THE ORIGIN OF THE 25 μm EMISSION IN SEYFERT 2 GALAXIES

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We have made a statistical study of the optical and far-IR properties of all the Seyfert 2 galaxies in the catalog by Véron-Cetty and Véron (1987; hereafter VCV). Nuclear spectroscopic data were compiled from the literature and IR fluxes from the *Catalogued Galaxies and Quasars Observed in the IRAS Survey (1985)*; we used only those IR fluxes not flagged as limits or uncertain values. We have used for comparison four more lists of objects with IRAS fluxes: one of Seyfert 1 galaxies given by Rodríguez Espinosa, Rudy and Jones (1987), a list of LINERs compiled from the literature, a sample of "normal" spirals (those labeled H in Keel, 1983), and finally the galaxies catalogued as Starburst nuclei galaxies in VCV.

We found a strong correlation between the luminosity at 25 μm and the nuclear Hβ luminosity (Figure 1) confirming the idea that the emission in this band is of nuclear origin. Weaker or no correlation was found for the other IRAS frequencies (Figure 2) including 12 μm (not shown here). In "normal" spirals, the far-IR emission can be described as a combination of a cool, relatively constant "cirrus" emission from the neutral medium, and a warmer component associated to star forming regions. While the diffuse "cirrus" emission at the longer wavelengths is attributed to thermal dust heated by the diffuse interstellar radiation field, the emission at 12 and 25 μm has been attributed to transient heating of small dust grains (e.g., Draine and Anderson, 1985). The emission at 12 μm is best explained by the model of Puget, Leger and Boulanger (1985) who descibe the transient heating of Policyclic Aromatic Hydrocarbon (PAH) molecules. Their prediction for the ratio I_{12}/I_{100} agree very well with the observed ratio $0.03 \leq I_{12}/I_{100} \leq 0.08$ for our galaxy (e.g., Boulanger, Baud and van Albada, 1985) and the mean ratios that we obtained for "normal" spirals, LINERs and nuclear Starburst galaxies (all within the above range). Actually, for a still reasonable fraction ($\leq$ 15%) of Carbon in PAH molecules, this model can also explain most of the emission at 12 μm for Seyfert galaxies ($< I_{12}/I_{100} > = 0.12$). This may be the explanation of the weaker correlation found between the luminosity at 12 μm and the nuclear $L_{H\beta}$. From Table 1 we see that nuclear Starburst and Seyfert galaxies are similar in the sense that the model of disc emission cannot even marginally explain the emission at 25 μm. On the other hand, the position on the colour-colour diagrams of Seyfert 2 galaxies and nuclear HII regions has a good deal of overlap (e.g., Neugebauer, Soifer and Rowan - Robinson, 1986). We have found that 50% of the Seyfert 2 galaxies that we studied have $\alpha(60,25) < -1.5$ and 70% have $\alpha(60,25) < 1$ being thus, under this criterion undistinguishable from nuclear Starburst galaxies. We believe that this important overlap and the 25 μm excess mentioned above, indicate that the same process (thermal or non-thermal) must be generating this emission in the nuclei of both these types of galaxies. A more extensive discussion on this point is given elsewhere (Dultzin - Hacyan, Moles and Masegosa, 1988).

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Table 1. Predicted and Observed I_{25}/I_{100} Ratios

Type	I_{25}/I_{100} Mean	I_{25}/I_{100} Median	Number of Objects	References
Model	0.025–0.052	0.025–0.052	——	1
Our Galaxy	0.040–0.055	0.040–0.055	——	2,3
"Normal" Spirals	0.050	0.040	30	4
LINERs	0.070	0.070	26	5
Starburst Galaxies	0.180	0.150	43	4
Seyfert 2	0.240	0.150	61	5
Seyfert 1	0.350	0.340	39	4

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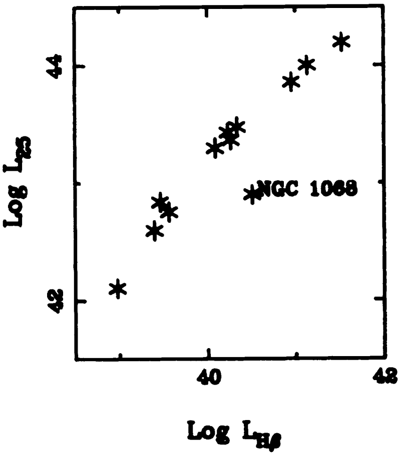

Figure 1. Luminosity of the nuclear Hβ *versus* the luminosity at 25 μm. Both in erg $sec^{-1}cm^{-2}$

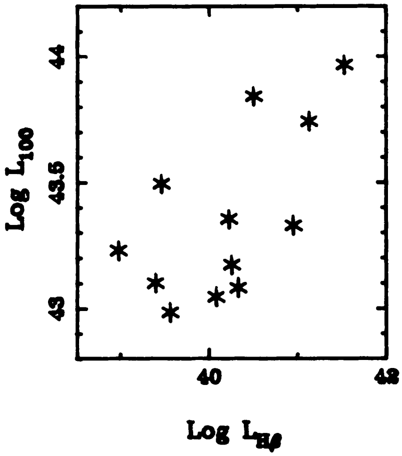

Figure 2. Luminosity of the nuclear Hβ *versus* the luminosity at 100 μm. Both in erg $sec^{-1}cm^{-2}$

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