

Title: HST Observations of the Luminous IRAS Source FSC10214+4724:
A Gravitationally Lensed Infrared Quasar

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Abstract:

With a redshift of 2.3, the IRAS source FSC10214+4724 is apparently one of the most luminous objects known in the Universe. We present an image of FSC 10214+4724 at 0.8 microns obtained with the Hubble Space Telescope WFPC2 Planetary Camera. The source appears as an unresolved ($< 0.06''$) arc $0.7''$ long, with significant substructure along its length. The center of curvature of the arc is located near an elliptical galaxy $1.18''$ to the north. An unresolved component 100 times fainter than the arc is clearly detected on the opposite side of this galaxy. The most straightforward interpretation is that FSC 10214+4724 is gravitationally lensed by the foreground elliptical galaxy, with the faint component a counterimage of the IRAS source. The brightness of the arc in the HST image is then magnified by ~ 100 and the intrinsic source diameter is $0.01''$ (80 pc) at 0.25 micron rest wavelength. The bolometric luminosity is probably amplified by a smaller factor (~ 30), due to the larger extent expected for the source in the far-infrared. A detailed lensing model is presented which reproduces the observed morphology and relative flux of the arc and counterimage, and correctly predicts the position angle of the lensing galaxy. The model also predicts reasonable values for the velocity dispersion, mass, and mass-to-light ratio of the lensing galaxy for a wide range of galaxy redshifts. A redshift for the lensing galaxy of ~ 0.9 is consistent with the measured surface brightness profile from the image, as well as with the galaxy's spectral energy distribution. The background lensed source has an intrinsic luminosity $\sim 2 \times 10^{43}$ solar luminosities, and remains a highly luminous quasar with an extremely large ratio of infrared to optical/ultraviolet luminosity.

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