Ground-state electromagnetic moments of ^{21}O

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As a continuation of our previous report,[1)] here we would like to give an overview of the intermediate results of analysis of the spectra obtained in the ^{21}O β-NMR experiment conducted at RIPS, RIBF. In the experiment, the ^{21}O beam was produced from a ^{22}Ne beam at 69 AMeV on a Be target in a projectile-fragmentation reaction involving one neutron pick-up.

In g-factor measurements, the beta-NMR[2)] technique was applied to the ^{21}O ions implanted into the CaO stopper crystal. The Larmor frequency, and hence the g-factor, have been straightforwardly determined from the spectrum obtained with a single-sweep width of 14 kHz (red triangles in Fig. 1) and the value of the ^{21}O magnetic moment $\mu(^{21}\mathrm{O}) \approx 1.5\ \mu_N$ was preliminary deduced.

In order to measure the electric quadrupole moment, the ^{21}O beam was implanted into a single crystal of TiO_2 to provide the electric-field gradient necessary for the β-NQR[3)] measurements. The obtained β-NQR spectrum is shown on Fig. 2. Although the statistics does not allow us to directly distinguish the anticipated double-resonance structure of the spectrum,[4)] the preliminary result of the least-chi-square fitting with a double-Gaussian function is consistent with the expected double-peak nature of the spectrum. The actual value of the quadrupole moment can be extracted from peak I, which corresponds to the substitutional implantation site in TiO_2. From the fitting curve in Fig. 2, $\nu_Q \approx 151.5$ kHz was preliminarily obtained. However, the final analysis and error assignments for both magnetic and quadrupole moments are in progress and will be reported later.

In terms of nuclear structure, at first glance, the neutron-rich ^{21}O appears to be a "normal" nucleus well characterized by a pure $1d_{5/2}$ single particle configuration. However, the theoretical interpretation of these results and the evolution of nuclear structure from ^{19}O to ^{23}O are still under discussion and will be described elsewhere.

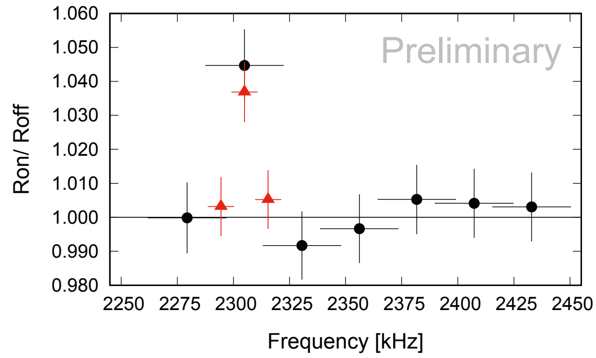

Fig. 1. β-NMR spectrum of ^{21}O in a CaO crystal. The horizontal error bars represent the widths of frequency sweep. Data obtained from two separate runs are shown. The Larmor frequency was determined from the spectrum represented by red triangles.

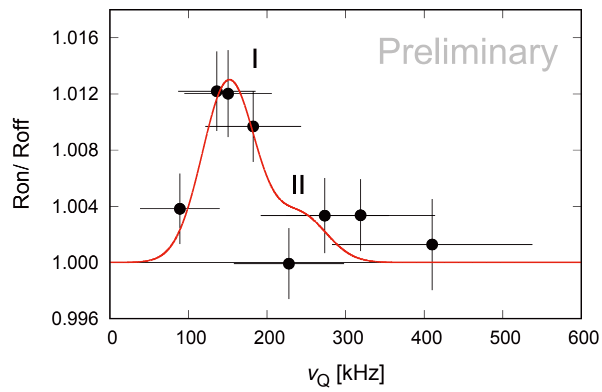

Fig. 2. β-NQR spectrum of ^{21}O in the TiO_2 single crystal. The red line represents the least-chi-square fitting with a double-Gaussian function taking into account the physical expectations based on previous works.[4)] The interval between the two peaks is a fixed value defined by the ratio between the electric-field gradients of two different implantation sites in TiO2. For the definition of ν_Q, see Ref. 5).

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