Carbon Isotope Ratios and Lithium Abundances in Open Cluster Giants

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CN lines at 8000 Å have been observed in giants of 17 open clusters and carbon isotope ratios have been obtained for the same. This ratio is an important indicator of the extent of convective mixing in a star since $^{13}$C is dredged from the interior of the star to the surface during mixing, thus reducing the surface $^{12}$C/$^{13}$C ratio. The clusters vary in ages from 20 million years to about 5 billion years and have turn-off masses varying from about 1 $M_\odot$ to about 8 $M_\odot$. Correlations between the mean isotope ratios and the turn-off masses of the clusters show a definite trend implying that older clusters with less massive giants in general have lower isotope ratios than their younger, more massive counterparts. The Li line at 6707 Å has also been observed in these giants and the Li abundance determined. This element is also another important indicator of mixing in a star since it is fragile and easily destroyed during convective mixing. We have correlated the Li abundance with the cluster turn-off masses and also with the carbon isotope ratios and these correlations along with the one mentioned above, have helped give us important insights into basic stellar evolution. We agree with previous predictions that the upper limit for Li abundance in normal giants is 1.2.

The Evolution of Activity of Late-Type Giant and Subgiant Stars

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We have obtained IUE spectra of a large sample of late-type giants and subgiants. We have found evidence that subgiants in the mass range of 1.2-1.6 $M_\odot$ undergo a sudden decline in UV transition region emission as these stars cross the H-R diagram on the way to the red giant branch. Based on an inspection of X-ray images in the archives of the Einstein Observatory, we have found a similar decline in the coronal emission of these stars. The decline in UV and X-ray emission coincides with a sharp falloff in axial rotation rates of cool subgiant stars. We suggest that t1017his evolutionary transformation may result from a decline in the importance of acoustic heating among late A - early F type stars and the growing strength of magnetic dynamos among the cooler stars of spectral types late F - early G. Although the observational sample is less complete for the F-G giant stars, a similar picture emerges for these stars.

Comparison of Predicted vs. Measured Stellar Magnetic Fields

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We have used Einstein Observatory IPC x-ray spectra of a sample of late-type stars to derive coronal temperature and emission measure data. These values are used as input to a coronal heating model that predicts magnetic field strength and filling factor with a minimal number of simplifying assumptions. These predictions are compared with direct measurements of magnetic fields on the same sample of late-type stars. We will discuss the results and their interpretation. This work was supported by NASA Grant NAGW-112.