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The impact of metal depletion on convective mixing prescriptions in 1D stellar evolution models

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1D stellar structure and evolution codes (SSECs) are widely used in astrophysics to determine fundamental stellar properties. Since our theoretical knowledge is incomplete, it is necessary to calibrate these codes empirically, especially free parameters such as the convective mixing length, or $\alpha_{\rm MLT}$. Historically, we have relied on the Sun for this task. This has resulted in the ad hoc adoption of solar-valued parameters in models of stars with highly non-solar properties, including stars with very different chemical compositions.

With greater availability of high-precision observational data, however, we are recently able to calibrate SSECs using direct measurements of other stars.
My recent work presents empirical mixing length calibrations six stars with metallicities below [Fe/H]≤ -2.3. We find that sub-solar mixing lengths are required to reproduce the observed properties of our sample, suggesting a need to better constrain the relationship between $\alpha_{\rm MLT}$ and abundance. These findings call into question the use of current stellar evolution databases, all of which assume solar-valued mixing lengths in their isochrones regardless of metallicity specification.
Our results likewise emphasize the need for more high-precision measurements of low-metallicity stars so that they may be used as calibrating agents for the next generation of highly accurate 1D stellar models.

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Talk/Poster

Talk

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