HIGH PRECISION MEASUREMENT OF THE 3-ALPHA DECAY FROM THE HOYLE STATE IN THE $^{12}C(^{12}C,3\alpha)^{12}C$ REACTION

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The direct 3-alpha decay branch from the second 0^+ state at E_x = 7.65 MeV in ^{12}C, which is known as the Hoyle state, is considered to affect the triple-alpha reaction rate strongly and to give crucial information on its structure. We have performed a high-precision measurement of the 3-alpha decay from this state using the $^{12}C(^{12}C,3\alpha)^{12}C$ reaction at E_{12C} = 110 MeV at the Cyclotron and Radioisotope Center, Tohoku University. The branching ratio of the direct 3-alpha decay was under the detection limit in the present experiment. By comparing with Monte Carlo simulations for three decay mechanisms as the sequential decay through the ground state of ^8Be, the direct decay with equal energies of three alpha particles, and the direct decay to the phase space uniformly, we have obtained the upper limit of 0.2% on the direct 3-alpha decay, which was further improved value in comparison with the previous upper limit. We have also measured the 3-alpha decay from the broad 10 MeV state in ^{12}C using $^{12}C(^{12}C,3\alpha)$ reaction in order to investigate the alpha cluster structure. In this contribution, details of the experiment and analysis for these studies will be presented, including a new result of the measurement for the broad 10 MeV state in ^{12}C.