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Strong Evidence for the Density-Wave Theory of Spiral Structure in Disk Galaxies: Pitch Angle Measurements in Different Wavelengths of Light. HAMED POUR-IMANI, DANIEL KENNEFICK, JULIA KENNEFICK, BENJAMIN DAVIS, DOUGLAS SHIELDS, MOHAMED SHAMEER ABDEEN, Univ of Arkansas-Fayetteville — The density-wave theory of galactic spiral-arm structure makes a striking prediction that the pitch angle of spiral arms should vary with the wavelength of the galaxy's image. The reason is that stars are born in the density wave but move out of it as they age. They move ahead of the density wave inside the co-rotation radius, and fall behind outside of it, resulting in a tighter pitch angle at wavelengths that image stars (optical and near infrared) than those that are associated with star formation (far infrared and ultraviolet). In this study we combined large sample size with wide range of wavelengths, from the ultraviolet to the infrared to investigate this issue. For each galaxy we used an optical wavelength image (B-band: 445 nm) and images from the Spitzer Space Telescope at two infrared wavelengths (infrared: 3.6 and 8.0 μm) and we measured the pitch angle with the 2DFFT and Spirality codes (Davis et al. 2012; Shields et al. 2015). We find that the B-band and 3.6 μm images have smaller pitch angles than the infrared 8.0 μm image in all cases, in agreement with the prediction of density-wave theory. We also used images in the ultraviolet from Galaxy Evolution Explorer, whose pitch angles agreed with the measurements made at 8.0 μm. Because stars imaged at those wavelengths have not had time during their short lives to move out of the star-forming region.

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