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The Dawn of 3D Stellar Evolution and Nucleosynthesis

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Stars play a key role in the Cosmos through the light they shine, the chemical elements they produce and the kinetic energy they inject into their surroundings via winds and supernova explosions. For many decades, our understanding of the structure, evolution and fate of stars has greatly benefitted from comparing spherically symmetric, one-dimensional (1D) theoretical models to a variety of observations. The large increase in the number and quality of observations combined with the advent of asteroseismology probing the interior of stars, however, has exposed the limitation of 1D models. The increasing computing power available has now reached the point where significant fractions of a star and for an increasing duration can be simulated in 3D using realistic stellar conditions, which represents the dawn of multi-D stellar evolution and nucleosynthesis modelling of stars. In this talk, I will review some of the most critical limitations of 1D models and the latest 3D simulations providing new insight and guidance to improve 1D models and our understanding of stars and their impact.

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