ISO SPECTROSCOPY OF THE GALACTIC CENTER AND STARBURST NUCLEI

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Since its launch in November 1995, the Infrared Space Observatory ISO has converted mid-infrared spectroscopy into a mature tool. Due to its proximity, brightness, and the wealth of complementary information, the center of our Galaxy remains a unique testbed for studies of galactic nuclei. A first analysis of the 2.4-45μm spectrum obtained with ISO-SWS (Fig. 1) has been presented by Lutz et al. (1996a). One of the surprises is a determination of the mid-infrared extinction law from comparison of the Galactic center hydrogen recombination line fluxes and case B expectations: The extinction law clearly lacks the deep minimum near 7μm expected for standard graphite/silicate mixes. External galaxies are less close to the ideal 'screen' case and cannot provide the detail of the GC recombination line spectrum needed to derive an extinction law. However, simple ratios of the strongest recombination lines are inconsistent with a classical extinction law and any dust configuration.

Low excitation fine structure lines are the most prominent emissions in the spectrum of the Galactic center as well as in spectra of starburst galaxies. Line ratios between different ionization stages of the same element like [NeIII] 15.55μm / [NeII] 12.81μm provide an extinction-insensitive tool to determine the hardness of the ionizing UV spectrum, and hence the population of hot stars. The GC spectrum is soft, as expected for an ageing population from a star formation event that stopped several million years ago. The sample of observed starburst spectra shows a spread from GC-like low excitation to high excitation spectra that are similar to active star forming regions like W51. A quantitative analysis using a combination of starburst and photoionization models confirms the impression of similarity: The fine structure line spectra of starburst galaxies can be fit with plausible star forming histories and stars forming up to at least 50 solar masses.

Y. Sofue (ed.), The Central Regions of the Galaxy and Galaxies, 91-92.

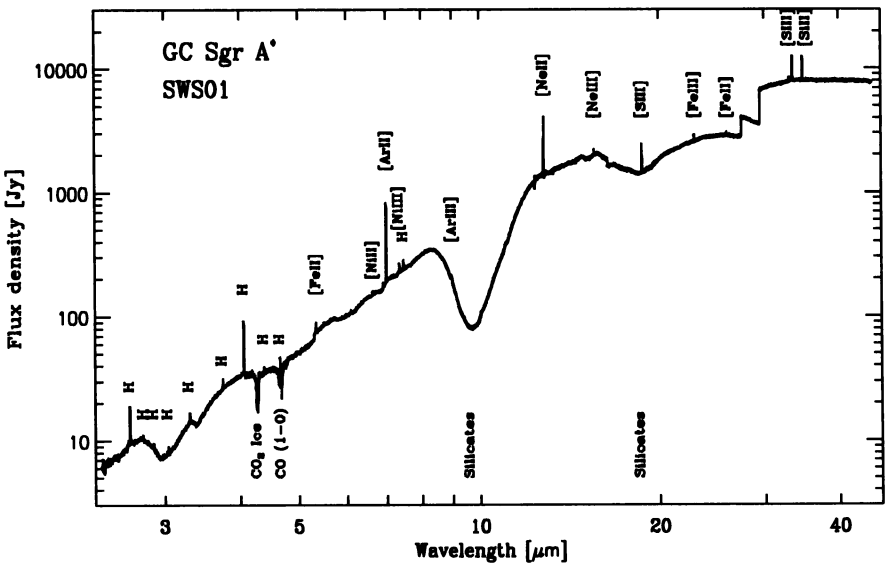

Figure 1. ISO-SWS spectrum of the Galactic center

ISO spectra provide us with two new tools to determine the source of power of ultraluminous infrared galaxies (ULIRGs). While ULIRGS as a class were discovered by IRAS nearly 15 years ago, the evidence for either a starburst or an AGN nature had remained inconclusive mainly because of problems to penetrate the heavy extinction to their nuclear regions. The two new indicators in ISO spectra are:

1) High-excitation fine structure lines like [OIV] 25.9μm and [NeV] 14.3μm are strong in the narrow line region excited by an AGN but absent or extremely faint in starburst spectra.

2) The 'PAH' emission features, the most prominent located at 7.7μm, are strong in the integrated spectra of star forming regions and starburst galaxies, but faint in AGN spectra or very close to stars, due to destruction of their carriers in extremely intense radiation fields.

Application of these tools to samples of ultraluminous infrared galaxies (Lutz et al. 1996b, Genzel et al. 1997) shows that the vast *majority* of ULIRGs is *predominantly* powered by star formation. A few examples of AGN-dominated ULIRGS exist, however (e.g. Mrk 273), and low luminosity AGNs may coexist with the dominant starburst in others.

References

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