TABLE 1

ELECTRON KINETIC ENERGIES IN PHOTOIONIZED NEBULAE

| | $\langle E \rangle$ | $\langle E \rangle / k$ |
|---|---|---|
| Photoelectrons: | | |
| H II region SED | 4.54 eV | 52.7 kK |
| PN SED | 22.9 eV | 266 kK |
| AGN SED | 27.7 eV | 321 kK |
| Thermal electron | 0.862 eV | 10 kK |

We can quantify this by considering an average of the photoelectron energy, $h(\nu - \nu_0)$, where $h\nu$ is the ionizing photon energy and $h\nu_0$ is the ionization potential, weighted by the incident photon spectrum $4\pi J_\nu / h\nu$ and the photoionization cross section $\alpha_\nu$:

$$\langle E \rangle = \langle h(\nu - \nu_0) \rangle = \frac{\int_{\nu_0}^{\infty} \frac{4\pi J_\nu}{h\nu}\, h(\nu - \nu_0) \alpha_\nu \, d\nu}{\int_{\nu_0}^{\infty} \frac{4\pi J_\nu}{h\nu}\, \alpha_\nu \, d\nu}. \quad (1)$$

Table 1 gives this mean energy in both eV and Kelvin units for three different SEDs. The O star is the softest of the three continua, producing photoelectrons with a kinetic energy equivalent to 53 kK, the planetary nebula is intermediate, and the active galactic nucleus is the hardest SED with 321 kK.