



# ESO Science

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# ESO Facilities

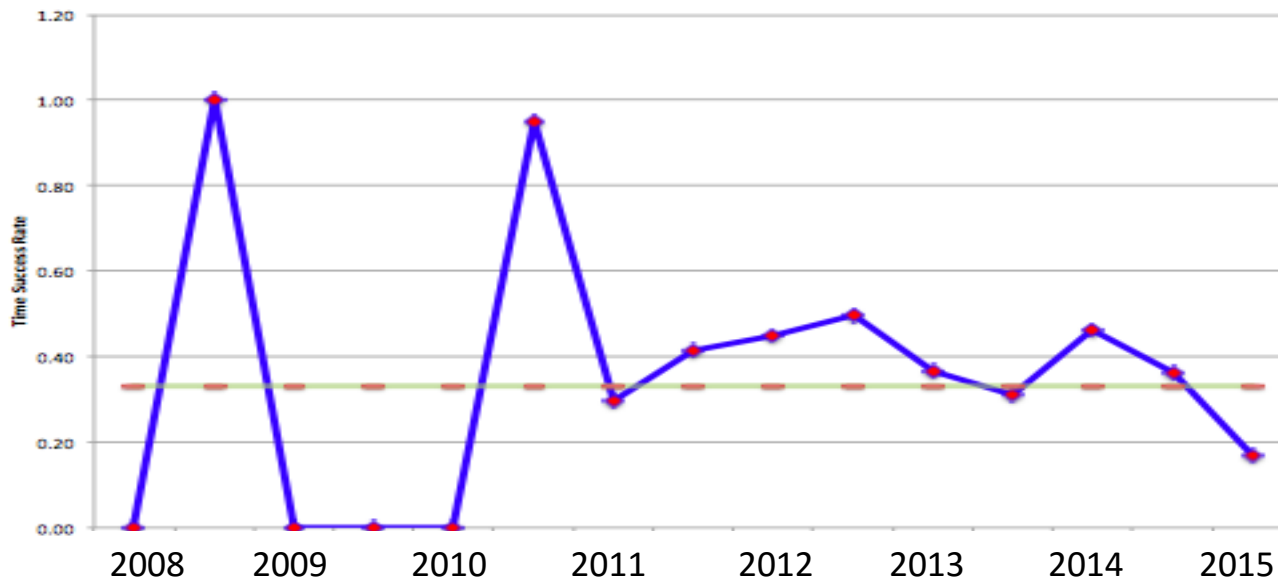
- World-leading Astronomical Observatories exploiting:
  - Excellent atmospheric conditions at the world's best sites in the Atacama desert
  - State-of-the-art technologies,
  - innovative engineering and design,
  - Highly skilled and dedicated staff
  - Efficient support services and infrastructure
  - Programmes by ambitious and creative astronomers



# Brazilian Astronomy

- Increasing engagement with both ESO and with scientists and engineers in its member States
- Involvement in Instrumentation programmes
- Award of observing time and data exploitation
- Opportunities for Industry

**Time Success Rate (assigned/requested)**



Brazilian observing proposal success rates are comparable to those of other ESO Member States

