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NEW OBSERVATIONS OF THE C IV AND N V RESONANCE DOUBLETS IN THE PLANETARY NEBULA NGC 3918

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RESUMEN

Presentamos nuevas medidas de los dobletes resonantes λλ1238/1243 de N V y λλ1548/1551 de C IV obtenidas con el satélite *IUE* en alta dispersión y longitud de onda corta.

Se miden los cocientes de intensidad de las líneas de los dobletes obteniéndose 1.87±0.15 para el N V y 1.83±0.11 para el C IV. Estos valores son compatibles dentro de las imprecisiones observacionales, con el valor esperado para ambos cocientes que es 2.

ABSTRACT

We present new short wavelength high dispersion *IUE* measurements of the resonance doublets λλ1238/1243 of N V and λλ1548/1551 of C IV. The observed intensity ratios are of 1.87±0.15 for N V and 1.83±0.11 for C IV; compatible, within the observational uncertainties with the expected ratio of 2.

Key words: NEBULAE-PLANETARY – ULTRAVIOLET-SPECTRA

I. INTRODUCTION

From a 120 min high dispersion short wavelength exposure Peña and Torres-Peimbert (1983) measured an anomalous value of 1.2±0.1 for the N V resonance doublet intensity ratio λλ1238/1243; and a normal value of 1.9±0.2 for the C IV λλ1548/1551 intensity ratio.

The emissivity ratio for both doublets is 2 and there is no apparent cause for the reported anomaly. Three mechanisms were proposed to try to explain it: a) Internal dust absorption that required a very steep wavelength dependence. b) Line absorption of N V resonance doublet by a generalized hot interstellar medium. This medium, in the direction of NGC 3918 ($\ell = 294.7°$, $b = 4.7°$) would need a column density ratio N(N V)/N(C IV) = 14 in order to explain both the anomaly in the N V ratio and the normal value of the C IV ratio. c) Line absorption by N V in a possible very extended envelope surrounding the visible nebula. In this case the required column density of the envelope would also have N(N V)/N(C IV) ≅ 14.

Considering that the N V lines are extremely faint and the C IV lines were overexposed, we decided to request more observing time to confirm our measurements.

II. OBSERVATIONS

We attempted the longest possible exposures at the International Ultraviolet Explorer Satellite (*IUE*) to derive reliable measurements for the faint N V lines, as well as short exposures to measure the bright C IV lines. Details of the short wave primary camera (SWP) exposures are given in Table 1; we also present, for each N V and C IV line, the measured flux from the *IUE* calibration for high dispersion spectra by Cassatella, Ponz, and Selvelli (1981), estimates of the error in the measurement due to the uncertainty of the continuum level, the full width at half maximum (FWHM) and the full width at zero intensity (FW0I).

In Figure 1 we present the profiles of the N V resonance doublet taken from the 120 min and 150 min exposures, a composite spectra of both and a smoothed profile (5-point smooth). In Figure 2 the C IV line profiles are shown, from the 15, 20, 20 and 30 min exposures respectively.

III. DISCUSSION

We will present a detailed analysis of the observations elsewhere (Torres-Peimbert and Peña 1984), but regarding the ratio of the C IV and N V resonance doublet, the new data are fairly complete and do not show evidence of anomalies in the intensity ratios. On the other hand, the measured FWHM of the lines are comparable with the values obtained from other planetary nebulae by Feibelman (1983).

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1, *IUE* Guest Observer.

TABLE 1

CHARACTERISTICS OF THE OBSERVED LINES

	SWP 21762	SWP 21763	SWP 21764	SWP 21765	SWP 21766	SWP 21767	SWP 21768	SWP 18030[a]
Δt (min)	150	60	120	20	15	20	30	15
λ1238								
Flux[b] (10^{-12})	3.58 ± 0.06	5.2 ± 0.10	4.11 ± 0.04	...	...	...	...	...
FWHM (A)	0.14	0.17	0.19	...	...	...	...	...
FWOI (A)	0.41	0.50	0.36	...	...	...	...	...
λ1243								
Flux. (10^{-12})	2.04 ± 0.05	2.50 ± 0.07	2.3 ± 0.10	...	...	...	...	...
FWHM (A)	0.21	0.32	0.43	...	...	...	...	...
FWOI (A)	0.42	0.36	0.81	...	...	...	...	...
λ1548								
Flux (10^{-11})	⩾ 3.63 ± 0.05	⩾ 6.2 ± 0.22	⩾ 4.1 ± 0.15	7.5 ± 0.86	7.0 ± 0.63	7.1 ± 0.38	6.2 ± 0.24	6.8 ± 0.30
FWHM (A)	0.47	0.38	0.50	0.21	0.29	0.21	0.29	0.29
FWOI (A)	1.03	0.95	0.95	0.67	0.82	0.67	0.77	0.74
λ1551								
Flux (10^{-11})	⩾ 3.07 ± 0.05	⩾ 4.0 ± 0.20	⩾ 3.3 ± 0.15	3.7 ± 0.75	3.9 ± 0.70	3.8 ± 0.56	3.6 ± 0.21	3.9 ± 0.30
FWHM (A)	0.44	0.33	0.43	0.25	0.34	0.26	0.27	0.29
FWOI (A)	0.89	0.86	0.86	0.59	0.92	1.00	0.66	0.74
λλ1238/43	1.75	2.08	1.79	...	...	...	...	...
λλ1548/51	...	...	...	2.03	1.79	1.86	1.72	1.74

