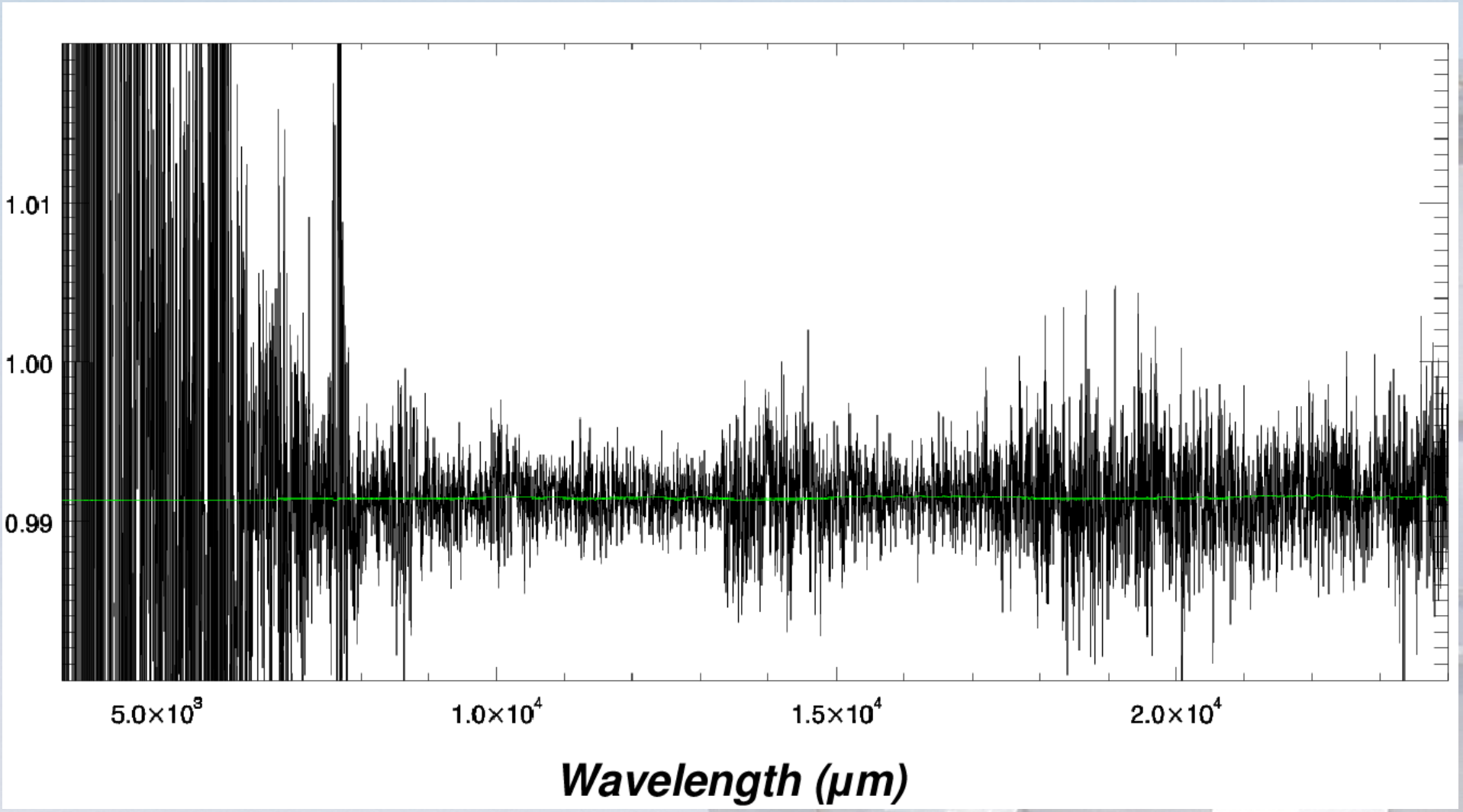
Goal: atmospheric characterization on Earth-like planets witin the Habitable Zones (HZ) of M stars.