Note that small number statistics lead to large fluctuations in early years

# A Brazilian-led Large Programme on the ESO VLT

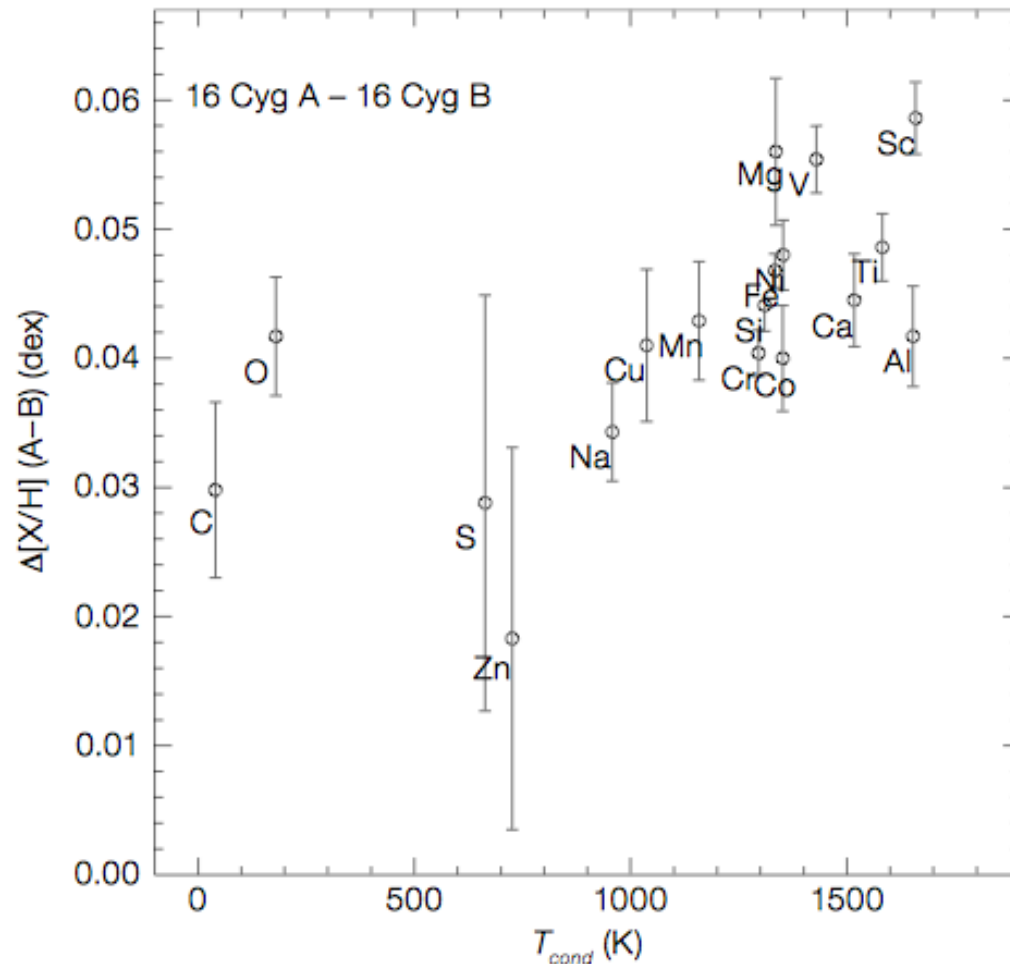
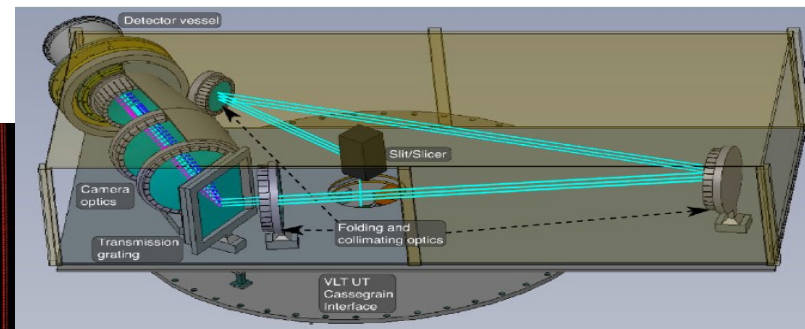
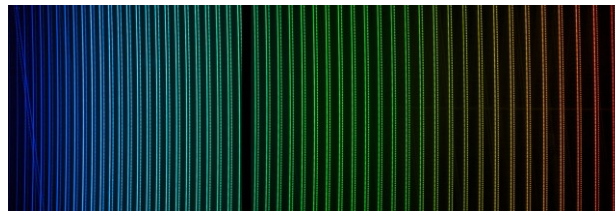


Figure 3. Abundance differences between the binary Solar twins 16 Cyg A and 16 Cyg B. The star without planets is enhanced in both volatiles and refractories, i.e., the star with a detected giant planet (16 Cyg B) is deficient in those elements, probably because they were used to form the giant planet 16 Cyg Bb. The trend with condensation temperature ( $T_{cond}$ ) could be a signature of the rocky core of the giant planet.

