

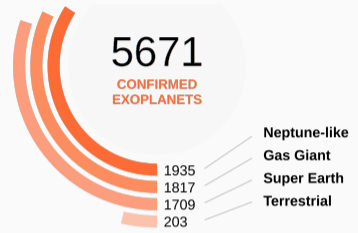
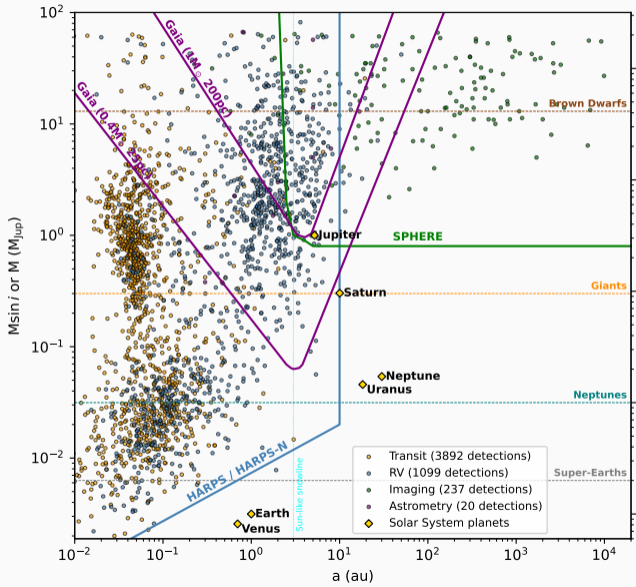


THE ARCHITECTURE OF PLANETARY SYSTEMS

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GIAMPAOLO PIOTTO, LUCA MALAVOLTA, LUCA BORSATO,
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EXOPLANETARY ARCHITECTURE AT A GLANCE




IMAGING
SPHERE@VLT
SHARK-NIR@LBT

RADIAL VELOCITY
GAPS group
with HARPS-N@TNG

ASTROMETRY AND ITS SYNERGIES
Hip-Gaia PMa to constrain orbital solutions

Valerio Nascimbeni's talk
Transiting exoplanets with
space- and ground-based facilities



SPHERE AT VLT AND THE SHINE SURVEY

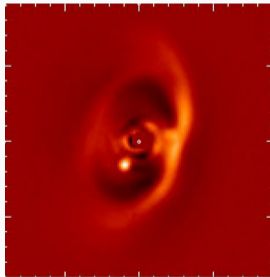
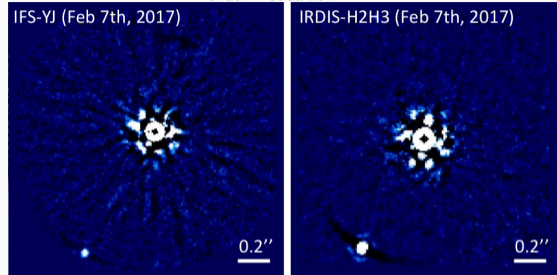
Spectro-Polarimetric High contrast imager
for Exoplanets REsearch

Major project with relevant OAPd participation.
First light in 2014, 260 GTO nights and OT programs.
About 150 papers from GTO

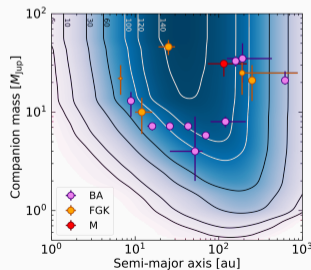
SpHERE INfrared survey for Exoplanets (SHINE)

More than 200 nights, 400 targets observed
Two planets, one BD, four proto-planetary disks
Frequency of $>10\text{au}$ substellar objects is $<10\%$

