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INFRARED RADIATION FROM THE SEYFERT GALAXY NGC 1068

A. G. PACHOLCZYK

and

W. Z. WISNIEWSKI

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A. G. PACHOLCZYK and W. Z. WISNIEWSKI

Steward Observatory

University of Arizona

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The nuclei of Seyfert galaxies and quasistellar sources show several similar features like broad emission lines in their spectra, compact dimensions and variable radio radiation. These features suggest that phenomena of similar nature but of different scale may take place in the nuclei of Seyfert galaxies and in quasistellar sources (Burbidge and Burbidge 1963, Shklovskii 1965). To the list of features common to some of those two types of objects we can now add one more, namely strong infrared radiation.

Strong infrared radiation of the Seyfert galaxy NGC 1068 was detected in October 1966 when multicolor observations of this galaxy were made with the Johnson UBVRIJHKL photometers attached to the 60-inch telescope of the Lunar and Planetary Laboratory, University of Arizona. The description of the photometric system and of the photometers used can be found in the literature (Johnson 1964, Johnson and Mitchell 1962) except for that of the recently added Vycor substrate interference filter with the transmission band 0.22μ centered on a wavelength of 1.62μ (called the H filter). This filter has not yet been tested for long wavelength leaks. Observations were made with a 15" diaphragm. Because of the particular structure of the JHKL photometer the sky readings were made at a distance of 22 seconds of arc from the center of the galaxy. It is therefore possible that the observed fluxes may be too low by 10% at most.

TABLE 1

UBVRIJHKL PHOTOMETRY OF NGC 1068

Object	U	B	V	R	I	J	H	K	L
NGC 1068	12.23	12.09	11.24	10.49	9.86	8.77	7.87	7.22	5.30

TABLE 2

COMPARISON OF THE COLORS OF THE SEYFERT GALAXY NGC 1068 WITH THE COLORS OF A MEAN S GALAXY AND OF THE QUASISTELLAR SOURCE 3C 273.

Object	U-V	B-V	V-R	V-I	V-J	V-H	V-K	V-L
NGC 1068	+0.98	+0.85	+0.75	+1.38	+2.47	+3.37	+4.02	+5.94
Mean S Galaxy	+1.51	+0.96	+0.90	+1.70	+2.28	-	+3.31	+3.50
3C 273	-0.68	+0.20	+0.24	+0.74	-	-	+3.60	-

The photometric data obtained for NGC 1068 are listed in Table 1. Table 2 gives the colors of NGC 1068 together with those of a mean spiral galaxy (Johnson 1965), and of the quasistellar source 3C 273 (Low and Johnson 1965). Probable errors of measurements through the UVBRI filters are 0.05 mag., while the errors of the JHKL measurements are estimated as 0.1 mag. The magnitudes listed in Table 1 were converted into fluxes with the use of Johnson absolute calibrations (Johnson 1966). These fluxes are plotted on Figure 1 with the data for a mean spiral galaxy of the same I magnitude. In the neighborhood of 0.9μ (the I filter) the distribution of energy in the spectrum of NGC 1068 and of a mean spiral galaxy is similar, however for both shorter and longer wavelengths NGC 1068 exhibits a large excess of radiation. This excess of radiation is also plotted in Figure 1 and is strikingly similar to the spectrum of 3C 273. If one subtracts the radiation of a typical stellar component from the radiation of the nucleus of NGC 1068 the resulting distribution of the radiation strongly suggests a quasar-like component located in the nucleus of the Seyfert galaxy NGC 1068.

