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THE HYDRODYNAMIC MOMENT EQUATIONS: AN ALTERNATIVE TREATMENT FOR STELLAR CONVECTION

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Abstract. The quantitative description of the role of convection in energy transportation in both stellar cores and stellar envelopes has remained a difficult task. Its detailed interaction with radiation, rotation, magnetic fields, and various mechanisms for pulsational instability in stars is still only partially understood. State-of-the-art opacity and nuclear reaction data have improved considerably during the last two decades, but further progress in our understanding of stellar evolution, stellar pulsation, or even more accuate determination of basic stellar parameters require a more elaborate convection treatment than traditional mixing length theory. The hydrodynamic moment equations open a new perspective, as they offer the potential for a convection treatment which is reliable, manageable, and versatile at the same time for an entire spectrum of astrophyiscal problems rather than just a few specific topics. We will discuss the basic ideas behind this recent approach as well as results from an extended series of tests of convection models based on the moment formalism by comparing their solutions with numerical simulations.