3. Investigation of spins, electromagnetic moments and charge radii of radioactive nuclei by laser spectroscopy.

One of the most important problems in nuclear physics is a correct description of the nuclear ground states. To solve this problem, one needs experimental information on the ground states characteristics. The significance of this information rises greatly, if one can trace the changes of these characteristics with the changes of the nucleon numbers N and Z within sufficiently wide limits far from the stability line. The task of the nuclear theory is twofold: firstly the general trends of the observed isotopic and isobaric dependencies have to be described and secondly it is of importance to explain the sudden changes of some nuclear parameters near some peculiar points on the chart of nuclides. The data on the nuclei near nucleon drip lines are of special interest, since particularly for these nuclei the validity of up-to-date theoretical approaches could be questioned first of all.

The laser spectroscopy plays the leading role in the creation of the two-dimensional picture of the ground state properties. It enables one to determine spins, magnetic dipole moments, electric quadrupole moments and also variations of the mean square charge radii. These values are calculated making use of the data on the measured isotope shifts and hyperfine structures of optical lines of the atomic transitions.

In 1979 the construction of a high-sensitive laser installation for hyperfine structure and isotopic shifts studies was started at the IRIS facility. The first experimental results - isotopic changes of charge radii for long-lived Eu isotopes - were obtained in 1983. In summary, laser spectroscopic studies of more than a hundred nuclides have been carried out at IRIS. Spins, electromagnetic moments and isotopic changes of mean square charge radii for these nuclei have been determined. Theoretical analysis of experimental data has shown the significance of the obtained results for the understanding of nuclear structure.

As it has been shown during the latest two decades in the trend of ISOL facilities the idea of a refractory high temperature cavity use to construct a high efficient selective laser ion source which was firstly proposed and realized at the IRIS facility turned to be very fruitful for efficient and selective ionization of many elements of the periodic table. Furthermore, as it has been demonstrated during the latest experiments, the developed LIS construction was used practically without any modification for laser spectroscopic investigations of a very large region of exotic nuclei.

*(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**").*