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## **HOW DOES THE CARBON FUSION REACTION HAPPEN IN STARS?**

The  $^{12}\text{C} + ^{12}\text{C}$  fusion reaction is one of the most important reactions in the stellar evolution. Due to its complicated reaction mechanism, there is great uncertainty in the reaction rate which limits our understanding of various stellar objects, such as explosions on the surface of neutron stars, white dwarf (type Ia) supernovae, and massive stellar evolution. In this paper, I will review the challenges in the study of carbon burning. I will also report recent results from our studies: 1) an upper limit for the  $^{12}\text{C} + ^{12}\text{C}$  fusion cross sections, 2) measurement of the  $^{12}\text{C} + ^{12}\text{C}$  at deep sub-barrier energies, 3) a new measurement of the  $^{12}\text{C}(^{12}\text{C}, n)$  reaction. The outlook for the studies of the astrophysical heavy-ion fusion reactions will also be presented.

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