A Micro-Wave analogy experiment to measure the scattering properties of dust aggregates: Experimental set-up and first results for protoplanetary disks

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Young Protoplanetary disks are central to the process of planetary formation. Observationally, planets around main sequence are ubiquitous and the case for planets detected during their formation, i.e, still within their parent disk, is growing. The formation of a planet requires the growth of solids (dust) by several orders of magnitudes, from (sub-)micron sizes to kilometer sizes ... and this is a major problem! because disks are short-lived, collisions are expected to shatter pebbles / boulders when they reach decimeter-meter sizes, particles are rapidly drifting inward because of gas drag, etc...

Instruments on large telescopes are providing novel insights on the structure and content of protoplanetary disks. Rings and gaps are found that may trace the presence of planets. Interestingly, the signature of dust scattering are now measured not only in the optical and NIR with better resolution than before, but also at mm wavelengths with ALMA, probing larger particles. Scattering phase functions, in intensity and linear polarisation, are slowly becoming available. The first results are pointing toward the presence of dust aggregates whose exact properties are not well known... just yet.

The scattering and polarisation properties of aggregates depend on several parameters. In this contribution we will present the first results of a Micro-Wave analogy experiment to measure the scattering properties of large aggregates.

Contrarily to most other experiments, our set-up allows to control the position, size, shape and refractive index of the aggregates with high accuracy. Aggregates are fabricated by 3D printing, with material carefully tailored to match the complex refractive index of astronomical dust.

The talk will be split in three parts: (1) We will present the experimental set-up, (2) the protocol to build the aggregate analogs, and (3) the results of first measurements to explore the effets of surface roughness on the shape of the scattering phase function.