THE TOTAL MASS OF DDO 154

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The total mass and total extent of galaxies (including their dark halos) are fundamental parameters that are completely unknown for all galaxies. The best estimates we have for spiral and dwarf irregular galaxies come from detailed mass models using extended HI rotation curves. But, in every galaxy studied so far, such analysis only succeeded to derive lower limits of the total mass and total extent of their dark halo out to the last measured velocity point of the rotation curves which are still flat or even rising, implying that more dark mass is present at larger radii.

While it is conceivable that the total mass of galaxies could be determined by dynamical methods (satellite galaxies, galaxies in pairs or in groups), the main hope to derive the total extent is that, at least in some galaxies, the HI extends all the way to the edge of the halo (and still be detectable) so that the kinematics show the expected Keplerian decline if all the mass has been encountered.

Combining data from the DRAO interferometer array in Penticton, BC., with VLA observations, it was possible to recover all the single dish flux of DDO 154 of which $\sim 30\%$ was missing from the VLA data alone. The missing flux was found to be in an extended low surface brightness component in the outer parts of this dwarf irregular galaxy. The new combined data show that the HI disk extends to ~ 6 optical radii (R_{Ho}) or 21 optical scale lengths (α^{-1}) at a level of 1.0×10^{19} cm^{-2}. A total HI mass of 2.2×10^8 $\mathcal{M}_\odot$ is derived which gives an $(\mathcal{M}_{HI}/\mathrm{L}_B) \simeq 7$. This allows to extend the rotation curve by more than 33% in radii.

The new combined data confirm that the rotation curve not only is declining in the outer parts, but that it runs parallel to the Keplerian decline expected if all the mass has been encountered. It thus seems that we have reached the edge of the mass distribution for DDO 154. This allows to derive a *total* mass of $\mathcal{M}_{tot} \simeq 3.0 \times 10^9$ $\mathcal{M}_\odot$, of which 90% is dark, and an upper limit to the radial extent of $\mathrm{R}_{tot} \leq 8$ kpc.

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