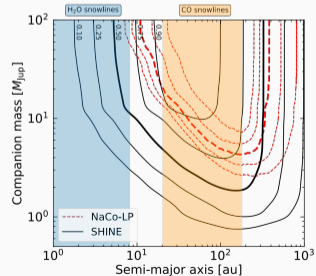
Chauvin et al. 2017



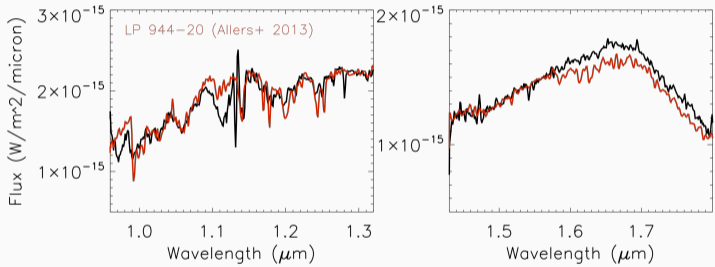
Kepler et al. 2018



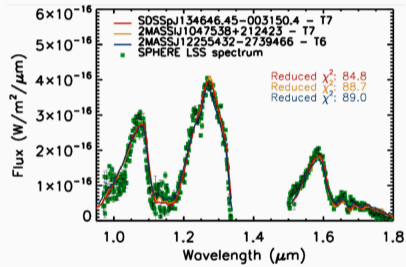
Vigan et al. 2021



Atmospheric characterization of DI substellar companions with SPHERE LSS (R=350)
Key to investigating their formation and evolution processes
Complementary to atmospheric characterization of highly irradiated short-period transiting planets



Bonavita et al. 2017

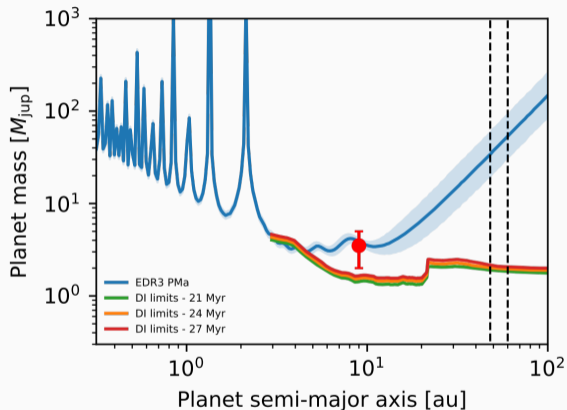
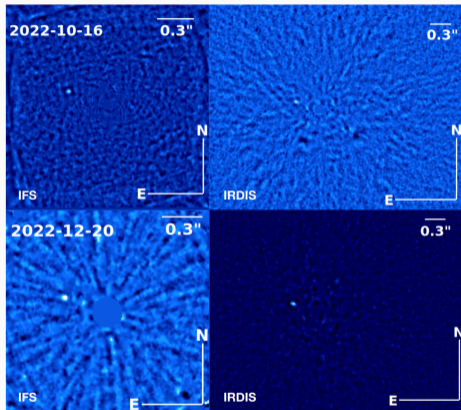


Mesa et al. 2020

Cecilia Lazzone's poster
Exomoons and binary planets



Significant proper motion anomaly as pre-selection tool for imaging surveys, Mesa et al. 2023



F8 star with PMA $S/N=9$ observed with SPHERE@VLT in Y-K bands, companion at $8.6_{-1.1}^{+1.2}$ au with $5.24 \pm 0.05 M_{\text{Jup}}$.
 First companion below the deuterium burning limit discovered by coupling DI and PMA measurements!



Near-infrared high-contrast coronagraphic camera, synergic observations with SHARK-VIS and LMIRCam

Focus on exoplanets, disks and Solar System small bodies.

