Barlow: With reference to the discrepancy between the dust color temperatures determined from 10-18μ data by Cohen and Barlow (1974) on the one hand and from the longer wavelength data presented by Moseley and Harper on the other, recent infrared observations at Cerro Tololo of southern planetaries made by Cohen and myself show that our broad bandpass 10μ filter significantly overestimates the strength of the true continuum, as determined using a narrow bandpass 9.8μ filter. This overestimate is due to the inclusion of various emission lines and features in the broad 10μ bandpass. Use of the 9.8μ data instead of the 10μ data leads to significant lowering of the derived 10-18μ color temperatures and better agreement with the data of Moseley and Harper.

MEDIUM RESOLUTION SPECTROSCOPY OF NGC 7027 FROM 16 TO 38 MICRONS

J.F. McCarthy, W.J. Forrest, and J.R. Houck
Center for Radiophysics and Space Research, Cornell University

NGC 7027 was observed on two nights, 1976 May 18-19 and 20-21, using the 36" telescope of the KAO. A medium resolution, two channel, Helium-cooled grating spectrometer was used to observe the bands, 16-23μ ($\Delta\lambda$ = 0.5) and 20-38μ ($\Delta\lambda$ = 1.2). The beam size was 30". A nearly flat smooth continuum over the entire band was observed with a peak intensity of 7 x 10^{-16} W/cm^{2}μ between 20 and 25μ.

The 8-14μ spectrum of 7027 has several spectral features. The strongest of these is a broad 11.3μ emission band which has been tentatively identified by Gillett et al. (1973) as due to carbonate grains. Laboratory measurements of the carbonate grains that are most likely to be abundant, $MgCO_3$, $CaCO_3$ and $FeCO_3$, have been made by Angino (1967) and Morandat et al. (1967), using various suspension and pellet techniques. Penman has calculated the emission coefficient for small grains on the basis of Mie theory and the bulk dielectric coefficients. These investigations predict long wave-length (22 to 35μ) carbonate lattice resonances, which are in general stronger than the 11.3μ resonance. Our spectrum does not show any isolated emission features in the 22 to 35μ range. This indicates that carbonates are not the dominant source of the radiation observed at these wave-lengths.

The spectrum is fit by grains with an emissivity proportional to $1/\lambda^2$ and a temperature of 90°K. Such an emissivity law is expected for small graphite grains. Several recent determinations (cf. Torres-Peimbert and Peimbert [1977]) indicate carbon is significantly overabundant in NGC 7027, suggesting that graphite is a likely grain material. If the grains are graphite, the mass in dust required to give the observed flux is approximately 2.5 x $10^{-2} M_\odot$ (assuming a distance of 1 kpc) and the corresponding total mass is approximately $1 M_\odot$ assuming the carbon abundances given by Torres-Peimbert and Peimbert (1977). This mass is much larger than the mass in ionized gas but is comparable to the mass of the recently discovered molecular cloud surrounding NGC 7027 (Mufson *et al*. 1975).

No evidence of the 25.87μ fine structure line of OIV was observed. An upper limit of 2 x 10^{-16} W/cm^2 is set by our data. Simpson had predicted a flux of 3.8 x 10^{-16} W/cm^2. This difference can be reconciled by a slight increase in the assumed electron density. Our spectrum is consistent with $n_e > 2.5 \times 10^4$ cm^{-3}. Scott (1973) derived a value of $n_e = (5.0 \pm 0.5) \times 10^4$ cm^{-3} from high resolution 5 GHz observations.

This work was supported by NASA grant NGR 33-010-081.

REFERENCES

Angino, E.E. 1967, *Am. Mineralogist*, *52*, 137.
Gillett, F.C., Forrest, W.J., and Merrill, K.M. 1973, *Ap. J.*, *183*, 87.
Morandat, M.J., Lorenzelli, M.V., and Lecomte, J. 1967, *Journal de Physique*, *28*, 152.
Mufson, S.L., Lyon, J., and Marionni, P.A. 1975, *Ap.J.* (*Letters*), *201*, L85.
Penman, J.M., preprint.
Scott, P.F. 1973, *M.N.R.A.S.*, *161*, 35.
Torres-Peimbert, S. and Peimbert, M. 1977, preprint.

OBSERVATIONS OF INFRARED FINE-STRUCTURE LINES: [S III]

Lawrence T. Greenberg
Physics Department, University of California, Berkeley

Recent observations of the 18.7 μm fine-structure line of S^{++} in NGC 7027 and BD+30°3639 (Greenberg, Dyal and Geballe, 1977 *Ap.J.*(*Letters*), *213*, L74) allow the first determination of an ionic column density in ionized nebulae. The line ratios 18.7 μm/λ9532 and λ6312/λ9532, besides yielding both electron density and temperature in the S^{++} region, have been used to indicate that the fine-structure levels of S^{++} are collisionally saturated. In this case the 18.7 μm surface brightness directly measures the column density of S^{++} ions with little dependence upon nebular structure, the major uncertainty being the experimental error. This research has been partially supported by NASA Grants NGR 05-003-511 and NGL 05-003-272.

https://doi.org/10.1017/S007418090014272X Published online by Cambridge University Press