The mixing length ratio; the Sun, alpha Cen A and B

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It has been a common practice to utilize the mixing length approximation for determination of the temperature gradient within the convection zones, in stellar model construction. The approximation which was originally developed to describe incompressible terrestrial convection, is an extreme simplification of the actual physical process of stellar convection. The major source of uncertainty in this approximation is the mixing length itself. In actual model construction, the mixing length ratio, which is the mixing length scaled with local pressure scale height, is chosen in such a way that Solar models have the correct radius. Then, the same value is used for all the other stellar model construction, simply because there has been no alternative way to estimate the mixing length ratio for different cases.

To test the validity of the same mixing length ratio from star to star, or at different stages of evolution of a star, models for alpha Cen A and B have been constructed. From observations we know the luminosities of the A and the B, and the surface temperature of the A and the B. We have to use these 4 knowns for determination of 5 unknowns, namely, Age of the system, the mixing length ratio of the A and that of the B, and the initial Y (=1-X-Z), and the initial Z. One can assume that the chemical composition and the age of the two stars are the same, By taking this condition as the "5th known", series of models have been constructed, and the mixing length ratios of the two stars have been compared with each other and with that of the SUN. As stellar seismic data become available, the seismic information will further constrain the number of the "possible" models.