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Progress on Decay and Resonance Laser Ionisation Spectroscopy of Neutron Rich Polonium at ISOLDE

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Beyond Bi ($Z = 83$) and the $N = 126$ neutron shell closure, the longest lived isotopes of each element are found beyond $N = 134$. This is due to the fast alpha decay of isotopes towards the $N = 126$ shell closure. While this has been well established, information on the ground state properties is missing for Po ($Z = 84$) isotopes. Moreover, this region is known for the occurrence of octupole deformation in the ground state [1] and is of interest for ongoing searches for atomic electric-dipole-moments.

Polonium isotopes with $N \geq 137$ have been observed in fragmentation studies, however, the half-life, α -to- β -decay branching ratio and charge radius of ^{220}Po remain unknown due to difficulties in measuring ^{220}Po in fragmentation studies and producing pure beams in laser spectroscopy studies [2]. We have performed decay spectroscopy of $^{219,220}\text{Po}$ at CERN ISOLDE with the ISOLDE Decay Station (IDS) and the Alpha SETup (ASET). Laser spectroscopy measurements were performed, in the ion source, using IDS as a highly sensitive ionization rate detection setup. These investigations were made possible by utilizing a Perpendicularly Illuminated Laser Ion Source and Trap (PI-LIST) device [3], in LIST mode, to reduce the isobaric Fr contamination which previously prevented measurements at ISOLDE in this region. We present the first results for the half-life and α -to- β -decay branching ratio of ^{220}Po , the hyperfine structure and isotope shift measurements of $^{211,217,218,219,220}\text{Po}$ including high-spin isomers in $^{211,212}\text{Po}$, and preliminary analysis of the hyperfine structure of ^{219}Po .

References

- [1] L. P. Gaffney, P. A. Butler, M. Scheck, et al., “Studies of pear-shaped nuclei using accelerated radioactive beams,” *Nature*, vol. 497, no. 7448, pp. 199–204, May 1, 2013, issn: 1476-4687. doi:10.1038/nature12073. [Online]. Available: <https://doi.org/10.1038/nature12073>.
- [2] D. A. Fink, T. E. Cocolios, A. N. Andreyev, et al., “In-Source Laser Spectroscopy with the Laser Ion Source and Trap: First Direct Study of the Ground-State Properties of Po 217 , 219,” *Physical Review X*, vol. 5, no. 1, p. 011 018, Feb. 20, 2015, issn: 2160-3308. doi:10.1103/PhysRevX.5.011018. [Online]. Available: <https://link.aps.org/doi/10.1103/PhysRevX.5.011018> (visited on 07/23/2024).
- [3] R. Heinke, M. Au, C. Bernerd, et al., “First on-line application of the high-resolution spectroscopy laser ion source PI-LIST at ISOLDE,” *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms*, vol. 541, pp. 8–12, Aug. 2023, issn: 0168583X. doi: 10.1016/j.nimb.2023.04.057. [Online]. Available: <https://linkinghub.elsevier.com/retrieve/pii/S0168583X23001945> (visited on 06/22/2024).

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