Discovery of Earth-like planets within HZs is just a question of time, and then next step will be to characterize the exoplanet atmosphere

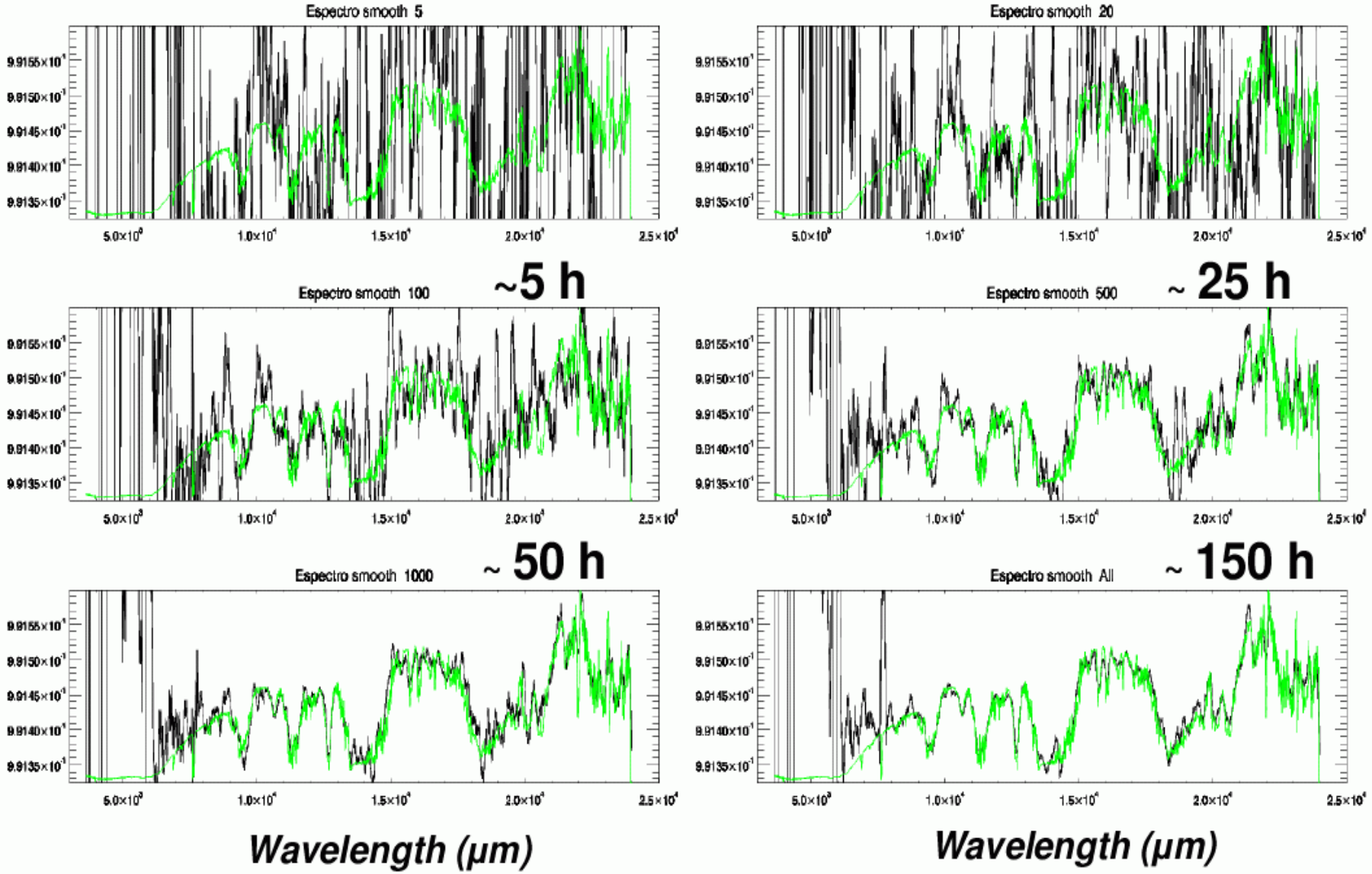
- Direct imaging
- **In- and out-of-transit comparative spectr.**

- Ultra-stable low-to-medium (R~500-1000) resolution spectrograph
- SNR 20000-30000 (~ 500 spectra):
  - 55 hours of E-ELT time/ target.

- Targets selected from ***KEPLER*** (50-640 detections), CoRoT and filtered out with ***HARPS-NEF*** and JWST.


