Wide-field Infrared Survey Explorer

WISE High Resolution Galaxy Atlas

T. Jarrett (IPAC), F. Masci (IPAC), C.W. Tsai (IPAC), S. Petty (UCLA), D. Benford (GSFC), K. Sheth (NRAO)

After eight months of continuous observations from a sun-synchronous polar orbit, WISE mapped the entire sky at 3.4 μm, 4.6 μm, 12 μm and 22 μm, producing a coadded Image Atlas and a Source Catalogue, available through the Infrared Science Archive. The data reduction pipeline was optimized to detect and measure the fluxes of point sources. Sources that are larger than one arc minute in diameter, however, will not have been characterized in the released data products. Accordingly, we have begun a dedicated project to fully characterize large, nearby galaxies and produce a legacy image atlas and catalogue that will serve the community for decades to come. Here we demonstrate the early results of the WISE High Resolution Galaxy Atlas (WHRGA) project for a sample of 17 galaxies, chosen to be of large angular size, diverse morphology, and covering a range in color, stellar mass and star formation. It includes many familiar galaxies, including M51, M81, M87, M83, M101, IC 342. Photometry and surface brightness decomposition is carried out with special super-resolution processing of WISE imaging, achieving spatial resolutions similar to that of Spitzer-IRAC. In this work we present basic photometric and characterization measurements for the sample galaxies, comparing the WISE results with those of Spitzer and IRAS. We derive star formation rates using the PAH-sensitive 12 μm (W3) and warm dust sensitive 22 μm (W4) measurements, and stellar masses using the 3.4 μm (W1) and 4.6 μm (W2) measurements that trace the host galaxy-dominated evolved population of stars. We highlight and showcase the detailed results of M 83, comparing the WISE/Spitzer results with the radio Hi gas distribution and GALEX UV emission, tracing the evolution from gas to stars. In addition to the super-resolution images, WISE’s all-sky coverage provides a tremendous advantage over Spitzer for building a complete nearby galaxy catalog, tracing both stellar mass and star formation histories. We discuss the construction of a complete mid-infrared catalog of galaxies in D < 40 Mpc.

Resolution-Enhanced Mosaic Images

The WISE Data Science Center has developed a generic co-addition and resolution enhancement (HiRes) tool specifically designed to operate on WISE single-exposure image frames. This tool produces science-quality mosaic products with statistically-validated uncertainty estimates on fluxes. The HiRes algorithm is based on the Maximum Correlation Method (MCM) of Masci & Fowler (2009) and is an extension of the classic Richardson-Lucy deconvolution algorithm.

Since WISE is an all-sky survey, covering every pixel of the heavens, the WISE High Resolution Galaxy Atlas (WHRGA) will provide resolution-enhanced equivalents for the largest galaxies in the local universe, including those of the immense Andromeda System and the Local Group. This provides a data continuity between WISE and Spitzer, whose WISE completes the infrared sky without Spitzer coverage or regions that were mapped coarsely.

The WHRGA will represent a complete, unbiased mid-infrared census of the local extragalactic universe, a vital legacy that will serve the community for decades to come. The images and source catalog of the WHRGA will be made freely available through NASA/IPAC Extragalactic database (NED) and the Infrared Science Archive (IRSA).