

## FIRST OBSERVATION OF $^{60}\text{Ge}$ AND $^{64}\text{Se}$

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The neutron-deficient nuclei  $^{60}\text{Ge}$  and  $^{64}\text{Se}$  were observed for the first time following the fragmentation of  $^{78}\text{Kr}$ . This is the first observation of new proton-rich nuclei below  $Z=50$  in over three years.

A primary beam of 140-MeV/nucleon  $^{78}\text{Kr}$  was produced using the Coupled Cyclotron Facility and fragmented in a Be target. The secondary neutron-deficient fragments were separated by the A1900 fragment separator [1] and stopped in a stack of silicon PIN diodes. The fragments were identified by a measurement of energy loss, total energy, and time-of-flight.

$^{60}\text{Ge}$  is the last nucleus along the proton dripline lighter than cadmium which is predicted to be bound ( $S_{2p} = 50 \pm 240$  keV) by the latest atomic mass evaluation [2] and which has not yet been observed. Theoretical calculations predict  $^{60}\text{Ge}$  to be bound with respect to two-proton emission by 167(141) keV [3] and 630 keV [4], while  $^{64}\text{Se}$  is predicted not to be bound [2].

From the number of observed events of  $^{60}\text{Ge}$  and  $^{64}\text{Se}$  the production cross section and lifetime will be estimated. No events of  $^{59}\text{Ga}$  and  $^{63}\text{As}$  were observed confirming that these nuclei are unbound with respect to proton emission and upper limits of the lifetime can be established.

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- [1] D. J. Morrissey, B. M. Sherrill, M. Steiner, A. Stolz, and I. Wiedenhover, Nucl. Instrum. Methods Phys. Res. B **204**, 90 (2003).
- [2] G. Audi, A. H. Wapstra, and C. Thibault, Nucl. Phys. **A729**, 337 (2003).
- [3] W. E. Ormand, Phys. Rev. C **55**, 2407 (1997).
- [4] M.V. Stoitsov, J. Dobaczewski, W. Nazarewicz, S. Pittel, and D. J. Dean, Phys. Rev. C **68**, 054312 (2003).