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Role of the CNO cycle in massive stars

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The CNO cycle consists of a series of nuclear reactions that provide energy in stars. There exist multiple different cycles depending on temperature and relative abundance of elements in stars. In the Sun the CNO cycle is a catalyst cycle where nuclear reactions cycle through carbon, nitrogen and oxygen. Initially, a free proton fuses with a carbon-12 nucleus starting a sequence of reactions which transform hydrogen into helium and produce energy. We can identify four catalytic cycles. The first cycle produces about 1% of the energy in the Sun. The second cycle, which involves production of fluor-17, occurs rarely in the Sun, while the third and fourth cycles are only present in very massive stars. The Borexino measurement on CNO neutrinos has offered the opportunity to probe experimentally this scheme which turns to be crucial for energy production in stars with a mass larger than 1.3 Msun. In the talk the idea of catalytic cycles is reviewed and the impact of the Borexino measurement is discussed.

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