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Optimizing linewidth measurements for a low-scatter Baryonic Tully-Fisher Relation

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The Arecibo Pisces-Perseus Supercluster Survey (APPSS) aims to observationally measure the dark matter mass density of Pisces-Perseus by detecting the peculiar velocities of galaxies falling onto the supercluster. To do this, APPSS will measure galaxies' distances using the Baryonic Tully Fisher Relation (BTFR), which relates a galaxy's baryonic mass and rotational velocity. Recovering the signature of infall as robustly as possible requires a careful choice of rotational velocity measurement, as the use of various velocity definitions changes the scatter and systematics of the relation. We introduce and compare multiple automated methods for measuring a galaxy's rotational velocity using its unresolved line profile. The velocities discussed include global HI profile width measures commonly reported in large surveys, velocity widths derived from best-fit parametrizations to profiles, and velocity widths derived using more novel methods including the spectral line's curve of growth and neural network-derived velocities which incorporate information about the profile's width and shape. We compare these velocity measures by finding best-fit BTFR relations for two samples of galaxies - the SPARC sample and a selected sample of gas-dominated ALFALFA galaxies (Papastergis et al. 2016).

With these best-fit BTFRs, we compare intrinsic scatters and residual correlations with source properties to investigate how velocity choice affects the absolute and systematic uncertainties of BTFR-derived galaxy distances. This research is supported by NSF/AST-1714828 and the Brinson Foundation.