Direct Imaging

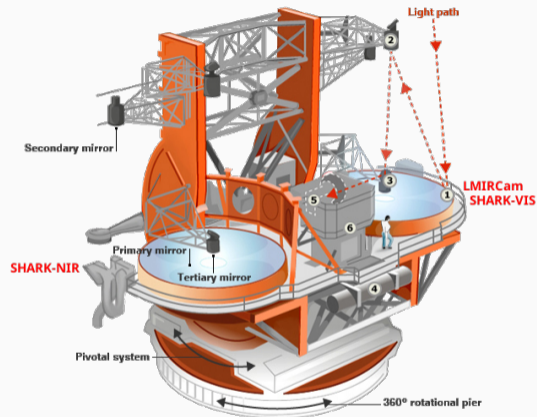
Coronagraphic Imaging

Long Slit Spectroscopy

Dual Band Imaging

| | |
|---------------------|------------------|
| 2014 | Proposal |
| Oct 2022 | LBT installation |
| Jan 2023 - Oct 2023 | Commissioning |
| Oct 2023 - ongoing | Early Science |

Commissioning and Early Science SPIE Proceeding:
Barbato et al, in press



Tania Sofia Gomes Machado's talk
SHARK-NIR: Hunting for Exoplanets and Beyond

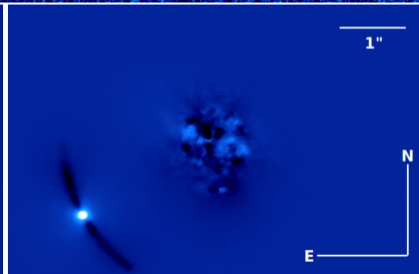
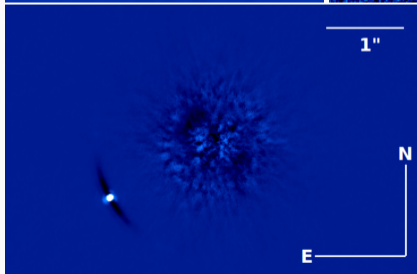
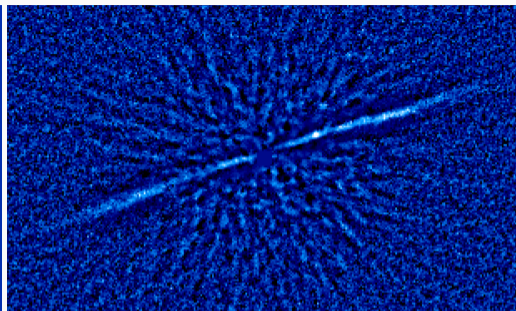
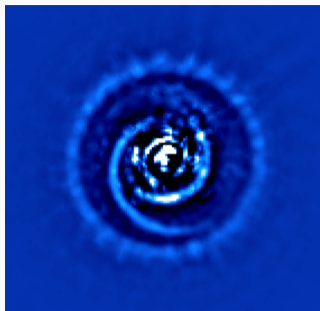


Early science runs
(Oct 2023 - May 2024)

Disks and structures
Exoplanets and BDs
(pre-selection with PMA)

First scientific papers soon,
e.g. **Mesa et al**, in review

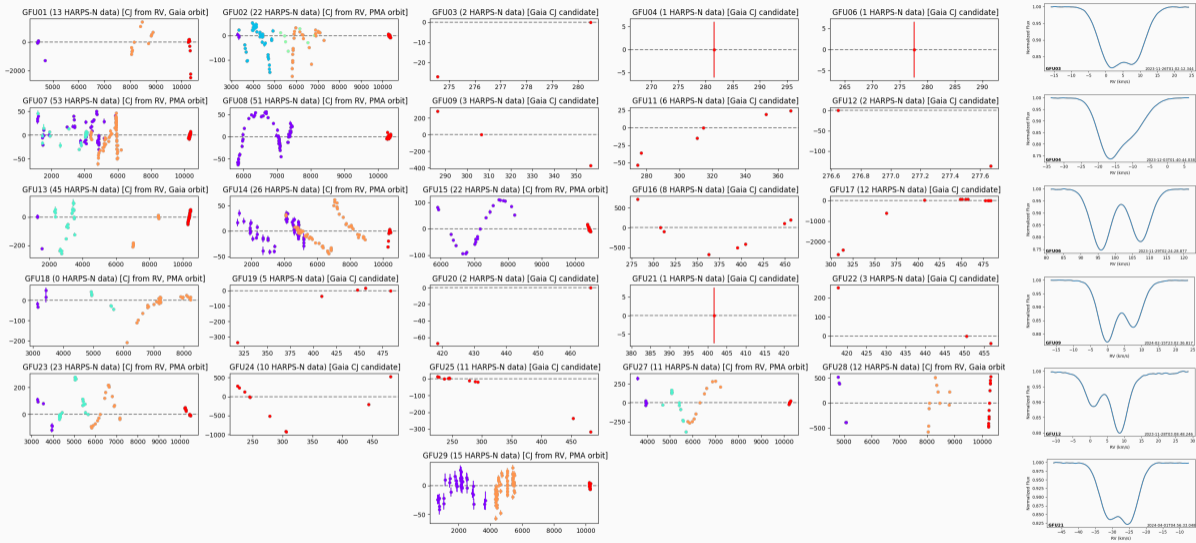
Next runs in Fall 2024:
the best is yet to come!