1.01
1.00
0.99
5.0×10^3
1.0×10^4
1.5×10^4
2.0×10^4
Wavelength (μm)

M8 star + 1 Earth

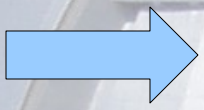


P3. Age evolution of the M-L relation for planetary-mass objects

P.I. R. Rebolo & V. Sánchez Béjar (IAC)

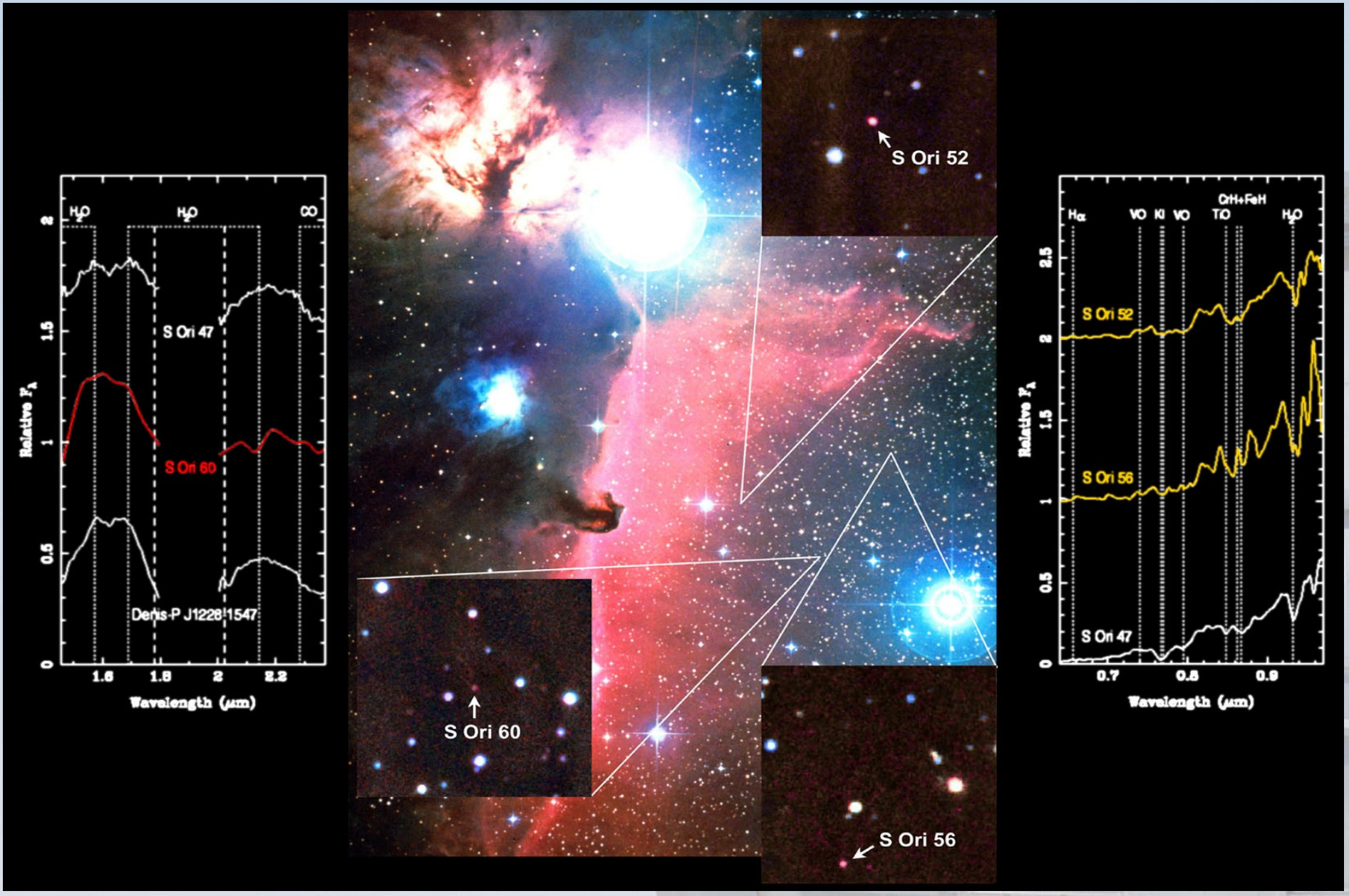
Goal: determine relation between fundamental parameters (M, L, T) to understand substellar evolution.

To achieve this: observations and mass dynamical determination of ultracool companions and planetary-mass objects arount BDs at *known evolution stages*



Stellar-clusters (Pleiades, Hiades) and stellar associations (Orion, Taurus, rho Oph) of known ages.