a. Obtained from the *IUE* Data Archive through the National Science Data Center.
b. Flux in erg cm^{-2} s^{-1}

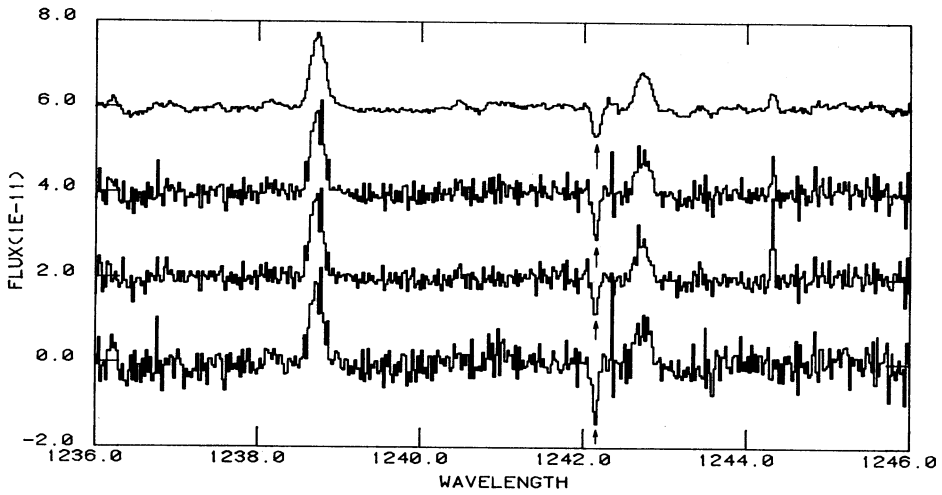

Fig. 1. Calibrated spectra showing the λλ1238 and 1243 N V lines. From bottom to top: SWP 21764 (120 min), SWP 21762 (150 min), a composite of both exposures and a smoothed version for the composite. The feature marked with an arrow is a reseau mark.

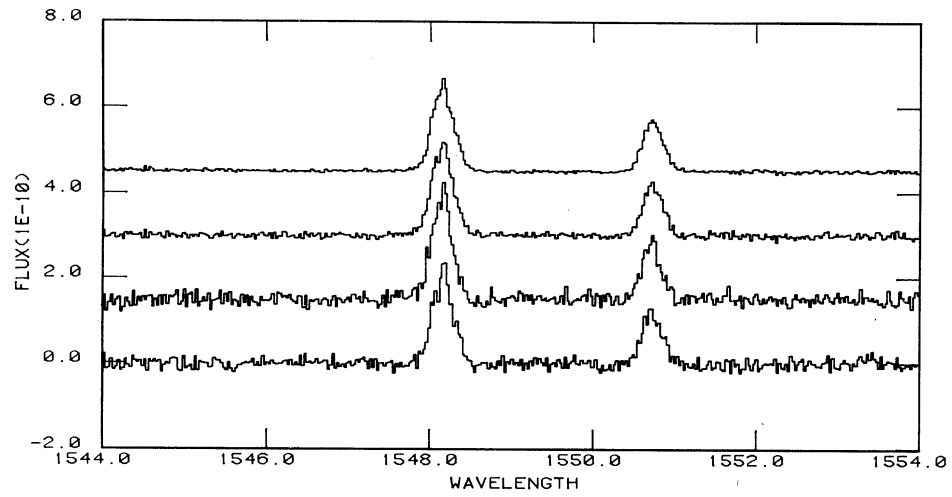

Fig. 2. Calibrated spectra of λλ1548 and 1551 C IV lines. From bottom to top: SWP 21766 (15 min), SWP 21765 (20 min), SWP 21767 (20 min), and SWP 21768 (30 min).

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