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The HI gas distribution and dark matter content of the Bulgeless Galaxies NGC4701 and NGC4775

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Abstract. We present GMRT HI observations of two bulgeless spiral galaxies NGC 4701 and NGC 4775. Both galaxies are gas rich, nearly pure disk in morphology and close to face-on. NGC 4701 is a low surface brightness galaxy wih an extended HI gas disk. NGC 4775 is a gas rich dwarf. Our aim is to understand the role of the dark matter halo in limiting the evolution of bulges in these galaxies. As a first step we have mapped the HI gas distributions and derived their HI rotation curves. We present early results of this study and discuss the implications of our results.

Keywords : galaxies – Spiral – HI – dark matter

1. Introduction

Bulgeless galaxies are an extreme class of late type spiral galaxies (Scd to Sm) that have practically no bulge in their disks (Boker et al. 2002). They are gas rich galaxies but generally show only poor to moderate star formation. Their formation and evolution is not well understood. The two main questions regarding their evolution are (i) why have they not formed bulges and (ii) what is the origin of their relatively high disk rotation velocities ? One of the possible explanations for the lack of bulges could be the presence of dominant dark matter halos in the inner disks of these galaxies. The dark halo impedes the formation of disk instabilities, star formation and overall disk evolution that can lead to the growth of bulges. In this paper we present some early results of the study of the dark matter content of the two bulgesless galaxies, NGC 4701 and NGC 4775.

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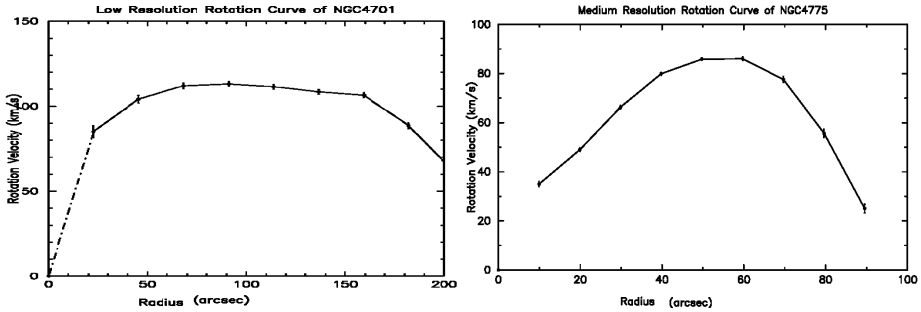

Figure 1. The figure on the left low reolution rotation curve of NGC4701. The gas extends out to 160″ or 11.2 Kpc. The figure on the rght is the medium resolution rotation curve of NGC 4775. The gas extends out to 60″ or 7.5 Kpc.

2. Bulgeless spiral galaxies NGC 4701 and NGC 4775

We observed the HI emission in the two bulgeless spiral galaxies NGC4701 and NGC4775 using the GMRT during November, 2009. The data was analysed using AIPS. The HI intensity, velocity field and velocity dispersion (moment2) maps were derived for both galaxies. The moment 1 maps were used to derived the rotation curves using the software package NEMO (Teuben et al. 1995). The galaxy sizes and disk profiles were determined using GALFIT (Peng et al. 2010).
NGC 4701 : The SDSS B band optical profile shows that the galaxy is a low surface brightness spiral, with an extended HI disk that is approximately 6 times as large as the optical disk. We have measured its stellar mass using the its K band luminosity and the appropriate M/L ratio. We have summed up the stellar, HI and molecular hydrogen (H_2) gas masses to derive the total baryonic mass. The HI rotation curve was used to determine the dynamical mass (Figure 1). We find that the baryonic mass is only 6% of the dynamical mass. Hence NGC 4701 is a dark matter dominated galaxy.
NGC 4775 : It is also gas rich but the HI disk radius is only 1.3 times the stellar disk. The HI disk appears to be lopsided and its velocity field is extended along the major axis which suggests the presence of a small bar or gas inflows. We derived its stellar mass from its K band luminosity. We added up the stellar, HI and H_2 gas masses to determine the the total baryonic mass and compared it to the dynamical mass. The baryonc mass is about 50% of the dynamical mass in NGC4775. Hence this galaxy is not as dark matter dominated as NGC4701.

3. Conclusions

We find that in terms of mass, NGC 4701 is dark matter dominated whereas NGC 4775 is not. In future work we will compare the dark matter content in the inner disks of these galaxies to fully understand the effect of dark matter on bulge evolution.

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