- Targets selected from dedicated surveys (VISTA) on 8-10 m telescopes.
- HARMONI low-R confirms binarity candidates & spectral energy distribution
- HARMONI high-R RV on each cpt.


S Ori 52
S Ori 60
S Ori 56
S Ori 47
S Ori 60
Denis-P J1228.1547
Relative F_λ
Wavelength (μm)
Hα
VO
KI
VO
TiO
CrH+FeH
H2O
S Ori 52
S Ori 56
S Ori 47
Relative F_λ
Wavelength (μm)

- Requirements:
  - AO DL imaging in J to resolve J~25-26 companions around J~22-23 primaries.
  - AO DL low-R (R=1000) in the NIR (J) for component characterisation of each binary system.
  - AO DL medium-R (R=10000) in the NIR (J) for RV determination of components in the binary system.
  - Proper confirmation with second epoch observations.

- Total program ~600 hrs over 6 years.
  - ~200 targets to be observed and extrapolation from solar neighborhood, ~20 cool BDs and 5-10 massive giant plantes with 5-20 AU separations.

P4. Solar System minor bodies characterisation

P.I. J. Licandro (IAC)

Goals:

•Mass determination, binary rates, rotational periods, sizes, shapes, densities of Kuiper belt objects.

• Imaging of Solar System's planetary satellites and multiwavelength surface coverage.

•Larger TNOs resolved by E-ELT in order to investigate cometary activity at large heliocentric distances.

•TNOs spectroscopy to identify surface ices, composition, physical states.

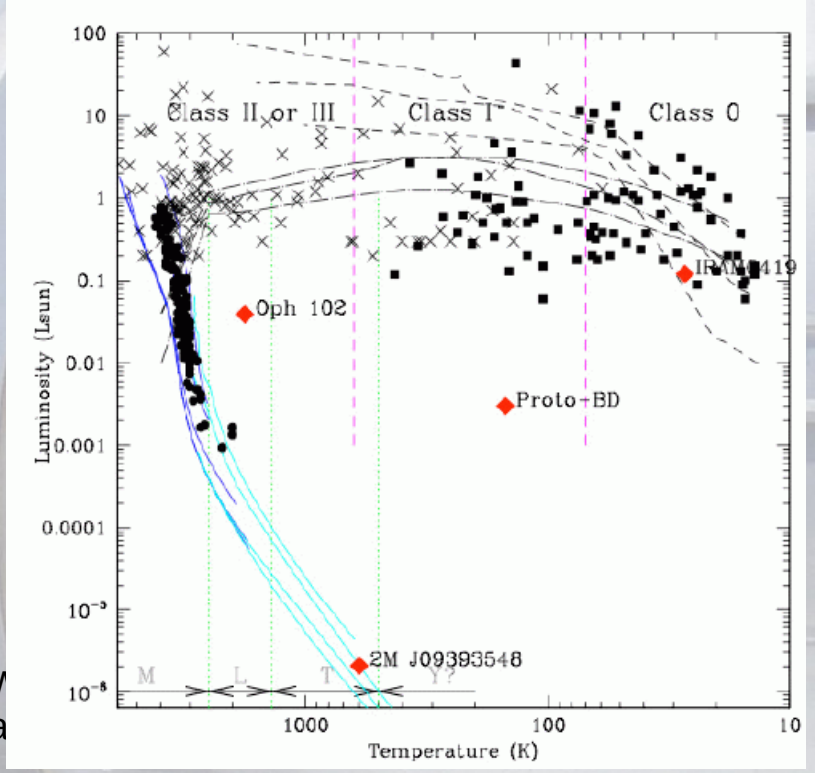
P5. Taxonomy of the formation of Low Mass Objects: from the Local Bubble to the Perseus Arm

P.I. D. Barrado y Navascues (LAEX-CAEB)

Goals: insights into star formation in the low-mass range & how this compares in the locally vs Perseus arm.

Other questions to address:

- Evolution of Young Stellar Objects (especially very low luminosity)
- Protoplanetary disk properties and evolution.
- Multiplicity in very low-mass very young objects.

