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A multi-wavelength view of planet forming discs: unleashing the full power of ALMA for grain growth studies

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Observations at sub-mm/mm wavelengths allow us to probe the solids in the interior of protoplanetary discs, where the bulk of the dust is located and planet formation is expected to occur. However, the actual size of dust grains and the physical properties of the disc interior are still largely unknown due to the observational limits of past sub-mm/mm studies. ALMA, thanks to its exquisite resolution and sensitivity, is an unprecedented tool to study grain growth in large samples of discs.

In my contribution I will present a novel analysis method that constrains the radial profile of the maximum grain size in protoplanetary discs by means of a simultaneous fit of spatially resolved observations at several sub-mm/mm wavelengths (Tazzari et al. 2016, A&A 588, A53). By breaking the degeneracy between the opacity, temperature and density contributions to the sub-mm emission, this method enabled us to find observational evidence of a radial sorting of grain sizes in a few discs, an effect that is expected from dust evolution models including grain growth and radial drift.

I will also present new ALMA 3 mm observations of 35 discs in the Lupus star forming region (Tazzari et al., in prep) and the results of the coupled analysis with our previous 890 μm ALMA survey of the same discs (Ansdell et al. 2016, ApJ 828 46; Tazzari et al. 2017, A&A 606 A88). I will discuss the grain sizes inferred for such homogeneous sample of discs in comparison with the level of grain growth in other regions with different mean ages.
Finally, after characterising how the contamination from optically thick emission would affect grain size estimates, I will show that a minimum level of grain growth is always needed to account for the distribution of spectral indices and sub-mm fluxes that we currently observe.

Consider for a poster?

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