DETAILED CHEMICAL ANALYSIS OF TWO GIANTS IN THE SGR DSPH

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The 8m class telescopes allow for the first time to study stars of external galaxies with the same resolution and S/N ratio which has been so far used for Galactic stars. It is quite likely that this study will shake some of our current beliefs. In this poster we highlight some of the results which have been obtained for two giants in the Sgr dSph thanks to the UVES spectrograph on the ESO 8.2m Kueyen telescope. Further details on the observations and data analysis may be found in Bonifacio et al.1

1 Results

The two stars turned out to be rather metal-rich with [Fe/H] ≈ −0.3. This was somewhat a surprise since the stars have roughly the same V − I colour but differ in V by 0.18 mag and were thought to be representative of the spread in Sgr RGB which common–wisdom has attributed to a spread in metallicity.2,3,4,5,6,7 Given the steepness of the RGB in this colour range it may well be that the two stars lie in fact on the same isochrone and their V − I colours are different but photometric errors of ≈ 0.04 mag make them equal. However there is another possible explanation whose consequences are rather intriguing and cannot be easily discarded: the two stars have a different distance. A difference of about 2 kpc would be enough to explain the difference in V mag. This value is not unreasonable since Ibata et al.5 estimate a line–of–sight depth of about 1.2 kpc. From our spectra we may find evidence which further supports this possibility: the Na I D lines of the brighter star, # 143, appear perfectly symmetric with no hint of the presence of interstellar components at the radial velocity of Sgr, while the fainter star, # 139, shows a weak but definite asymmetry in both Na I D lines, which may be interpreted as due to interstellar material associated with Sgr.

The high metallicity found for both stars implies that Sgr has undergone a high level of chemical processing; it also suggests that a sizeable population of Sgr is this metal–rich. The abundance pattern is interesting, although most of the elements with A ≤ 39 are consistent within error with the solar ratio, taken at face value they are all slightly sub-solar. On the other hand Ba and more
massive elements show over-solar ratios. The pattern may be summarized as follows: Na and Sc are over-deficient with respect to iron by about 0.4 dex; heavy neutron-capture elements Ba, La, Ce, Nd, Eu are over-abundant with respect to iron by 0.3 to 0.5 dex; Y is over-deficient with respect to iron by about 0.4 dex.

It is interesting to compare the abundances of these two Sgr giants with those obtained by Shetrone et al.\(^8\) for three other Local Group Galaxies (Draco, Ursa Minor and Sextans). One should also keep in mind that Sagittarius is considerably more massive than the other three galaxies and this is, perhaps, the key to understand its high-metallicity population. The [Mg/Fe] ratio seems to drop, with increasing [Fe/H], faster in Local Group Galaxies than it does in the Galactic Halo or disk and this could be the signature of a very low or episodic star formation. It shall be very interesting to see what is the [Mg/Fe] ratio of the metal-poor population of Sagittarius, when its existence is confirmed. Damped Lyman $\alpha$ systems, observed in absorption in the line-of-sight of QSO’s have metallicities in the range -2,-1 and show [$\alpha$/Fe] ratios which are solar\(^9,10\). Could Damped Lyman $\alpha$ systems be linked to dwarf galaxies? This possibility is appealing, although these galaxies are now devoid of gas, they must have been relatively rich in gas when the stars we observe now were formed.

The over-deficiency of Na seems a common occurrence in Local Group galaxies, although there is no definite trend and a large scatter. On the other hand Y is always over-deficient with very few exceptions and this over-deficiency is mirrored by an overabundance of heavy elements.

References