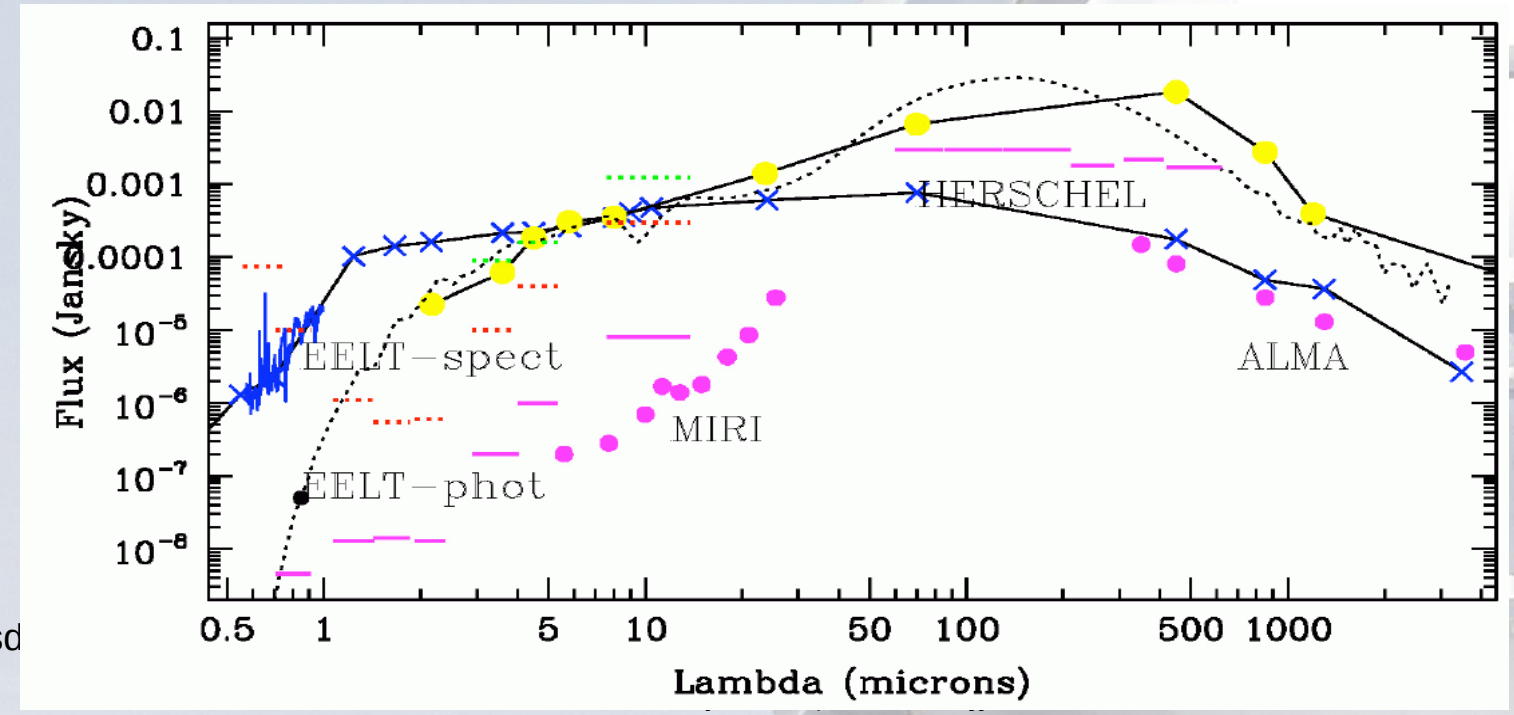


I. Multiplicity in protostars at the very low-mass regime.
   - NIR and mid-IR imaging (MICADO or METIS)

II. Spectroscopic characterization in the optical and NIR.
   - Low- and med-R spectra [0.5,1.0] μm (OPTIMOS) & zJHK (HARMONI/EAGLE)

III. Optical and NIR spectroscopy to study activity and accreting related phenomena.
   - Low- and med-R spectra [0.5,1.0] μm (OPTIMOS) & zJHK (HARMONI/EAGLE)

IV. The disk/envelope as a whole: SED characterization.



V. Mid-IR photometry and spectroscopy: ices, silicates at 10μm.

- Low-res spectroscopy in the mid-IR imaging (METIS)

What is most appreciated in the E-ELT for this science case is it spatial resolution (e.g. Spitzer lacks of it) allowing the detection of faint companions at small angular distances.

- Targets selected from detections achieved with:
  - Spitzer data
  - Akari All Sky Survey.
  - Herschel Space telescope
  - Additional synergies with mid-IR on JWST and ALMA.