FIRST OBSERVATION OF ^{21}Ne STRUCTURE IN THE ^{17}O(α,α) RESONANCE REACTION

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^{20}Ne nucleus is a famous textbook example of α-clustering. On the other hand, practically nothing is known on α-cluster structure in ^{21}Ne. The low neutron binding energy in ^{21}Ne makes this case much more special than, for instance, nearby ^{19}Ne. The properties (in particular, widths) of α-cluster states in ^{21}Ne should be sensitive to single particle admixtures. A combination of ^{20}Ne collective deformation with the extra neutron, and with the α-cluster degree of freedom can be also an interesting issue. There were no data on ^{21}Ne because of the experimental difficulties (in particular, of the classic approach to resonance scattering) and because of the difficulties of the interpretation of resonance scattering of α particle on ^{17}O with spin $5/2^+$.

We will present the first measurements of ^{17}O + α elastic scattering done at DC-60 cyclotron using the Thick Target Inverse Kinematic (TTIK) [1–3] method.

The *R*-matrix analysis of this experimental data has been performed for the first time [4]. The α and neutron decay channels of ^{21}Ne were included for this fit. A total of 35 states were used to fit of the total energy spectrum, from excitation energy of 8 MeV to 13 MeV. We identified that the α-cluster states in ^{21}Ne have many surprising properties, the foremost of which is the discovery of a broad, $l = 0$ state which is evidence of a developed α-cluster structure. Similar states may be present in many other nuclei in this mass range and have impact on our understanding of the cluster structure as well as on calculations of the various nuclear processes in stars. We also found that the properties of the positive parity levels support a weak coupling of the ^{17}O α-cluster.

The present data can also be used to revise results of the measurements of ^{17}O(α,*n*) reactions [4].

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