GAPS 20th Progress Meeting, 17th-19th April 2024, Padua
Coordinating the shared efforts of the Italian exoplanetary community with HARPS-N at TNG

GAPS GAIA FOLLOW-UP SUBPROGRAMME

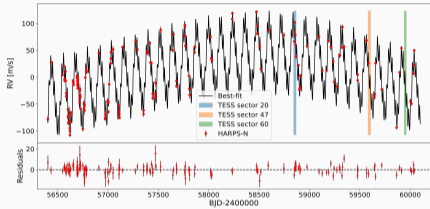


HARPS-N search for inner low-mass planets with outer companion having Gaia-derived true mass.

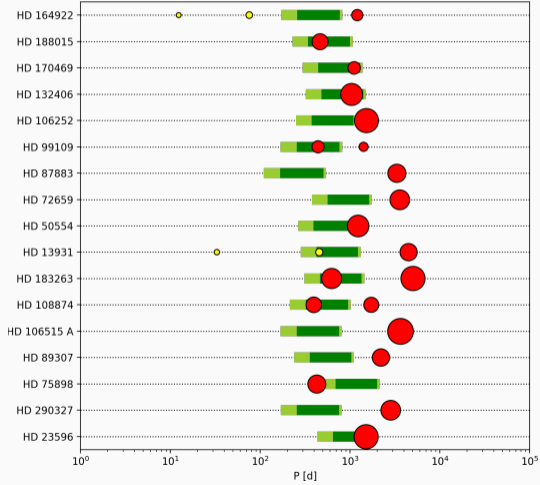
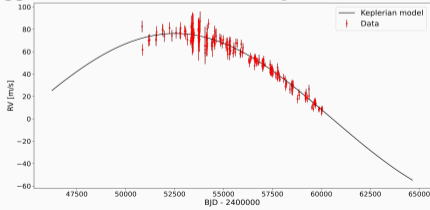
Updated binary contamination fraction in astrometric solutions, Barbato et al. in prep

RADIAL VELOCITY: GAPS KNOWN PLANETS SUBPROGRAMME

12yr search for additional companions in the presence of outer giant planets around 16 stars with HARPS-N
Preliminary occurrence rates: 12% mini Neptunes, 92% super Earths

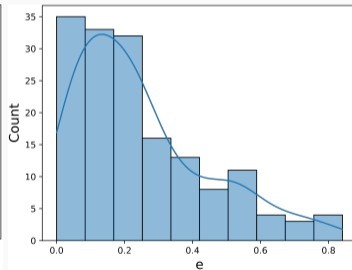
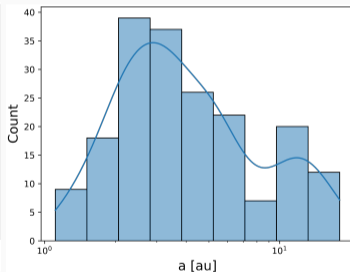
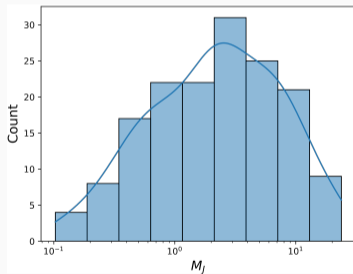


