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The origin of dust and molecular gas in galactic winds

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The origin of dust and molecular gas observed outside of galaxies remains puzzling and poorly understood. Dust is expected to be rapidly destroyed via sputtering, suppressing the formation of molecular hydrogen. In addition, cool clouds should be dispersed via fluid instabilities within a few cloud-crushing times. To study this problem, we use a suite of cloud-crushing simulations featuring a novel non-equilibrium chemistry network coupled with a dust evolution model that includes both sputtering and dust growth (accretion). We find that when cooling dominates over cloud destruction, the cloud develops into a two-phase structure: a warm, diffuse phase and a cold, dense phase. Dust in the cloud survives and can even reform due to dust growth in the cold phase. This leads to the formation of molecular hydrogen in the cold phase when a significant amount of dust survives. Our results support the scenario that the observed dust and molecular gas outside of galaxies originate from the interstellar medium entrained by galactic winds.

Section

Galaxy/Extragalactic

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