Planet-gas interactions in debris discs: Observable outcomes

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Since recently, consequent amounts of CO gas were observed in old debris disks which were expected to be gas-free. At this stage, planet formation already occurred and fully formed planets are expected to be evolving in these disks. In this presentation, I will show how these planets might form observable substructures in the gas of these debris disks. When a massive planet is embedded in a gas disk, it opens a gap by pushing the gas away from its orbit. I use hydrodynamical simulations with the FARGO3D code to estimate the structure of typical debris disks perturbed by the presence of planets of different characteristics (masses and locations). With the help of the radiative transfer code RADM3D coupled to the observing tool CASA, I am able to derive realistic ALMA synthetic images of the disks' gas emission. We find that, unlike in protoplanetary disks which host too much gas, a gap opening planet in a debris disk with a lower surface density produces an observable gap in the gas emission. We therefore suggest an observation criterion in order to estimate whether the produced gaps can be visible or not depending on the planet characteristics and observation setup. By comparing to known debris disks, we determine ideal candidates to search for such perturbations. This method can lead to a new way to indirectly detect exoplanets at an intermediate stage during their formation.