

Studying brown dwarf dust cloud distribution through polarisation

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Brown dwarfs are compact objects with masses between those of stars and planets. They are not massive enough to sustainably burn hydrogen, and eventually cool down due to the lack of an energy source. Cool brown dwarfs host low-temperature atmospheres, favouring molecules over single atoms, and dust grains. Those dust grains may form clouds in their atmosphere, leading to polarised light through scattering and flux variations if the cloud deck is heterogeneous.

Variations in the cloud cover of brown dwarfs have been measured through photometry monitoring and polarisation observations. This project aims at detecting time dependence of the polarisation for LHS102B, 2MASS J1507-16, and 2MASS J0036+18, which could be then explained by large-scale cloud coverage variations. Our data consists of unique observations obtained with the FORS 2 instrument on the 8.2-m telescope of the VLT in Chile. Our goal is to extract the polarimetric information from our images and answer to these questions: (1) Do we see any variations of the signal with time and can we relate this to the rotation of the brown dwarf?, (2) Can we set constraints on the typical size of cloud holes?, and (3) How do the measurements compare with atmospheric models of brown dwarfs that predict polarimetric signals? We have obtained high SNR images with 16 retarder-plate angles and reduced the data using the method described in Patat & Romaniello (2006), achieving a level of sensitivity better than 0.05%. We are currently working on the data reduction to improve its sensitivity.

Beyond the reduction of the data available, another deliverable of the project is a Python data reduction pipeline which can be used for other polarisation observations. The code will be made available once the project is complete.