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HI Properties of LSB Dwarf and Blue Compact Dwarf Galaxies

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Abstract.
We present high resolution ($\sim 15''$) VLA HI observations of one LSB dwarf galaxy and 5 Blue Compact Dwarfs. Previous works have emphasized the difference in the peak column density of the HI between the two types of galaxy. However, the peak column density is typically only a factor of 2—4 greater in BCDs than in LSB dwarfs, suggesting that the difference between the two is one of degree, not quality. The HI morphologies of the two types are often quite similar.

1. Introduction

Gas rich dwarf galaxies can be divided into two groups based upon their optical properties. Dwarf irregulars tend to be of low surface brightness, and generally have low current star formation rates. Blue Compact Dwarfs (BCDs), in contrast, tend to have higher surface brightnesses, their optical morphologies being dominated by a large burst of star formation. The differences in the global properties of their gaseous components, as traced by HI, are not so immediately apparent. Previous work (e.g. Taylor et al. 1994, van Zee et al. 1998) has shown that the two types of galaxy often have similar HI masses, average column densities, and rotation curves, but that the BCDs have peak column densities of HI higher by a factor of $\sim$ 2—4 than LSB dwarf irregulars. BCDs also often show signs of kinematically irregular gas – detached clouds, or warped disks, for example. Here we present HI data which, along with data from the literature, will be used to compare LSB dwarf galaxies with BCDs in an upcoming paper.

2. Observations

21-cm line HI observations of 7 BCDs and one LSB dwarf galaxy were conducted with the VLA in the most compact (D) and second most compact (C) configurations, with the correlator configured to provide a velocity resolution of 5.2 km s^{-1}. The angular resolution of the resulting data cubes ranged between $13''$ to $22''$. The rms noise in a channel map ranged from 0.6 mJy beam^{-1} to 1.1 mJy beam^{-1} Figure 1 shows for six dwarf galaxies an HI column density map (left) and a velocity field map (right).

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The Challenge: The HI distributions of the galaxies are quite similar. Can you pick out which galaxy is the LSB dwarf, based upon the HI distribution alone? Answers will appear at the end.

3. LSB Dwarfs, BCDs, and Interactions

The HI distributions of LSB dwarfs and BCDs can appear similar, with central concentrations and diffuse outer regions occurring often in both types of galaxy. Thus the difference between them may be more a matter how high the central gas density reachs, rather than a qualitative distinction. If the gas density explains the difference in star formation properties between the two types, the question then becomes, what is the cause of this difference in gas density. One possibility is that gas rich dwarfs naturally exhibit a range in central gas density, and the fraction with the highest density become BCDs. Another possibility is that the increased gas density at the center is created by the inflow of gas from the outer regions of the galaxies. Galaxy interactions are known to drive this sort of radial gas motion in spiral galaxies, and may play a similar role for dwarfs.

Taylor (1997) compared the frequency with which HI rich companions are found near LSB dwarfs with that for BCDs. The LSB dwarfs had such companions at less than half the rate as did the BCDs, suggesting that interactions between galaxies can play a role in triggering star bursts in dwarf galaxies. But interactions are not the whole story. Not all of the LSB dwarfs were isolated, and not all of the BCDs had close neighbors. To investigate the differences between the two types due to differences in the degree of interaction, we selected galaxies from the surveys of Taylor et al. (1995, 1996) to include isolated examples, cases of distant interaction, and cases of close interaction.

The global properties (e.g. mass, *average* column density) of the HI in LSB dwarf galaxies and BCDs are very similar. We will use our data to compare small scale properties (e.g. peak column densities), kinematics, and interaction properties to determine which of these elements are most important in determining the star formation properties in these galaxies. For example, in the case of massive galaxies, it is well known that prograde interactions result in much stronger disturbances (and more stronger effects on star formation rates) than do retrograde interactions. Data such as ours are essential to understanding the star formation properties in dwarf galaxies.

Answers

a: F495-V1 – LSB dwarf; b: Haro 21 – BCD; c: UM372 = UGC1297 – BCD; d: UM500 = UGC7531B – BCD; e: UM456 – BCD; f: UM501 – BCD.

References

Taylor, C.L. 1997 ApJ, 480, 524

Taylor, C.L., Brinks, E., Pogge, R.W., & Skillman, E.D. 1994 AJ, 107, 971

Taylor, C.L., Brinks, E., Grashuis, R.M. & Skillman, E.D. 1995 ApJS, 99, 427: erratum 102, 189

Taylor, C.L., Thomas, D.L., Brinks, E. & Skillman, D. 1996 ApJS, 107, 143

van Zee, L., Skillman, E.D. & Salzer, J.J. 1998 AJ, 116, 1186

https://doi.org/10.1017/S0252921100054531 Published online by Cambridge University Press

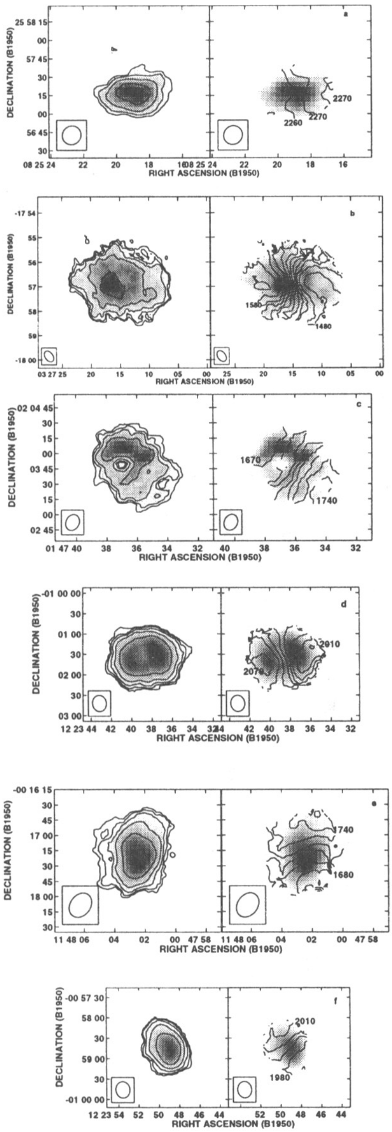

Figure 1. HI column density (left) and velocity field (right) maps for 5 BCDs and one LSB dwarf galaxy. In each case the greyscale shows the column density, and represents a different range of values for each galaxy. The column density contours, however, are the same for every galaxy: 0.5, 1, 2, 4, 8 and 16 $\times$ 10^{20} cm^{-2}.

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Searching for LSB - VI

OK, we are all agreed, we will need a bus.

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