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On the reliability of stellar models used to probe new (and old) physics.

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The high temperature and density that develop within the cores of evolved stars, from red giants to supergiants, make them ideal sites to investigate deviations from the standard models describing the behaviour of matter in extreme conditions. Note that these conditions are often not accessible by current laboratory experiments. A growing amount of scientific papers discuss various methods to investigate old physics (e.g., turbulence) or new physics (e.g., peculiar properties of standard and/or non-standard particles) by comparing stellar models predictions to several astronomical observables, among which surface composition of stars, stellar macroscopic properties (luminosity, effective temperature, age⋯) or the frequencies of pulsation modes. However, the constraints obtained in this way are limited by the effective reliability of the stellar models that depends on the uncertainties of the adopted input physics (opacity, equation of state, nuclear reaction rates, and the like) and on the numerical method used to solve the differential equations describing the physical and the chemical structure of a star. In this talk I will discuss, how to evaluate the reliability of the theoretical predictions, the power and the limits of the methods employed to constrain new/old physics and possible (promising) future developments.

Session

Stellar evolution

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