OBSERVATIONS OF HI BR α, [Ne II], AND [Ar III] FROM THE CENTRAL PARSEC OF THE GALAXY

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H I Br α (4.05 μm), [Ne II] (12.8 μm), and [Ar III] (9.0 μm) emission lines from Sgr A West were mapped with ~100 km/s and 2" resolution. The observations were made with the U. T. infrared echelle spectrometer (IRSHELL) on the IRTF in April 1988. The instrument simultaneously measures 10 64-point spectra along a 2 x 10" slit. Data analysis is still in progress; preliminary results are presented here.

The following conclusions have been reached at this point:

1. Over much of the region observed, except near IRS 16 and Sgr A*, the spatial and spectral distributions of Br α [Ne II], and [Ar III] are similar.
Mean flux ratios are:

$$[\text{Ne II}]/\text{Br}\,\alpha = 18$$
$$[\text{Ar III}/\text{Br}\,\alpha = 0.35$$

Assuming $A_{4.0\mu m} = 1.1$, $A_{9.0\mu m} = 3.0$, and $A_{12.8\mu m} = 1.1$, the reddening corrected ratios are:

$$[\text{Ne II}]/\text{Br}\,\alpha = 18$$
$$[\text{Ar III}]/\text{Br}\,\alpha = 2.0$$

Assuming $T_e = 10{,}000$ K, the ionic abundance ratios are:

$$Ne^+/H^+ = 1.6 \times 10^{-4}$$
$$Ar^{++}/H^+ = 2.3 \times 10^{-6}$$

The observed Ne^+/H^+ ratio is twice the solar Ne/H ratio, whereas Ar^{++}/H^+ is about 0.4 times solar Ar/H. Assuming the abundances of both Ne and Ar are twice solar, we conclude that $Ar^{++}/Ar \approx 0.2$. The required T_{eff} of the source(s) of ionizing radiation is 35,000 K, assuming spectra like O stars.

2. The excitation of the ionized gas, determined from [Ne II]/[Ar III], does not peak on the infrared continuum sources, indicating that they are not the locations of ionizing stars. There is some evidence of peaking of the excitation near IRS 16 and Sgr A*, suggesting that much of the ionizing radiation originates in this region.

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3. Near IRS 16 and Sgr A*, Br α shows broad lines (FWHM ≈ 600 km/s) which are not seen in the forbidden lines. The broad-line region is spatially extended, with a FWHM ≈ 4". The line is broad throughout the region, and there is no significant displacement between the red and blue-shifted emission. We conclude that the broad line does not result from rotation about a massive object. Two possible explanations are high velocity outflow and rapid turbulent motions. The suppression of the broad-line emission in [Ne II] and [Ar III] may result from high densities ($\geq 10^6$ cm^{-3}), or from high excitation.

4. Even away from IRS 16, Br α is systematically ~ 50% broader than [Ne II] and [Ar III]. [Ar III] may be somewhat broader than [Ne II] in some regions, and [Ar III]/[Ne II] may increase somewhat near IRS 16, suggesting that the broad-line region may have higher excitation than the surrounding region.

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