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Star by star simulations in RAMSES

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I am currently testing a model I have implemented in RAMSES which treats individual stars, both in isolated galaxies and cosmological context. In this talk, I will present a new star formation model that samples the IMF fast and accurately, hence allowing for a more sophisticated star-by-star treatment of stellar feedback processes. The model can currently trace stars down to 8 solar masses and an extension down to one solar mass stars is currently under development. In addition, this model allows for a treatment of previously unexplored collisional effects such as runaway stars in a fully cosmological context. I demonstrate the importance of this mechanism on scales covering ultra-faint dwarves up to Milky Way-mass galaxies. We find that massive runaway stars can explode 100s of parsecs away from their natal birth environments, hence injecting energy and metals in low-density gas. This leads to a change in outflows properties on galactic scales which impact the evolution of the aforementioned galaxies. Runaway stars is an ignored effect in modern simulations of galaxy formation, and quantifying this is important for our understanding of galaxy evolution.

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