# MG-AL ANOMALY IN THE GLOBULAR CLUSTER

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The aluminum-enhanced stars have been observed in some of globular cluster giants [1]. Recent observations indicate that $^{24}$Mg decreases in these stars [2, 3]. From the current standard theory of stellar evolution, it is known that the temperature hardly reaches high enough to burn $^{24}$Mg in the red giants.

One possibility to solve this problem is that these stars have different initial abundances from other stars. However, this possibility cannot explain that the abundances of other elements are homogeneous in a cluster, and especially the fact that the total abundance of Al and Mg is almost constant in those stars. It indicates that Mg makes Al in the evolution of stars by $(p, \gamma)$ reactions.

There are other possibilities that the reaction rate of $^{24}\mathrm{Mg}(p,\gamma)^{25}\mathrm{Al}$ may be larger than the current estimate and that the mechanism may exist to make the temperature higher in the globular cluster giants. If the temperature becomes higher, the reaction rate of $^{24}$Mg $(p,\gamma)^{25}$Al becomes larger. We discuss the abundances under the mechanism to make the temperature high enough to decrease $^{24}$Mg. For this purpose, we investigate the anomaly using the hydrogen shell flash model providing a sufficiently high temperature to burn $^{24}$Mg [4]. If hydrogen mixes into the He-core, hydrogen burning makes a thermal runaway and the temperature at the burning shell becomes higher.

The reaction network used here consists of 61 isotopes of 16 lightest species and the reaction rates are taken from Ref. [5]. We assume the hydrogen shell flash model, which results from the mixing of hydrogen into the He-core. The present calculation is performed in the case that the core-mass is $0.4\mathrm{M}_\odot$, the mixing depth of hydrogen into the He-core is 2 pressure scale heights and the initial abundances are Z=0.0004 with the relative abundances in the solar ratio except that O, Ne, Mg and Si are enhanced over their scaled solar values by 0.4 dex.

The changes of temperature and density are shown in Figure 1. By taking into account a rapid change of temperature and density due to the hydrogen shell flash, the change of abundances in the burning shell is calculated. In Figure 2, we show the calculation of the hydrogen shell flash model.

It is shown that $^{24}$Mg decreases when the temperature increases rapidly. Although we do not consider the details of the mixing mechanism and the possibility which the true reaction rate of $^{24}\mathrm{Mg}(p,\gamma)^{25}\mathrm{Al}$ is defferent from now nsed one at the present stage, we wish to go to these problems in the future work.

## References

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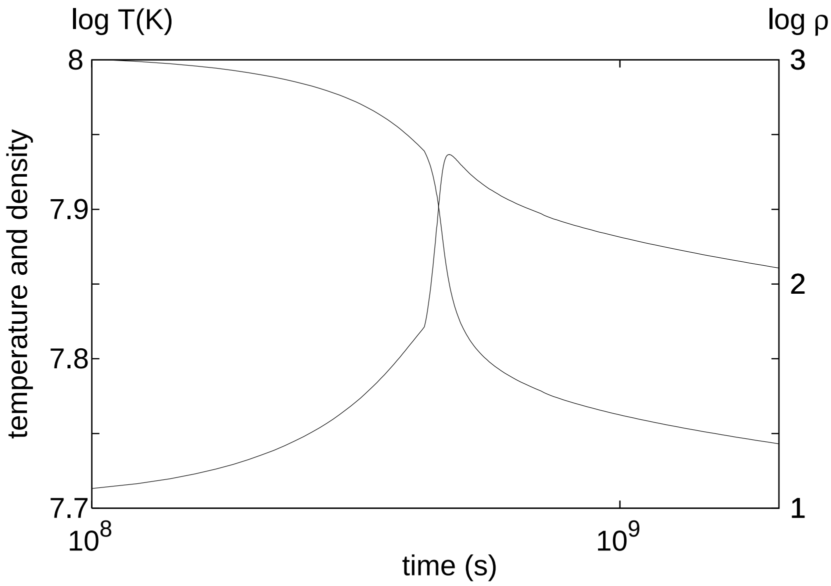


Figure 1: Changes of temperature and density in the hydrogen shell flash.

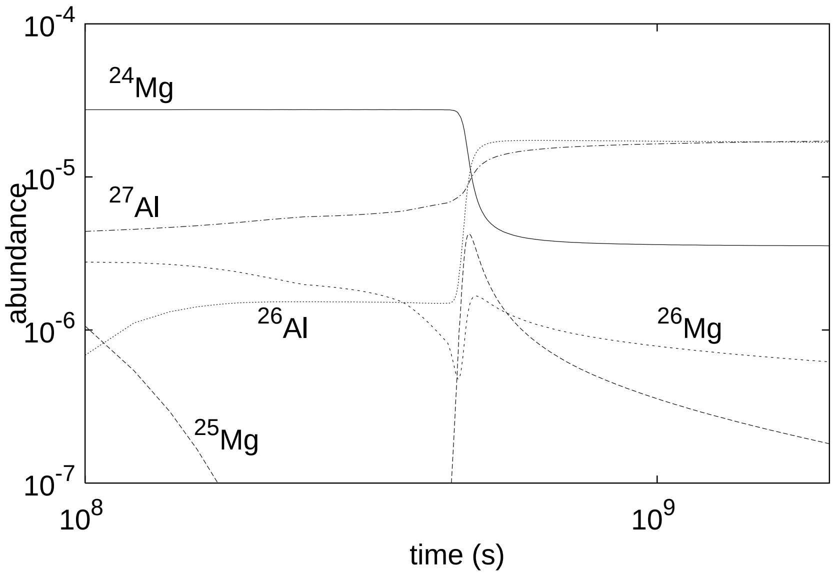


Figure 2: Changes of abundances in the hydrogen shell flash.