Abstract

Chemical composition of metal-poor stars are crucial to develop an understanding of the nature of the earliest stars formed in the universe, the nucleosynthetic events associated with them as well as to redefine the models of galaxy formation. The elements produced in the hot, dense conditions in the Big Bang were created in primordial nucleosynthesis. But other isotopes and elements were produced by nucleosynthesis inside stars and explosive nucleosynthesis like in supernova. As the star has exhausted hydrogen in its centre it contracts and can eventually start the fusion of helium to carbon. Then the massive stars are mainly responsible for producing elements beyond carbon upto iron in their core. Elements heavier than the iron peak are made via two principal processes: the rapid neutron-capture process (r-process) and the slow neutron-capture process (s-process). Insight into the astrophysical sites and the production mechanisms of various elements can be obtained by studying chemical composition of stars and the processes those are responsible for synthesizing those elements. It is worthwhile to compare and examine the abundance patterns of elements observed in stars belonging to globular clusters as well as in some peculiar stars various locations within a galaxy. The primary objectives of this study are:

• Determination of chemical compositions of a selected sample of peculiar stars from spectroscopic analysis with special emphasis on the origin and distribution of slow neutron-capture elements within the framework of a parametric model based study and to complement

our studies with other studies available in literature.

• To understand the elemental distribution of a few elements by studying some nuclear burning cycles within the primordial scenario which are currently observed in the metal poor stars of Globular clusters which has been decomposed into six chapters.

In the first chapter, the distribution of elements in the galactic disk, halo, bulge, globular cluster and in a peculiar group of metal poor stars like CEMP-, CH- and Ba-stars have been reviewed. All these various sites have shown abundance an anomaly in respect to $alpha$-capture, Fe-peak and neutron capture elements which have been confirmed by various authors in their study. This chapter also contains the various nucleosynthesis mechanisms starting from the big bang ie primordial nucleosynthesis up to post main sequence evolution via stellar nucleosynthesis that leads to the production of various elements in stars and its obvious importance in galactic chemical evolution.

The second chapter deals with the basics of a spectroscopic study, which involves the observation, the data reduction techniques. In one part of this work we have used Image Reduction and Analysis Facility (in short IRAF) for spectroscopic analysis of our sample of four Ba stars (namely HD 49641, HD 58368, HD 119650 and HD 191010). The atmospheric parameters (Effective temperature, [Fe/H], log g, microturbulent velocity) of those stars have been found out as they are the pre-requisites for estimating the abundance of other elements. Moreover, the possession of radial velocity also points towards the binarity of those stars.

For abundance analysis of stars the methods to find these quantities have been discussed. Equivalent widths are found from an unblended spectral lines of elements which are then used to find the abundance of elements for a suitable model atmosphere selected from Kurucz' grid of model atmospheres. Ours stars are found out to be slightly massive than the sun and the critical analysis of the abundance trends are much more similar to that of giants with enhancements in neutron capture elements which is a characteristic of abundance patterns of Ba stars. All of these in detail have been presented in the chapter three.

In the next chapter ie chapter four we have investigated some p-capture nuclear cycles (CNOF, NeNa and MgAl) in fast rotating massive stars to justify the observed abundance of O, Na and Al in the metal poor stars of globular cluster M3, M4, M13 and NGC 6752. It has been found that within the temperature, density condition the yield of these three elements from the mentioned cycles is strongly correlated with the observed abundance of the same in the stars of those four globular clusters within the primordial scenario.

Next we have taken the CNOF cycle again to explain the abundance of fluorine which are observed in the metal poor stars belonging to globular cluster M4, M22, 47 Tuc and NGC 6397. Here to we find a strong correlation between the observed and estimated fluorine abundance within the framework of evolutionary scenario.

And the last chapter gives the summary of the research work highlighting the important results. A brief description of the future work and a direction to proceed further is also discussed.