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Measuring oxygen isotopes beyond the neutron dripline: Two-neutron emission and radioactivity[1]

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The availability of rare isotope beams has made it possible to extend nuclear structure measurements to nuclei far away from stability. Drastic changes in the structure, properties, and available decay-modes of these exotic isotopes have been observed in comparison to their stable counterparts. The oxygen isotopic chain has been particularly interesting with observations of new shell closures at N=14 and N=16. The MoNA-LISA/Sweeper setup at the National Superconducting Cyclotron Laboratory at Michigan State University has allowed for studies of the oxygen isotopes to be extended beyond the neutron dripline. Recently, the ^{26}O ground state was observed for the first time and shown to be unbound by less than 200 keV. The low energy ground state of the two-neutron unbound ^{26}O opened the possibility for the discovery of two-neutron radioactivity. A new technique was developed to measure the lifetimes of neutron unbound nuclei in the picosecond range. This technique was applied to the ^{26}O decay and a half-life of $4.5^{+1.1}_{-1.5}$ (stat.) ± 3 (sys.) ps was extracted. This corresponds to ^{26}O having a finite lifetime at an 82% confidence level and, thus, suggests the possibility of two-neutron radioactivity.

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