Contribution ID: **33** Type: **not specified**

A Nearby Galaxy Perspective on Dust Evolution.

Friday, 2 July 2021 14:55 (20 minutes)

The efficiency of the different processes responsible for the evolution of interstellar dust on the scale of a galaxy, are to date very uncertain, spanning several orders of magnitude in the literature. Yet, a precise knowledge of the grain properties is the key to addressing numerous open questions about the physics of the interstellar medium and galaxy evolution. In this talk, I will synthesize an empirical statistical study, aimed at quantifying the timescales of the main cosmic dust evolution processes, as a function of the global properties of a galaxy.

We have modeled a sample of $\simeq$800 nearby galaxies, spanning a wide range of metallicity, gas fraction, specific star formation rate and Hubble stage. We have derived the dust properties of each object from its spectral energy distribution. Through an additional level of analysis, we have inferred the timescales of dust condensation in core-collapse supernova ejecta, grain growth in cold clouds and dust destruction by shock waves. We show that dust production by core-collapse supernovae is efficient only at very low-metallicity, a single supernova producing on average less than $\simeq$0.03 $M_\odot$/SN of dust. Our data indicate that grain growth is the dominant formation mechanism at metallicity above $\simeq$1/5 solar, with a grain growth timescale shorter than $\simeq$50 Myr at solar metallicity. Shock destruction is relatively efficient, a single supernova clearing dust on average in at least $\simeq$1200 $M_\odot$/SN of gas.

Our results provide valuable constraints for galaxy evolution, and propose a framework for interpreting the dust masses of distant galaxies, derived from millimeter observations.

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