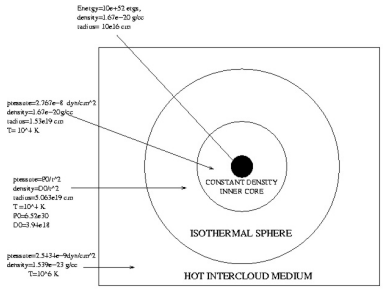
On the formation of Globular Clusters

Hercules Cluster (M13)

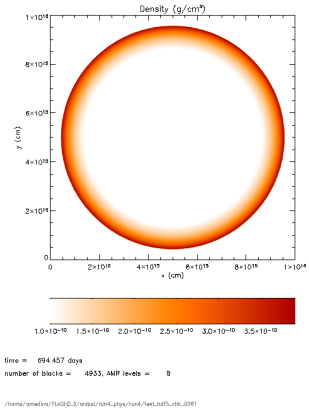


INITIAL SETUP FOR THE GLOBULAR CLUSTER FORMATION PROBLEM

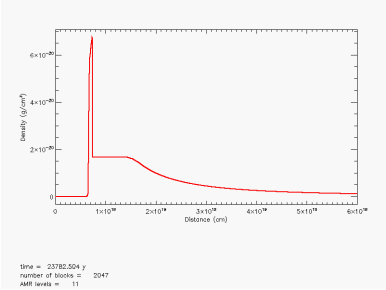
(FULLY IONIZED HYDROGEN, MOLECULAR WEIGHT=0.5)

All in hydrostatic equilibrium except for the supernovae explosion

Although globular clusters have been studied for decades, their formation mechanism still remains unclear, as does their role in nucleosynthesis during the early stages of galactic evolution. In our research, we focus on one of the considered scenarios for their formation, that of self-enrichment within the proto-globular cluster cloud. The ejecta from multiple supernova explosions arising from an early generation of stars sweeps up the ambient gas within the cloud as it expands outwards, slowing down in the process until it becomes radiative. The transition to the radiative stage can lead to the onset of hydrodynamic instabilities and mixing of the ejecta products with the surroundings. If the proto-cluster cloud can avoid disruption the gas may condense to form stars, giving rise to a low metallicity globular cluster. We have investigated this model using one-dimensional numerical hydrodynamic simulations in spherical geometry. The simulations were carried out using the FLASH code, a modular, adaptive-mesh, parallel, multi-dimensional, multi-species PPM based hydrodynamic code. Radiative cooling is included via a cooling function obtain Sutherland & Dopita (1993). Two dimensional simulations (with FLASH) are now in progress.



Sedov scaled solution density profile.



1D density profile in spherical geometry using cooling function obtained from [5].

References

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