Faculty of Science and Health

FACULTY RESEARCH COMMITTEE

Undergraduate Summer Research Internship Scheme 2017

Project Title: *Searching for circumplanetary material around the young planet β Pictoris b*

Principal Investigator: *Dr. Ernst de Mooij*

School/Research Centre: *School of Physical Sciences*

Project Description

Project Aims

The young star β Pictoris hosts many exciting features. It was one of the first stars for which a debris disk, the leftovers from star- and planet formation, was identified. Furthermore, observations have presented evidence for several families of comets orbiting the star.

More excitingly, in 2008 a giant planet was imaged directly, confirming the existence of a young, massive, planet orbiting the star. Over the past 8 years, the orbit of the planet has been mapped, and we now know that during 2017/2018 the planet will pass within 10 milli-arcseconds of the star, as seen from Earth. Although it is highly unlikely that the planet itself will transit, the Hill sphere, the region around the planet where its gravity dominates over that of the star, will. Since the planet is very young, there could be material left over from the planet's formation which might even be in the process of forming moons. Interestingly, old measurements of the brightness of the system show signs of a potential transit of circumplanetary material in 1981.

During the closest approach in the next year, a large collaboration will be monitoring this event using telescopes on the ground and in space. At DCU, Dr. Ernst de Mooij is leading an effort to use ground-based high-resolution spectroscopy to both identify and characterise any transiting circumplanetary material.

The goal of this project is to use initial high-resolution spectroscopic observations together with simulations of the signatures of ring systems to develop a robust method to detect the signature of transiting circumplanetary material. Detecting such events reliably and as soon as the data is available is crucial, since they can be used to trigger follow-up observations to study the event in detail, without wasting telescope time on false positives. Since a typical event will last only ~2 days, rapid follow-up is essential.

Potential Candidates

The intern will work directly with Dr. Ernst de Mooij on a day-to-day basis on processing and analysing data from state of the art astronomical instruments. As part of this, the intern will contribute to the programming (using python) of the data reduction and analysis pipeline. The focus will be on the implementation and testing of different criteria to identify and verify potential events. The programming skills developed will be very useful not only for a potential career in astrophysics, but can be used in many different areas, ranging from the sciences and engineering to finances. Since several members of

the collaboration are based at Queen's University Belfast, it is expected that, as part of this project, the intern will make one or more day-trips to Belfast to work with these collaborators. It is hoped that the work will lead to scientific publications and would provide research experience that might lead to a final year project. This would also very strongly support a future Irish Research Council postgraduate studentship applications, for a student who is interested in pursuing postgraduate studies towards an MSc or PhD degree in the future.