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Quantum scattering of three particles in stars: new understanding of the formation of 12C

Wednesday, 2 November 2011 14:00 (30 minutes)

One of the most important subjects of nuclear physics is to understand the origin of the elements surrounding us. In this talk I will focus on 12C, an essential element for life. It is well known that 12C is formed from three alpha (4He) particles in stars. Theoretical description of this reaction, however, has been oversimplified. I will explain how to formulate reaction rate of a ternary process, which begins with three-body scattering states, using the basic concept of the continuum-discretized coupled-channels method (CDCC). The reaction rate of the 12C formation process is calculated with the accurate picture of the three-body quantum scattering. The new rate is markedly larger than the previous one by more than 20 orders of magnitude at 10^7 K. I will clarify where this difference comes from, by explaining what the previous model assumed. This study will lead one to new understanding of the "origin" of 12C.

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