TITLE: Contribution to the Theory of Star Formation using Computer Simulations of Turbulent Molecular Clouds

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ABSTRACT:

Stars play a central role in shaping the history of our Galaxy, from its large scale evolution to the formation of planetary systems. Our understanding of their formation inside large clouds of molecular hydrogen is still incomplete. Due to the complex interplay of various physical effects over a vast range of scales, computer simulations have become an indis- pensable tool for theoretical studies of star formation. Sink particles are routinely applied in these simulations to represent forming stars and thus model processes happening on scales that cannot be resolved in the simulation. I describe a new sink particle algorithm for the astrophysical simulation code ramses. As a main novelty it forms sink particles only on the peak locations of well defined gas clumps. The algorithm thus works in tan- dem with a newly developed structure finding tool named phew. phew detects overdense regions and their entire substructure in a fully parallel fashion and can be applied in a broad astrophysical or cosmological context. Tests suggest that the pairing with a struc- ture finding tool improves the identification of sites where stars will form through local gravitational collapse. First simulations of star formation in turbulent molecular clouds performed with the new algorithm predict an overall realistic distribution of stellar masses, while the detailed mechanisms that prevent or promote the formation of low mass stars and brown dwarfs needs to be further examined.