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The evolutionary pathways of dust and cold gas in quiescent galaxies

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The evolution of galaxies is intrinsically tied to stars, but also gas, metals, and dust within the interstellar medium (ISM). These components are thought to be exclusively linked to the process of star-formation, implying that the molecular gas and dust should tightly follow each other's fate. However, the recent advent of the most powerful ground-based and space-based instruments such as the Atacama Large Millimeter/submillimeter Array (ALMA) and the James Webb Space Telescope (JWST), is providing strong evidence that even galaxies that stopped forming new stars millions, or even billions, of years ago (called quiescent galaxies or QGs), contain significant amounts of dust with respect to their stellar mass.

To overcome the observational challenges (mostly due to the significant observing time required to measure dust in QGs), we studied these objects in the state-of-the-art cosmological simulation SIMBA. In this talk, I present the main results of my work with SIMBA: the pathways for dust and cold gas in QGs up to z=2. During the talk I will show, for the first time, how different mechanisms, both internal and environmental, can affect the dust content after the cessation of the star formation. I will highlight how SIMBA predicts copious amounts of dust in QGs at high-redshifts, and paints a scenario in which quenching timescales and environments provide only a partial contribution to the evolutionary pathways of the ISM. I will finally explain the main result of my finding: a key new channel for dust re-formation in QGs. This involves a prolonged dust growth in the ISM, which activates almost independently from the evolution of the molecular hydrogen gas, presenting new exciting predictions for future observers.

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