DWARF GALAXIES, COLD DARK MATTER, AND BIASED GALAXY FORMATION

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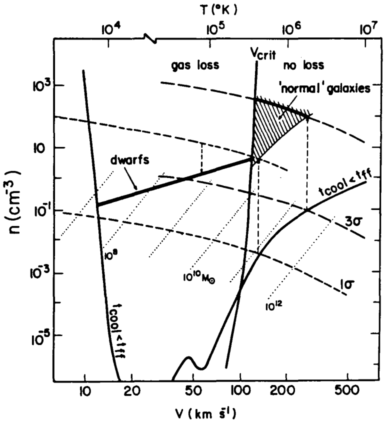
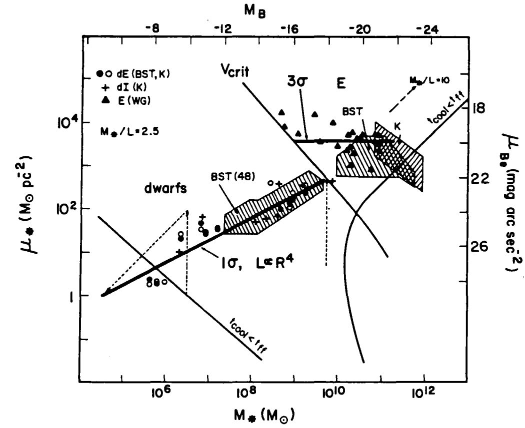
The formation of dwarf, diffuse, metal-poor galaxies, as a result of supernova driven winds, is reexamained in view of the accumulating data on dwarfs in the local group and in the Virgo cluster. The observed drop in both surface-brightness and metallicity with decreasing luminosity is not easily understood if the gaseous protogalaxies are self-gravitating (because they swell after gas-loss), but they are produced naturally inside dominant halos, with a mass-radius relation that indicates 'cold' dark matter. The theory predicts for the faint dwarfs an M/L that increases with decreasing luminosity up to 10-100, and a corresponding slow decrease in velocity dispersion down to 5-10 km/s.

We find that the condition for global gas loss due to the first burst of star formation is that the virial velocity be below a critical value on the order of 100 km/s. In any hierarchical scenario for galaxy formation, this condition leads to two distinct classes of galaxies as observed: (a) the diffuse dwarfs (both dEs and dIs that have retained some gas) which mostly originate from typical (1 sigma) density perturbations, and (b) the normal, brighter galaxies (including compact dwarfs) which can come only from the highest density peaks (2-3 sigma). This provides a statistical bias for the formation of bright galaxies in denser regions, enhancing their clustering relative to the diffuse dwarfs. It may help reconcile the observed large scale universe with the flat model predicted by inflation. The diffuse dwarfs are expected to trace the mass; they should be present everywhere, including in the 'voids' which are deficient in bright galaxies. A substantial amount of lost gas is expected to be present in the 'voids'.





The critical curves for cooling and for gas-loss confine the locii for dwarfs and for 'normal' galaxies, that emerge from 1 and 3 sigma CDM perturbations. Excellent agreement between the theory and observations.

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