Search for α -condensed state in ²⁰Ne

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Alpha particle clustering is an important phenomenon in light nuclei. On the basis of the Ikeda diagram, the α cluster structure has been predicted to emerge near the α decay threshold energy. The 0^+_2 state at $E_x = 7.65$ MeV in ¹²C, which is located higher than the 3α -decay threshold by 0.39 MeV, is a well-known 3α cluster state. This state is considered to be the α -condensed state where the three α clusters are condensed into the lowest orbit. It is theoretically predicted that such n α -condensed states appear in the heavier A = 4n nuclei, but have never been experimentally established.

In order to search for the α -condensed state in ²⁰Ne, we measured the excitation energy spectrum of the inelastic alpha scattering at 0 degrees using the spectrometer Grand Raiden at Research Center for Nuclear Physics (RCNP), Osaka University. In addition, we performed the measurement of the decaying particles from the excited state using a Si detecter array.

In the present talk, I will report the experimental details and cluster structures in 20 Ne. In the excitation energy spectrum obtained by gating on the alpha-decay channel, we found several peaks above the 5α decay threshold (19.17 MeV). In addition, we selected the decay events to the 0_6^+ state in 16 O, which is the candidate for the 4α -condensed state, and obtained the excitation energy spectrum of 20 Ne for the selected events. In this spectrum, a prominent peak at 23.5 MeV was found. This is a strong candidate for the 5α -condensed state.