Carbon Isotope Ratios in Carbon Stars of the Galactic Halo

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We have analysed the CN red system ($\sim$ 8000 Å) and the C_2 Swan system ($\sim$ 4700 Å) to obtain carbon isotope ratios ($^{12}C/^{13}C$) for carbon stars in the Galactic halo, known as CH stars. Isotope ratios are obtained for 6 CH stars by a curve-of-growth analysis of isolated ^{12}CN and ^{13}CN lines. In this analysis, we directly compare ^{12}CN and ^{13}CN lines of similar intensity (iso-intensity method), and the resulting $^{12}C/^{13}C$ ratios are almost independent of the model atmosphere and its parameters. The ^{13}CN lines were too weak to measure in some CH stars, for which we applied the spectral synthesis method to the stronger C_2 Swan band and obtained $^{12}C/^{13}C$ ratios for two stars and estimated a lower limit to the $^{12}C/^{13}C$ ratio for two others. In this case, however, the results depend on the model atmosphere and its parameters. Results from our present and previous work show that most CH stars (12 stars) have values distributed around $^{12}C/^{13}C \approx 10$ while two stars have very high values ($^{12}C/^{13}C \geq 500$). The distribution of the $^{12}C/^{13}C$ ratio in CH stars is different from those of the Population I carbon stars and Population II oxygen-rich giants (G – K types). The CH stars of very high $^{12}C/^{13}C$ ratio can be explained by dredge-up of ^{12}C due to the 3α-process as in Population I carbon stars (N–type). On the other hand, the formation of CH stars with low $^{12}C/^{13}C$ ratios requires a large supply of ^{12}C followed by a process for decreasing the $^{12}C/^{13}C$ ratio.

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