J Melendez (Universidade Sao Paulo) and colleagues report on initial results of high accuracy differential measurements of heavy elements in pairs of stars, to learn about the effects of planet formation. ESO Messenger 161, p 28

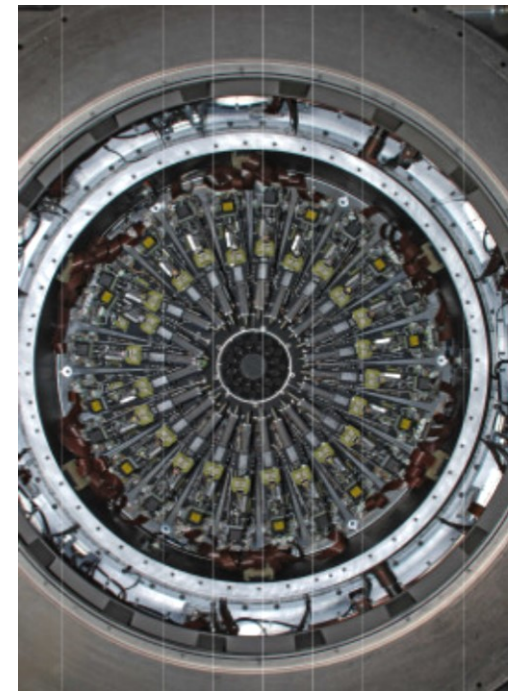
# Current Brazilian Instrumentation Projects at ESO

- Laser Frequency Comb installed in HARPS Spectrograph to further improve stability and precision of measurements
  - led by J.R. de Medeiros (UFRN), collaboration with Brazil, Spain, Germany, ESO
- CUBES a highly efficient Ultraviolet spectrograph for the VLT for abundance measurements
  - Led by B Barbuy and B Castilho
  - Phase A completed and project approved in 2012
  - Awaiting ratification so construction can proceed
- NIRPS high stability near-infrared spectrograph for exoplanet detection on the 3.6-m telescope, especially around M dwarfs
  - Led by UFRN



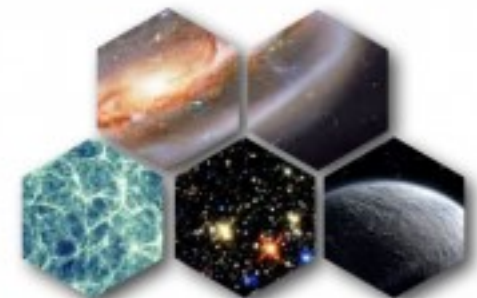
# UK Experience

- UK accession to ESO in 2002.
- P Roche – member and later chair of STC, then UK Council delegate and Council President
  - Chaired or participated in several instrument reviews, strategy meetings, workshops etc.
- UK quickly committed to ESO with main focus of optical/IR/mm-wave astronomy
  - Several scientists and engineers have moved to ESO
- Major Contributions include :
  - VISTA Telescope and IR Camera
  - KMOS Instrument for the VLT,
  - Visiting instruments
  - HARMONI (E-ELT), METIS (E-ELT),
  - MOONS (VLT), Adaptive Optics etc
- Industrial return: UK share of ESO procurements ~14% over the last decade.



# Recent UK – Brazil Collaborations

- Targeted funding from the UK Research Councils' Newton Fund and FAPESP
- UK collaborations with Sao Paulo and LNA on MOSAIC multi-object spectrograph for the E-ELT
  - Astronomy meeting on stellar populations in Sao Paulo (30 Nov - 2 Dec).
  - 3-day instrumentation/engineering meeting at LNA/Sao Paulo (22-24 Feb, 2016).
  - ESR visits to the UK (currently 7 visits to the UK planned from Brazilian PhDs, postdocs and engineers)
- Similar programmes with other member states
  - e.g. FAPESP – NWO Brazil : Netherlands



MOSAIC