An extensive program involving photometry of the remaining Seyfert galaxies is underway. Some of them are currently being monitored for

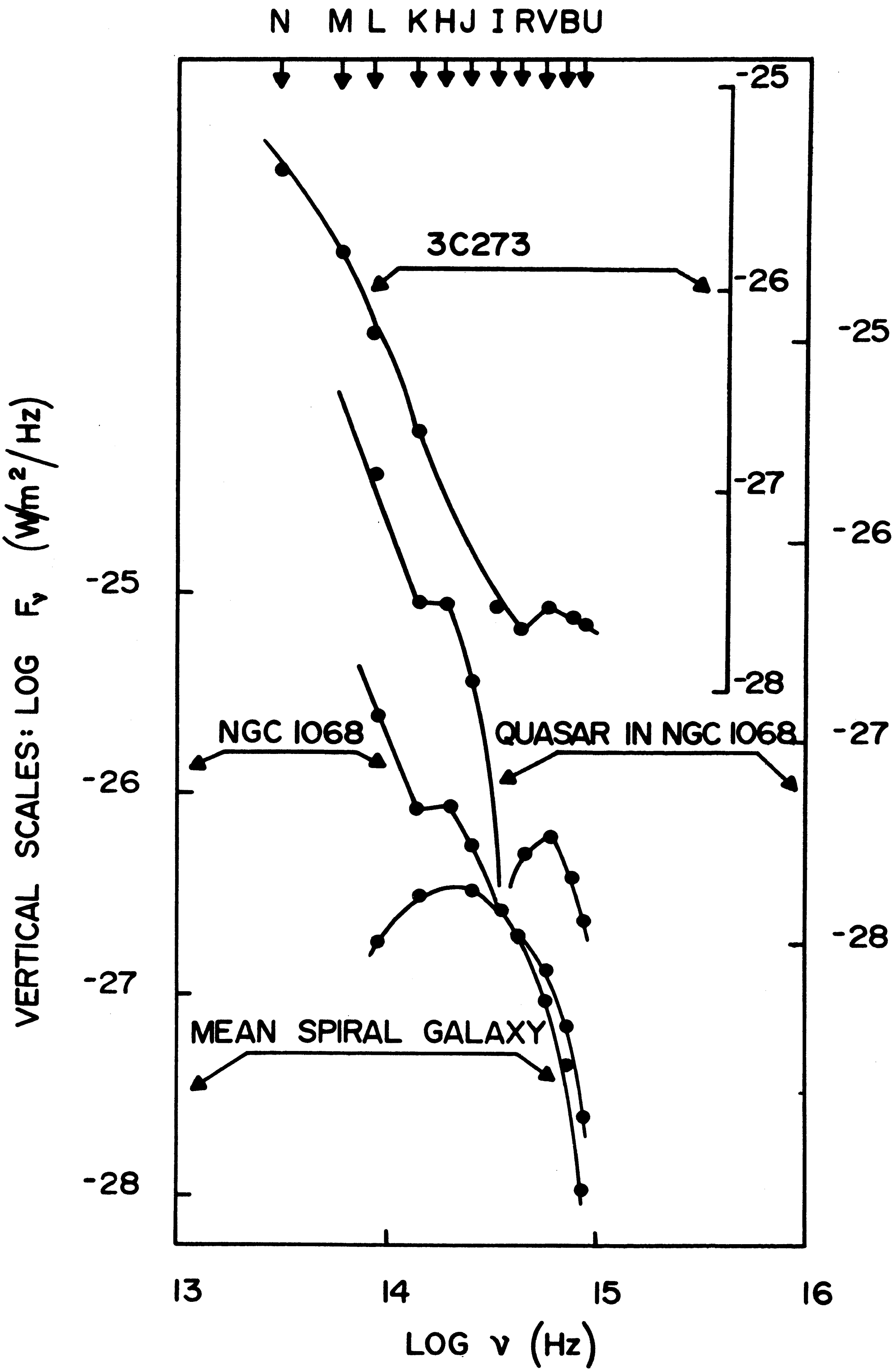

Fig. 1. Comparison of fluxes of NGC 1068, 3C 273 and a mean spiral galaxy. The fluxes for 3C 273 were taken from Low and Johnson (1964) and Low (1966).

variability in the U and L spectral regions in which the excess of the quasar-like component of radiation over the stellar component is the largest.

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