Ruggieri et al. 2024 a new wide giant around XO-2S

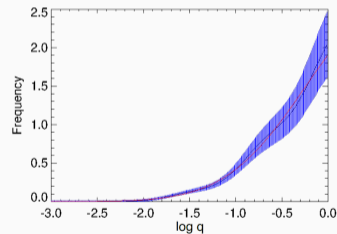
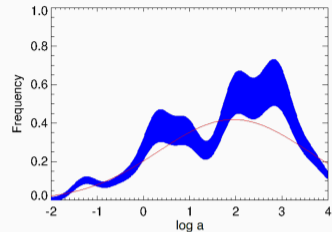
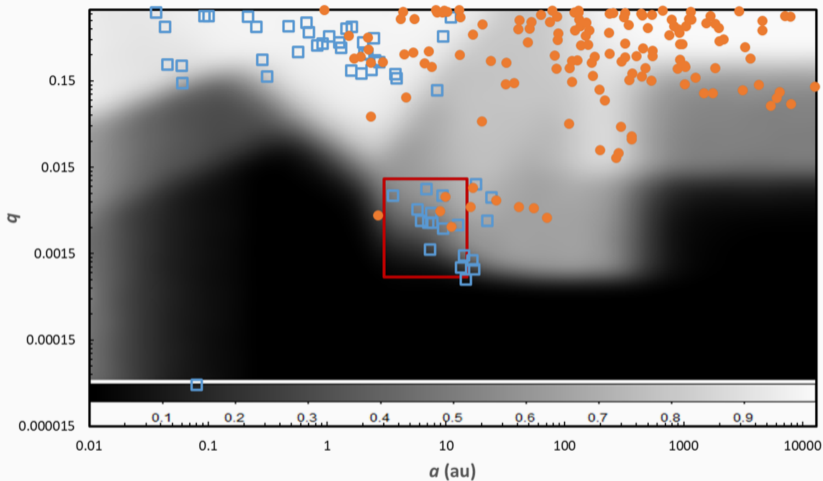


Ruggieri et al. in prep. refinement of HD72659

Ongoing work: analysis of larger literature sample of 190 planets in 174 systems.
First additional candidate planets identified and being analysed!
Full occurrence rate characterization to be presented in [Ruggieri et al. in prep](#)
Updated answers to fundamental open questions in exoplanetology!

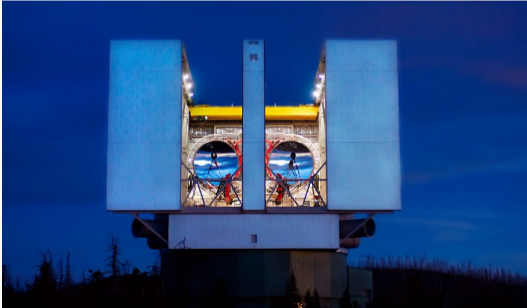


A RECENT DEMOGRAPHIC RESULT: JUPITER-LIKE PLANETS IN YOUNG ASSOCIATIONS



Gratton et al. 2024: multi-technique analysis shows Jupiter-like planets to be frequent ($57 \pm 11\%$) in young associations.

RV surveys find 6-20% around Sun-type stars. Lower formation rate in environments richer in early-type stars and long-term instability destroying systems?



COME AND TALK TO US!



Domenico Barbato



Silvano Desidera



Dino Mesa



Valentina D'Orazi



Elisabetta Rigliaco



Raffaele Gratton



Riccardo Claudi



Francesco Marzari



Valerio Nascimbeni



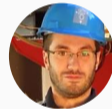
Cecilia Lazzone



Alessandro Ruggieri



Gabriele Columba



Domenico Nardiello



Giampaolo Piotto



Luca Malavolta



Luca Borsato



Martina Baratella



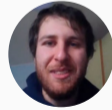
Giacomo Mantovan



Tiziano Zingales



Alice Zurlo



Vito Squicciarini