Disc-Planet Interactions During Planet Formation

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The discovery of many 1000s of exoplanets has led to questions about the origins of these systems. It is believed planets form in the protoplanetary discs, composed of gas and dust, that are observed to orbit around young stars. Figure 1 shows an observation from ALMA of a protoplanetary disc around the T Tauri star HL Tau. The disc is seen to be highly structured, possibly because of the presence of planets that are forming. Research in the Astronomy Unit at QMUL focusses on developing a theoretical understanding of how the gravitational interaction between a protoplanetary disc and embedded planets leads to structuring of the disc through the formation of spiral waves, gaps and vortices. A related issue is how these interactions influence the orbital evolution of embedded planets and possibly drive large scale migration, and how gas and dust from the disc accretes onto planets as they grow in mass. A PhD project in this area will involve conducting state of the art hydrodynamic and/or magneto-hydrodynamic simulations, and some analytical theory, to obtain a full understanding of the processes involved. An image taken from such a hydrodynamic simulation is shown in Figure 2. Scenarios involving planets forming around single stars or in binary star systems may be considered as part of this project.

Figure 1 ALMA image of the protoplanetary disc around the young star HL tau, showing gaps and rings possibly formed by the presence of embedded planets.

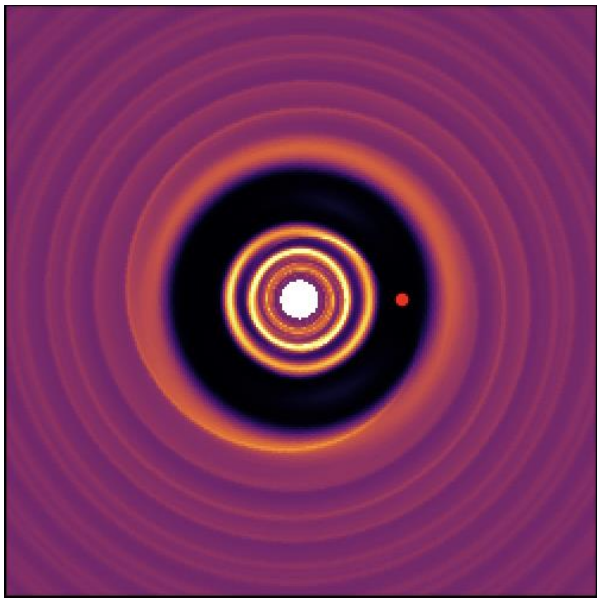

Figure 2 Image taken from a 3D simulation of a Jupiter mass planet embbeded in a protoplanetary disc, showing the formation of gaps and rings

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