STELLAR MG ABUNDANCES IN THE GALACTIC CENTER

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Star formation in the Galactic Center (GC) happens under unusual conditions, which include high gas temperatures, high velocity dispersions, and strong tidal shear (Spergel & Blitz 1992; Blitz *et al.* 1993). All these conditions may lead to an initial mass function (IMF) dominated by massive stars (Morris & Serabyn 1996). A history of chemical evolution dominated by massive stars is expected to result in enhancements of α-elements (Mg, Si, Ca, Ti) relative to Fe (Wheeler *et al.* 1989). This argument is the main motivation to study the abundance of Fe and Mg in GC stars.

To achieve our goal of measuring the Mg abundance we have observed the brightest cool stars in the GC using the CSHELL spectrograph ($\lambda/\Delta\lambda$ = 40,000) at the IRTF. We have chosen atomic absorption lines which are free from molecular contamination by CN, in M supergiants, and H_2O, in M giants and LPVs. Our sample is limited by the sensitivity of the CSHELL spectrograph, which requires an hour of integration for a star with K=9.

For our abundance analysis we are using model atmospheres for late type giants and supergiants from Brown *et al.* (1989) and Plez (1992), with the spectral synthesis program MOOG (Sneden 1973). Our abundance analysis requires as input parameters the star's effective temperature (T_{eff}), surface gravity (*log g*), and microturbulence velocity (ξ), and the line's oscillator strength (gf-value). For all GC stars except IRS 7 (Sellgren *et al.* 1997) we adopt T_{eff} from CO and H_2O absorption, present in K and H band low resolution spectra (Blum *et al.* 1996). The CO strength increases with decreasing T_{eff} and decreasing *log g*. The H_2O absorption has the same T_{eff} dependence but opposite *log g* dependence. These two features together provide a 2-D spectral classification (Kleinmann & Hall 1986). We adopt *log g* from M_{bol} and the location of stars in the HR diagram compared to evolutionary tracks. We estimate ξ from its correlation with *log g*. All the stellar parameters are obtained through the observable quantities T_{eff} and M_{bol}. We have studied how errors in T_{eff} and M_{bol} would affect our Mg

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abundance determination. The Mg abundance is quite insensitive to errors in M_{bol}, since a typical error of ±0.5 mag in M_{bol} correspond to an error of 0.02 dex in Mg abundance. It is more sensitive to errors in T_{eff}, since a typical error of ± 250 K represents an error in Mg abundance of 0.1 dex. T_{eff} is the key stellar parameter. Our analysis also needs the gf-values of the Mg line (2.2814 μm). We used the spectrum of αBoo and earlier abundance determinations to derive the gf-values though the synthetic model generated by MOOG. We also include the analysis of cool luminous stars of known abundances, to check our technique. Our determination of the Mg abundance in GC stars is still in progress. We have found the analysis to be complicated mainly due to uncertainties in T_{eff} of the coolest stars in our sample and due to the fact that the Mg line (2.2814 μm) is a blend of eight lines (hyperfine structure).

We have used two Fe lines, present in the same grating setting of Mg, to get Fe abundances for five stars in the GC. These results combined with our earlier determinations (Carr *et al.* 1996*a*, *b*; Sellgren *et al.* 1997) show that the Fe abundance in all GC stars is consistent with solar metallicity. Our results are tabulated below.

Star	# lines	[Fe/H]
IRS 7	7	−0.04 ± 0.15
IRS 11	2	−0.06 ± 0.21
IRS 19	2	−0.15 ± 0.44
IRS 22	9	+0.10 ± 0.16
IRS 24	1	−0.19 ± 0.28

References

Blitz, L., Binney, J., Lo, K. Y., Bally, J., & Ho, P. T. P. 1993, Nature, 361, 417
Blum, R. D., Sellgren, K., & DePoy, D. L. 1996, AJ, 112, 1988
Brown, J. A., Johnson, H. R., Alexander, D. R., Cutright, L. C., & Sharp, C. M. 1989, ApJS, 71, 623
Carr, J. S., Sellgren, K., & Balachandran, S. 1996*a*, in *The Galactic Center*, 4th CTIO/ESO Workshop, PASP Conf. Ser. 102, ed. R. Gredel, p. 212.
Carr, J. S., Sellgren, K., & Balachandran, S. 1996*b*, in *9th Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun*, ed. R. Pallavicini & A. K. Dupree, p. 711
Kleinmann, S. G. & Hall, D. N. B. 1986, ApJS, 62, 501
Morris, M. & Serabyn, E. 1996, ARA&A, 34, 645
Plez, B. 1992, A&AS, 94, 527
Sellgren, K., Carr, J. S., & Balachandran, S., presented at IAU Symp. 184, The Central Regions of the Galaxy and Galaxies, August 1997, Kyoto, Japan
Sneden, C. 1973, Ph.D. thesis, University of Texas
Spergel, D. N. & Blitz, L. 1992, Nature, 357, 665
Wheeler, J. C., Sneden, C., & Truran, J. W. 1989, ARA&A, 27 279