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Dust dynamics on adaptive-mesh-refinement grids: application to protostellar collapse

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We propose a method to follow the dynamics of gas and dust mixtures. We implement an algorithm (Lebreuilly *et al.* Submitted) in the adaptive-mesh-refinement code RAMSES (Teyssier 2002) that solves the monofluid equation of gas and dust mixtures in the diffusion approximation (Laibe & Price 2014). This algorithm allows an efficient simultaneous treatment of multiple dust species and is tested against canonical tests, e.g., the Dustywave, the Dustyshock and the Dustydiffuse.

A Boss and Bodenheimer (Boss & Bodenheimer 1979) protostellar collapse test of a rotating $1 M_{\odot}$ core is performed to study the dust dynamics during the formation of the first Larson core (Larson 1969). Eight dust species are simultaneously considered. The grains, with sizes ranging from 5nm to 0.5mm, are distributed as a power-law consistent with the MRN distribution (Mathis *et al.* 1977).

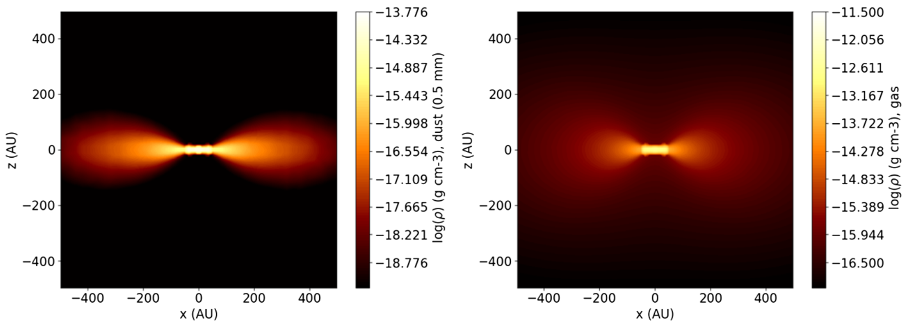

Figure 1. Edge-on cut of the collapse at $t = 120$ kyr. Dust density of the 0.5 mm grains (left) and gas density (right) for the Boss and Bodenheimer test. The color range is set so that, if the dust ratio was constant, the two maps would be the same.

Figure 1 shows the dust (0.5 mm grains) and the gas densities at $t = 120$ kyr. Dust decouples from the gas for grains larger than 100μm which is consistent with previous works (Bate & Lorén Aguilar 2017). Nano-dust remains very well coupled to the gas.

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