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Dusty protostellar collapses simulations in 3D with dust growth

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Dust grains are essential ingredients in star formation and play a significant role in gas/dust dynamics, chemical reactions, and radiative transfer. The efficiency of all these physical processes depends on the grain-size distribution and how it evolves in time. Thus, accurate dust modeling is a much needed feature of star formation simulations. Dust growth and fragmentation are mathematically described by the Smoluchowski coagulation and the fragmentation equations. Solving these equations accurately while preserving tractable computational costs is a tremendous numerical challenge, yet critical for understanding the formation of stars, disks and planets. In particular, low-order schemes do strongly overestimate the formation of large particles. We present a novel high-order discontinuous Galerkin algorithm (Lombart+,2021,2022,2024) that addresses all these issues. We aim to perform the first 3D simulations of dusty protostellar collapses that include realistic dust growth/fragmentation.

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