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In-source laser spectroscopy of short-lived isotopes in the lead region

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Systematic study of the evolution of the nuclear charge radii, deformation, configurations and other ground and isomeric states characteristics near the proton shell closure (Z = 82) is actual and important task. It will enable to construct the two-dimensional picture (with N and Z varied) of the changes of these fundamental nuclear characteristics.
One of the most efficient method for far-from-stability nuclear structure study is the method of resonance laser ionization in the laser ion source (LIS) [1], developed and firstly applied for in-source laser spectroscopy at the IRIS facility (PNPI). This method provides information about isotope shift (IS) and hyperfine structure (hfs) of optical lines. From these data changes in the mean squared nuclear charge radius, nuclear dipole magnetic and quadrupole electric moments, nuclear spins can be deduced. It was enable to obtain a wealth of new information about shape evolution and shape coexistence in atomic nuclei in the lead region: jump-like odd-even shape staggering in Hg isotopic chain [2]; early onset and gradual increase of deformation at N < 113 for Po nuclei [3], etc.
This contribution will discuss laser spectroscopy measurements for Bi nuclei (Z = 83) performed at IRIS (PNPI) and ISOLDE (CERN) facilities. The most interesting experimental results are as follows:
1) large nuclear shape staggering at A=188 (^{205}Bi), which is similar to the Hg shape staggering and appears at the same N;
2) large isomer shift, corresponding to more deformed configuration for intruder even-N Bi isomers ($I^{\pi} = 1/2^{+}$) with N = 108-118, which is the signature of shape coexistence in the corresponding nuclei;
3) marked deviation from the nearly spherical behavior for ground states of the even-neutron Bi isotopes at N < 109 in contrast to the Pb and Tl isotopic chains.
New data will contribute to the better understanding of the shape coexistence phenomena in this region.

References:
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