5. Resonance ionization spectroscopy inside the laser ion source and inside the volume of high temperature ionizing target at IRIS facility

Application of the new methods of resonance ionization inside the ion source and resonance ionization inside the volume of high temperature ionizing target, developed at the IRIS facility, the area of high interest for nuclear physics (nuclei near Z=64 and N=82) has been investigated.

Isotope shift measurements for the chain of neutron deficient Eu isotopes have been made with the method of resonance ionization inside the ion source. The changes in mean square charge radii for isotopes $^{137-144}$Eu have been evaluated. Hartree-Fock calculations with SkM' for the axially deformed nuclei have shown very strong dependence of mean square charge radii on the odd-particle state for measured isotopes. Hence, for correct theoretical description of the ^{137,138,139}Eu ground states is necessary to take into account the possibility of non-axial deformation of these nuclei.

Laser-spectroscopic Investigations of isotope and isomer shifts for the $^{145, 143}$ Gd isotopes on the optical line 569,6 nm have been carried out using the ionizing target method and the developed β- and γ- detection system. The changes of mean square charge radii for ^{145}Gd, ^{145}Gd^{m} and ^{143}Gd^{m} and magnetic moments for ^{145}Gd and ^{145}Gd^{m} have been evaluated.

The changes of mean square charge radii of Gd investigations have shown the faster increasing of nuclear deformation for Gd isotopes from the spherical nuclei near the magic neutron number N=82 to the deformed ones at N=79 as compared to the same neutron numbers for Eu isotopes. This behaviour is supposed to be connected with the different influence of the semimagic number Z=64 on the deformation development for the nuclei N<82.

There is no indication on the stabilization effect of the proton sub-shell Z=64 near the neutron sub-shell N=82 for Gd isotopes as well. Values of the dipole magnetic moments measured for ^{145}Gd and ^{145m}Gd are in a good agreement with magnetic moments of the other nuclei with the close neutron number.

(For more detailed review see article " Investigation of spins, electromagnetic moments and charge radii of radioactive nuclei by laser spectroscopy." in PNPI report of the High Energy Physics Division "Main Scientific Activities 1971-1996" and "Measurements of charge radii and electromagnetic moments of nuclei far from stability by photoionization spectroscopy in a laser ion source" in PNPI report of the High Energy Physics Division "Main Scientific Activities 1997-2001