The WISE Mission: an atlas for luminous galaxy evolution
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WISE is a NASA all-sky survey mission due for launch in 2009. WISE will produce a 4-band image of the mid-infrared sky at 3.3, 4.65, 12 and 23 µm with sensitivities of at least 0.1, 0.2, 0.6 and 2.6 mJy respectively. The passband profiles of the filters are shown in Fig 1, along with a range of template spectra that describe the spectral energy distributions of the wide range of galaxies that WISE will detect, based on the results of the SWIRE Spitzer Legacy survey (Polletta, priv. comm.).

We have convolved libraries of these mid-IR SEDs with the WISE passbands (see left) to predict the colors and flux densities of different galaxies that will be detected by WISE as a function of redshift. The WISE catalog alone can highlight of order $10^{0-7}$ unusual and extreme galaxies out to moderate and high redshifts (see right). WISE can thus identify the most interesting galaxies – perhaps in the richest environments – for follow-up spectroscopy and imaging observations withGBT, VLA, ALMA, JWST and optical/near-IR spectrographs. Its power is enhanced by combining optical data from SDSS, and in the future from synoptic survey telescopes like PanSTARRS and LSST. The 3.3 and 4.65 µm color can screen out brown dwarves, while stars are revealed in existing optical imaging.

The WISE bands detect dust and small-grain PAH emission at the longer wavelengths and evolved stellar populations at the shorter wavelengths. The WISE catalog alone will provide reasonable estimates of both the far-IR luminosity for dust-enshrouded galaxies, along with at least an an upper limit to the stellar masses developed up until the point of observation. The range of SEDs of galaxies that WISE is likely to find are plotted in Fig 1. In Fig 2 we show the sensitivity of the passbands to different redshifts/astrophysical properties for ultraluminous galaxies, and in Fig 3 we highlight the discriminatory power of WISE colors using the full range of templates shown in Fig 1, showing WISE color–color diagrams for these classes of galaxies at different redshifts are shown. In Figure 3 the color-color diagrams available from the WISE survey are shown to be suitable for identifying the most luminous high-redshift galaxies and AGN on the grounds of their powerful mid-infrared emission, with neither spirals nor ellipticals having colors that can be confused. The range of positions occupied by the ultraluminous on these diagrams shows that the colors hold great promise as indicators of photometric redshifts and astrophysical conditions.

WISE will highlight millions of ideal ALMA targets at redshifts where star formation and black hole fuelling was most powerful.

WISE will also identify new asteroids and provide a baseline IR image of the sky for all classes of transient searches.

http://wise.ssl.berkeley.edu

http://www.astro.ucla.edu/~Ewright/WISE/