Contribution ID: **60** Type: **poster**

Changes in the mean-square charge radii of polonium at CERN-ISOLDE

The region of the nuclear chart around the neutron-deficient lead isotopes is famous for the coexistence of different shapes at low energy. The lead isotopes (Z=82), however, remain spherical in their ground state. With two protons outside the lead closed core, the polonium isotopes (Z=84) also exhibit shape coexistence for the most neutron-deficient isotopes with intruding deformed bands. We investigated the influence of those intruding configurations on the ground state of the polonium isotopes by means of in-source resonant ionization laser spectroscopy.

Polonium isotopes and long-lived isomers from 191Po up to 218Po have been studied over two campaigns at the CERN-ISOLDE facility using the RILIS laser ion source. The isotope shift between all the isotopes have been extracted. Large-scale atomic calculations using the GRASP code and the RATIP package have been used to determine the electronic parameters necessary to deduce changes in the mean-square radii. The comparison between two transitions for the isotopes 200,202,204,206-210Po is used to assert the reliability of those calculations. A very large departure in the changes in $<r^2>$ $from sphericity is observed for A < 200 together with a reversing of the odd-even staggering below A = 196. The magnitude of the departure is much stronger than in the Hg ($Z = 80$) and Pt ($A = 78$) isotones, showing the importance of the specific shells involved beyond $Z = 82$.

The analysis of the hyperfine structure of the odd-A isotopes has been performed and electromagnetic moments have been extracted. The magnetic dipole moments are consistent with a large mixing in the configuration of the ground state of the most neutron-deficient isotopes.

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yes

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Track Classification: Shell structure far from stability