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In-Source Photoionization Spectroscopy: Methods of data analysis

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The laser ion source is not only a very effective in its normal use as an element-selective tool for producing intense ion beams, but it can be used as a very powerful atomic-spectroscopy tool due to the resonance character of the photoionization (In-Source Laser Resonant Photoionization Spectroscopy). In contrast to other laser spectroscopic techniques, in that case the laser frequency scanning procedure is applied directly within the mass-separator ion source. The main advantage of this technique is its very high sensitivity, nevertheless its spectral resolution is Doppler-limited, therefore the accurate data analysis is of great importance.
The method of analysis of the data obtained in the recent In-Source Spectroscopy experiments at ISOLDE will be presented. This method incorporates different types of corrections for the obtained optical spectra and solving the rate equations for the given photoionization scheme to take into account the saturation of transitions, pumping processes between hyperfine structure (hfs) components and a population redistribution of the hfs levels.

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