BROAD BASELINE FLUX DISTRIBUTION OF PLANETARY NUCLEI

Sara Heap (NASA/GSFC) and Ana V. Torres (NRC Research Associate, NASA/GSFC)

ABSTRACT. We have analyzed the flux distributions of 13 planetary nuclei (NPN) spanning the full range of spectral classes known among central stars, except white dwarfs (see Table 1). We combined low-dispersion spectra from the IUE archives with absolute spectrophotometric scans taken by Dr. P. Massey at Kitt Peak with the Intensified Reticon Scanner (IRS) to obtain flux distributions covering the wavelength range λλ1150-7200 at ∿ 7 A resolution. In order to get the intrinsic stellar energy distributions, we first corrected the observed fluxes for interstellar extinction, and then subtracted out the nebular fluxes, which we estimated from the Hβ flux on the IRS observations and from the nebular temperature, density and helium ionic abundances. Finally, we fitted blackbody curves to the stellar continua.

Most of the continua of the central stars are well fit by blackbody curves. However, there is no one-to-one correspondence between the blackbody temperature (T_{bb}, hereafter given in units of 10^3 °K) and the effective temperature (T_{eff}), because the stellar flux distribution depends on gravity (g) as well as on T_{eff}. Blackbody temperatures always overestimate T_{eff}, with the oberestimate increasing with g. The observations show this dual dependence on T_{eff} and g very clearly. As we go from low temperature, low-gravity stars (T_{eff} < 50, log(g) < 4, Of-type nuclei), to high temperature, high-gravity stars (T_{eff} ∿ 70, log(g)∿ 5, sdO types), the T_{bb}'s go from ∿40 to ∿ 200.

We compared the flux distributions of the O and WR-type NPN to those of their spectral counterparts among Pop I stars. The three Of central stars in our sample have flat continua (T_{bb} ∿ 40), also characteristic of young massive Of stars, which have $T_{bb} \leq 50$, independent of spectral type. NGC 2392 has the lowest color temperature of the three (T_{bb} = 35), which is even lower than its effective temperature (T_{eff} = 47, Méndez, Kudritzki *et al.* 1987, preprint). We interpret its low color temperature as a consequence of atmospheric extension. In WR-type NPN, T_{bb} goes from 21 at WC11 to > 100 at WC3. This large range in T_{bb} is totally unknown for massive WC stars, which have rather flat continua ($T_{bb} \leq 45$).

TABLE 1

NPN	Sp. Type	E(B-V)	T_{bb} (10^3 °K)	NPN	Sp. Type	E(B-V)	T_{bb} (10^3 °K)
NGC 1535	03	0.04	50:	IC 3568	05f	0.18	40
NGC 6210	03	0.05	65	NGC 6543	Of/WR	0.03	60
NGC 6058	sdO	0.05	100	M4-18	WC11	0.40	21
Abell 36	sdO7	0.05	150	NGC 40	WC8	0.40	40
NGC 4361	sdO	0.03	200	NGC 40	WC8	0.50	60-90
IC 4593	07f	0.05	40	Sand 3	WC3/OVI	0.45	100
NGC 2392	06f	0.05	35	NGC 2371-2	WC3/OVI	0.05	200

S. Torres-Peimbert (ed.), Planetary Nebulae, 308.