Search for Cluster states in light Nuclei with an Active Target TPC: A candidate for a linear quasi-molecular structure in ^{14}C.

I will present our recent finding of candidate linear-chain alpha-cluster states in the neutron-rich nucleus ^{14}C. One-dimensional alignment of alpha_ clusters in atomic nuclei, today known as a `linear-chain' structure, was first proposed in the 1950s. Experimental verification for such an exotic geometry, however, has been a longstanding challenge in nuclear physics. Using resonant _ scattering with a radioactive ^{10}Be beam, we have measured level energies and decay properties of excited states in ^{14}C that our analysis suggests are part of a rotational band with a linear-chain alpha cluster structure predicted by an anti-symmetrized molecular dynamics model. Our result supports not only the existence of linear-chain structure, but also the model's claim that the orthogonality of linear-chain states to other state configurations is essential to the formation of one-dimensional alpha_ clusters in atomic nuclei. Thus, our result opens the door to new experimental linear-chain alpha-cluster studies in nuclear physics as our technique allows us to measure both elastic and inelastic resonances over large angular and energy domains, which is very difficult with conventional methods. While one-dimensional alignment can be found in various many-body systems, our result is one of the rare candidates measured at the femto-meter scale, making our finding of great interest to both nuclear physics and the greater physics community. If results will be already available, some aspects of a very recent experiment at Triumf-Isac with a ^{8}He beam on ^{4}He will be shown in this context.

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