On the Origin and Evolution of Planets

EXOEarths@CAUP





The EXOEarths project and team

- Funded by ERC starting grant (Oct. 2009-Sept-2014)
- Complementary FCT and EU funding (ITN)
- The "team":
 - 9 Researchers (only one fixed position!!!)
 - 7 PhD students
 - 8 different nationalities!



Source of the second develop a team of researchers to do state-of-the-art research in exoplanet science in Portugal



- Planet search and characterization with Doppler radial velocity (RV) and transit techniques
- Study of stellar sources of noise to planet searches
- Star-planet connection: clues to planet formation and evolution
- Participation in ground and space based instruments:
 - ESPRESSO@VLT (under construction)
 - CHEOPS@ESA (selected "s-mission")
 - PLATO2.0@ESA (waiting for M3 selection)
 - HIRES@ELT (team is part of newborn consortium)

















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4





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Example research (1): stellar activity and RVs





Stellar noise: activity, oscillations, and granulation



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Example research (I): stellar activity and RVs



Simulated detection: 2.5 M_{Earth} planet in HZ of K-dwarf

- P = 200 days
- Includes: photon and instrumental noise, oscillations, granulation, and activity (spots)
- Correct observing strategy



Example research (II): a planet around alpha-Cen B





Example research (III): star-planet connection









- * ESPRESSO: a new instrument for the ESO/VLT telescopes
- International consortium including (in Portugal) researchers from CAUP and FCUL
- * Precision 10 times better then presently possible!
- * FDR in May 2013
- * Observations start in 2016



Main Science Cases

- Search for Earth-like planets orbiting solartype stars
- * Variability of physical constants (alpha and mu)





The CHEOPS Mission



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Planetenforschung



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Science objectives

- Mass-radius relation for planets below the mass of Saturn
- Constraints on planet migration paths
- Identification of planets w/ atmospheres in the 1–10 M_{Earth} regime
- Energy transport in hot Jupiter atmospheres
- New targets for future characterization facilities with spectroscopic capabilities





EXtra-solar planets and stellar astrophysics: towards the detection of Other Earths

Main

Team members

Latest results Publications Software tools Planet Journal Club Opportunities Press coverage ESPRESSO Funding







Researchers

http://www.astro.up.pt/exoearths

Vardan Zh. Adibekyan (CAUP) Works on spectroscopic analysis of solar type stars

Isabelle Boisse (CAUP) Research includes study of the causes of variations in radial-velocity measurements (related both to stellar activity or other sources) in order to improve measurement accuracy

Elisa Delgado Mena (CAUP) Specialist in the study of chemical abundances in solar type stars, in particular concerning planet hosts

Pedro Figueira (CAUP) Studies of high-precision Radial Velocities, with emphasis on the near-IR domain

Marco Montalto (CAUP)

Involved in different projects regarding high precision time-series photometry both from the ground (e.g. search for transiting planets in open clusters and photometric follow-up of stars with planets), and from space (PLATO mission)

Alexandre Santerne (CAUP)

Interested in transiting exoplanets, especially those discovered by space-based missions (CoRoT, Kepler): identification of astrophysical false-positives and validation of transiting low-mass planet-candidates.



Questions?



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14