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Towards the limits of stability - new decay data for the lightest mendelevium isotopes

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The exploration of neutron-deficient isotopes in the vicinity of the Z = 100 shell gap, offers valuable insight into the nuclear structure and the boundaries of stability for nuclei with extreme neutron-to-proton ratios. To investigate the limits of stability and also the effects of the single-particle states on the decay modes of these nuclei, the neutron-deficient isotopes of mendelevium (^{244,245}Md) were the subject of study in two recent experiments at GSI[1] and Lawrence Berkeley National Laboratory (LBNL)[2,3]. The results of the two experiments initiated a debate[4] on the mass assignment to the observed alpha (α) decay chains of the mendelevium isotope.

The α-decay energies of the reported ^{244}Md events in the experiment at Berkeley were assigned to the neighboring isotope ^{245}Md in a contemporaneous as well as an earlier experiment at GSI[5]. To resolve the disparity between the results from LBNL and GSI, a new experiment was conducted in May-June, 2024 at the Fragment Mass Analyzer (FMA)[6] located at the Argonne Tandem Linear Accelerator System (ATLAS) facility of Argonne National Laboratory (ANL). In this experiment, instead of the two-step procedure applied at Berkeley[2,3], the mass (A) and α-decay energies (E_α) of the evaporation residues (ERs) were measured simultaneously. This was achieved using the mass-separation capability of FMA in conjunction with the focal plane decay station, consisting of silicon detectors arranged in a box configuration surrounded by five germanium clover detectors.

The aim of this experiment was to resolve the discrepancy and assign proper α-decay energies to the mass-identified isotopes of mendelevium, and to establish a production cross-section for the isotope of mendelevium in question. The first analysis of the experimental data indicates the occurrence of events at the utilized beam energy that correspond to the reported E_α of ^{245}Md [1]. In this contribution, the results from the experimental data analysis will be presented.

References

[1] J. Khuyagbaatar et al., Phys. Rev. Lett. 125, 142504 (2020)
[2] J. L. Pore et al., Phys. Rev. Lett. 124, 252502 (2020)
[3] J. M. Gates and J. L. Pore, Eur. Phys. J. A 58, 1 (2022)
[4] F. P. Heßberger et al., Phys. Rev. Lett. 126, 182501 (2021)
[5] V. Ninov et al., Zeitschrift für Physik A Hadrons and Nuclei 356, 11 (1996)
[6] C. N. Davids et al., Nucl. Instr. and Meth. B 70 (1992)

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