Contribution ID: **47** Type: **Parallel talk**

# Direct imaging and spectral characterization of long period exoplanets and brown dwarfs

*Saturday 7 November 2020 12:00 (20 minutes)*

Very little is known about giant planets and brown dwarfs at an orbital separation great than 5 AU. And yet, these are important puzzle pieces needed for constraining the uncertainties that exist in giant planet formation and evolutionary models. Furthermore, evolutionary models of giant planets and brown dwarfs are plagued by a lack of observational constraints. The complex molecular chemistry of their atmospheres leaves a relatively wide parameter space for models to span.

To date, individual dynamical masses are known for only a handful of brown dwarfs, therefore any new detections contributes greatly to brown dwarf models as they provide important analogues for the characterisation of exoplanets. Radial-velocity measurements provide only a lower limit on the measured masses due to the unknown orbital inclination. Therefore directly imaging these candidates is needed to break that degeneracy and provide constraints on the dynamical mass of the companion.

I have selected ideal targets for direct imaging using the radial-velocity CORALIE survey for southern extra-solar planets with over 20 years worth of data containing a volume-limited sample of 1647 low-mass main sequence stars within 50 parsecs. As massive planets and brown dwarf companions are rare, one benefits from the CORALIE survey where we are able to identify golden targets for direct imaging. Detecting these giant companion candidates allows us to bridge the gap between radial-velocity-detected exoplanets and directly-imaged planets and brown dwarfs. I describe the progress towards the detection, characterisation and monitoring of widely-separated giant planets and brown dwarfs through both direct imaging and long-period radial-velocities. This includes the detection of several long-period radial-velocity giant planets and brown dwarfs, as well as the direct imaging of some of these companions with VLT/SPHERE and the discovery of a benchmark ~50MJup T-type brown dwarf. The discovery of such benchmark sources provides a powerful and critical tool of advanced evolutionary models.

As we move toward imaging smaller and smaller objects it is important to use these objects as a laboratory to test theoretical atmospheric models. The components of detecting long-period massive-companions helps to probe a parameter space in mass, separation and age where the occurrence rate of these objects is not well understood. They also serve as a stepping stone towards detecting smaller and smaller exoplanets using both of these methods of detection.

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**Session Classification:** Talks from participants: Astrophysics (de/engl)