

Off-line and On-line Applications of High Resolution Laser Spectroscopy on Exotic Species – Collinear and Alternative Approaches

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Abstract

Since the very early days of radioactive ion beam facilities (RIBs) using the thick-target hot-cavity ion source technique [1] up to today [2] laser spectroscopy has been one of the most fertile techniques for both, the efficient production of pure RIBs as well as the high precision investigation of atomic and nuclear parameters and structure of exotic species. To investigate the very small effects visible in the optical spectra, which are induced by the nucleus and its specific properties like spin, nuclear moments, charge radii and deformations, high resolution spectroscopic techniques are mandatory. Aside of the more and more upcoming direct in-source techniques [3], collinear arrangements of the exciting laser beam to the fast ionic or – after a suitable charge exchange process – well collimated atomic beam have been the working horse for many decades at all leading RIB facilities worldwide [4]. Today very sensitive detection techniques just slightly above the – one atom at a time technology – are at hand. These include advanced fluorescence counting, application of optical pumping and NMR effects, as well as collinear resonance ionization involving possibly a multitude of lasers. Apart of the striking on-line applications optical high resolution laser spectroscopy also plays a leading role in ultra-trace isotope determination providing highest isotopic selectivity [5] as well as in rare isotope purification, e.g. for fundamental studies on the neutrino mass, or on the lifetime of longest lived isotopes like ^{53}Mn or ^{60}Fe . The presentation will give a survey from the history to the present status of high resolution laser spectroscopy at both on-line and off-line facilities.

References:

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