Atomic Spectroscopy of Dysprosium Aiming Isotopic Enrichment via Lasers

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The ^{164}Dy isotope can be used in the construction of nuclear control bars, due to its high efficiency on neutron absorption. Moreover, other isotopes of dysprosium have other applications as cited in Marathe et al [1]. Thus, motivated by that, this work aims to contribute to the laser isotopic separation process of dysprosium in development at IEAv. Studies and experiments on optogalvanic spectroscopy were realized, using the technique of multiple steps in order to identify the possible photoionization routes for dysprosium, specifically in the spectral range between 555 nm and 615 nm. A computer code for spectra analysis and simulation, the ASAS Software[2] (Analysis and Simulation of Atomic Spectra), has been updated resulting in four new functions that assisted in the planning and interpretation of experimental results. The experiments were performed using a dysprosium hollow cathode lamp with neon as the buffer gas. The identification of ten lines of dysprosium in the experimental spectrum enabled the determination of the temperature using the Boltzmann Plot method. Given the temperature values and the principle of Boltzmann distribution, the population of atoms in the ground state was calculated. In the first step optogalvanic spectroscopy limited by Doppler, we observed five resonant transitions from the fundamental state of the Dy atom in the dye lasers spectral range: 555 nm to 575 nm and 585 nm to 615 nm. By means of two steps optogalvanic spectroscopy, fourteen transitions were observed. It was verified the existence of four energy levels not assigned yet in the literature. These energy levels are going to enable the study of new routes for the dysprosium photoionization process .

REFERENCE

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