# Core creation in galaxies and haloes via sinking massive objects

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We perform a detailed investigation into the disruption of central cusps via the transfer of energy from sinking massive objects. Constant density inner regions form at the radius where the enclosed mass approximately matches the mass of the infalling body. We explore parameter space using numerical simulations and give an empirical relation for the size of the resulting core within structures that have different initial cusp slopes. We find that infalling bodies always stall at the edge of these newly formed cores, experiencing no dynamical friction over many dynamical times. As applications, we consider the resulting decrease in the dark matter annihilation flux due to centrally destroyed cusps, and we present a new theory for the formation of close binary nuclei – the 'stalled binary' model. We focus on one particularly interesting binary nucleus system, the dwarf spheroidal galaxy VCC 128 which is dark matter dominated at all radii. We show that its nuclei would rapidly coalesce within a few million years if it has a central dark matter cusp slope steeper than $r^{-1}$. However, if its initial dark matter cusp is slightly shallower than a log slope of $-0.75$ at $\sim 0.1\%$ of the virial radius, then the sinking nuclei naturally create a core equal to their observed separation and stall. This is close to the log slope measured a recent billion particle CDM halo simulation.