SOME REGULARITIES IN THE MISSING MASS PROBLEM

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We discuss available information on the distribution of luminous and dark matter in eight galaxies. The galaxies have been chosen according to the following criteria: 1) existence of a good rotation curve, extending well beyond the optical radius; 2) a mass model has been published; 3) valuable constraints can be put on the amount of dark matter *inside the optical radius*. A full description of the data and reduction procedures is in Bahcall and Casertano (1985).

For each galaxy, the mass models proposed by the original authors have been used. These models are based on a variety of methods. All assume $M \propto L$ for the disk. For some of the models the mass-to-light ratio was chosen in advance; for others it is determined by the "maximum disk" assumption. In two cases (the Milky Way and NGC 5907) independent dynamical evidence supports the value chosen for M/L. We feel that this is the best information available at present. However, the mass models are mostly based on plausibility arguments, and other models, with different disk and halo masses, are possible.

The properties of the luminous and dark matter in these galaxies, when compared to each other, exhibit suggestive regularities. Perhaps the most striking is in the value of the ratio $M_{\mathrm{halo}}/M_{\mathrm{disk}}$ within the optical radius, which is nearly constant ($\pm 30\%$) and very close to unity, although disk and halo masses separately vary by a factor of 100. This close correlation between the properties of luminous and dark matter is borne out by the fact that rotation curves do *not* show any major features at the transition between disk-dominated and halo-dominated regions.

One possible interpretation of the observed regularities may be the existence of some process that tends to equalize the amount of dissipational and dissipationless material inside some typical scale. If so, the observed regularities will provide valuable constraints on processes of galaxy formation.

An alternative explanation is that luminous and dark matter are actually different manifestations of the same component; in other words, that the nonluminous matter is baryonic. This is consistent with the absence of a break in the rotation curves and the constant disk-to-halo mass ratio. In addition, it is known that in the solar neighborhood at least some of the dark matter must be in a dissipative, disklike component.

For this explanation to work, the unobserved material must be in the form of small-mass compact objects (neutron stars, white dwarfs, etc.), brown dwarfs, or very massive black holes.

REFERENCE

Bahcall, J. N. and Casertano, S. 1985, *Ap. J. Letters*, **293**, L7.

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