HELIUM I λ10830 OBSERVATIONS OF SEYFERT 2 GALAXIES

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1. INTRODUCTION

Because of the metastability of the 2^3S level of He I, a variety of effects can change the line strengths from pure recombination values in Seyfert galaxies (see Feldman and MacAlpine 1978). This occurs because the population which builds up in the 2^3S level can be collisionally excited to the 2^3P level, enhancing λ10830. The expected ratios of λ10830/λ5876 can be altered by internal or external reddening and vary with temperature, density and optical depth.

Previous observations of λ10830 in AGN were mostly of Seyfert 1 galaxies (LeVan *et al.* 1984 and references therein). We have measured the λ10830/λ5876 ratio in 12 Seyfert 2 galaxies and NGC 1275.

2. OBSERVATIONS AND RESULTS

Infrared observations were made with the Lick Observatory 3m Shane Telescope and the University of Minnesota/UCSD 1.5m Telescope at Mt. Lemmon. The observations were made either at a resolution of $\Delta\lambda/\lambda = 0.02$ and an aperture of 12.0" or a resolution of $\Delta\lambda/\lambda = 0.0033$ and an aperture of 7.5". The detector was a single germanium photodiode. Published results were used to scale λ5876 and $H\beta$ to the flux of [O III] measured in an 8.0" aperture.

Measured ratios of λ10830/λ5876 ranged from 5 to 28, while case B recombination values may range from 2.4 to 3.6. For $n_e > 600$, collisions dominate the production of λ10830, producing λ10830/λ5876 up to 15. Because several of the λ10830/λ5876 ratios are greater than that, and because $H\alpha/H\beta > 3.0$, the recombination value, we know that there is reddening affecting the line ratios. We have corrected the λ10830/λ5876 ratios for reddening derived from the Balmer lines, and find a range from 1 to 12.

3. DISCUSSION

While the high values are within the range produced by collisional enhancement of λ10830, the low values cannot be explained unless the density is very low. We

D. E. Osterbrock and J. S. Miller (eds.), Active Galactic Nuclei, 126–127.

consider two methods for depopulating 2^3S and one for destroying $\lambda 10830$.

We consider the intensity that the continuum source must have to photoionize the 2^3S level and thus decrease the strength of $\lambda 10830$. For typical luminosities and densities, this mechanism is important only within a few pc of the nucleus, a region which probably does not contain the bulk of the material.

For regions of high optical depth in $Ly\alpha$, resonant scattering of $Ly\alpha$ could increase the flux of $Ly\alpha$ to where photoionization by $Ly\alpha$ could be a significant destruction mechanism for the 2^3S level. We find that for column depth of $10^{21}\,cm^{-2}$ and neutral fraction 10^{-4}, the destruction of 2^3S by $Ly\alpha$ is negligable compared to other destruction mechanisms. In addition, any dust in the region will destroy the $Ly\alpha$ photons, further decreasing the importance of this mechanism.

A similar process of resonant scattering in a dusty medium could act to destroy $\lambda 10830$ photons. Again, we find that extremely large column depths are necessary before this mechanism can have a large effect. Only an *ad hoc* model where scattering takes place through dusty regions between clouds will work.

4. BROAD $\lambda 10830$ IN NGC 1068

The $\lambda 10830$ profile in NGC 1068 appears to show a broad component under the strong narrow component. A rough comparison with the broad component of $H\beta$ (Antonucci and Miller, 1985) yields $\lambda 10830/H\beta \simeq 4$, considerably greater than the average of 0.6 found for Seyfert 1 galaxies by LeVan *et al.* (1984). This may yield clues to the nature of the occulting disk or scattering medium in NGC 1068.

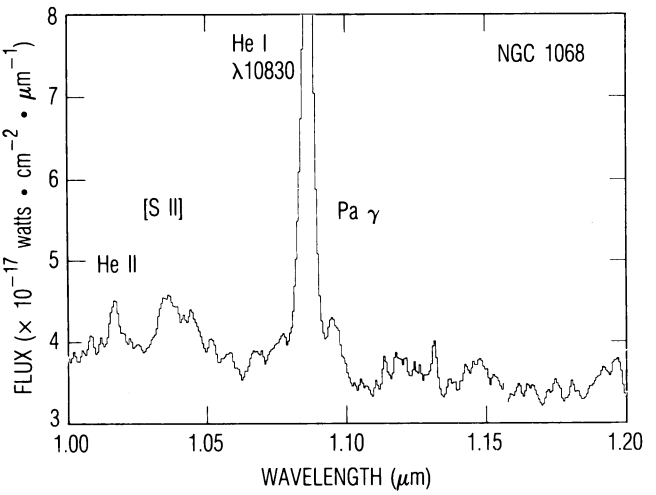

Figure 1 shows the broad component of the $\lambda 10830$ line in NGC 1068.

5. REFERENCES

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