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Resonant Ionization Spectroscopy for laser isotope separation of zinc isotopes

Resonant Ionisation Spectroscopy (RIS) refers to the selective excitation of a particular atomic isotope to an excited state by means of resonant light, followed by photo-ionisation and ion detection. ^{68}Zn and ^{67}Zn are important stable nuclides in medicine and industry. ^{68}Zn and ^{67}Zn are used to produce Gallium isotopes (^{68}Ga and ^{67}Ga) that are used in medical imaging such as Positron Emission Tomography (PET) and SPECT (single-photon emission computerised tomography) to detect inflammation, infection or cancer. The main aim of this project is to investigate, model and optimise RIS schemes for Zn isotopes (^{68}Zn and ^{67}Zn) that are suitable for laser-based separation of these isotopes from natural Zn. RIS is used to obtain spectroscopic data on the transition wavelengths, hyperfine structure, and transition strengths of the relevant energy levels.

In this presentation, an overview is given on the successful development of a RIS system for Zn. The experimental setup for a three-level excitation system will be discussed. The results for the fluorescence measurements of the $3d^{10}4s^2\ {}^1S_o$ - $3d^{10}4s4p\ {}^1P_1$ and $3d^{10}4s4p\ {}^3P_1$ - $3d^{10}4s4d\ {}^3D_2$ transitions will be reported as well as the successful ionization of Zn. A brief overview of the implementation of the time-of-flight mass spectrometer (TOF-MS) with the RIS system for the detection of Zn ions, will be given. The TOF-MS and RIS systems were finally used to investigate the optimal conditions for photoionization of the individual Zn isotopes.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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