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The baryonic Tully-Fisher relation from WALLABY

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We investigate the baryonic Tully-Fisher relation using data from the WALLABY pilot survey, which includes a total sample of 2,352 galaxies. To accurately measure line widths of HI global profiles, we develop and apply a spectral profile fitting technique based on the Busy Function (Westmeier+2014), which effectively reduces systematic biases caused by noise peaks in low S/N spectra. This method allows us to automatically and robustly measure line widths for large samples of galaxies. By comparing our measurements with those obtained from SoFiA (Westmeier+2021), we identify a systematic offset in the SoFiA-derived line width measurements. Using a Monte Carlo-bootstrap method, we estimate line width measurement uncertainties as well as validate the robustness of our spectral profile fitting technique. After correcting for peculiar velocities and deriving stellar masses using WISE band 1 magnitudes, we construct both the stellar mass and baryonic Tully-Fisher relations. These are based on a representative sample of ˜430 galaxies covering a broad mass range, from low-mass to high-mass systems, which were previously underrepresented. We quantify the statistical properties of the relations (such as slope, zero-point, and scatter) and particularly examine how the intrinsic scatter varies as a function of rotational velocity. Additionally, we investigate environmental effects by examining how the relation differs between galaxies in high- and low-density regions. Our results provide further insights into the fundamental drivers of variance in the baryonic Tully-Fisher relation and contribute to a deeper understanding of galaxy formation and evolution within the ΛCDM framework.

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