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Laser resonance ionization spectroscopy on scandium: towards production of medical radioisotopes

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The theranostics approach in nuclear medicine is based on the use of radiopharmaceuticals with similar chemical behavior, that enable both therapeutic and diagnostic applications with well managed kinetics and biodistribution in the body. As radionuclides are the active agents for such medicine, the most appropriate solution for the purpose is to use radioisotopes of the same chemical element, ensuring identical chemical properties.

Scandium isotopes are known candidates for theranostics approach: Sc-47 can be used for radionuclide treatment, while Sc-43 and Sc-44 are well suited for imaging procedures. On the other hand, the generation of scandium radioisotopes is often associated with isotopic cross-contaminations. This drawback can be overcome using the mass separation technique to extract desired radionuclides from an irradiated sample. The combination of an electromagnetic isotope separator with a resonant ionization laser ion source can provide an increased yield of extracted isotopes along with the highly improved elemental purity of the final product.

To develop a suitable ionization scheme, laser resonance ionization spectroscopy on scandium was accomplished. The work was focused on the characterization of a two-step ionization process, being considered as optimum in respect to efficiency, reliability and operation complexity. For this study, different first excitation steps in UV range were investigated, unfolding into broad spectra of auto-ionizing states. The spectroscopy results and further plans are going to be presented.

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