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Laser-based atomic spectroscopy for trace analysis

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The first demonstration of the use of lasers in spectrochemical analysis took place in 1962 when a ruby laser was used to evaporate and atomize a solid material. Apart from this early demonstration, the age of laser spectroscopy for spectrochemical analysis did not begin until about 1975 when the tunable dye laser, which allows resonant selective interaction with atoms and molecules was introduced.

Since then, a large number of techniques for trace element analysis have emerged in which the laser is used for vaporization/atomization of the sample and/or detection of atoms or molecules in solids, liquids, gases or plasmas.

It is the purpose of this talk to provide an overview of the analytical performance of the main laser-based techniques for trace element analysis. These techniques are based on the resonant absorption of laser radiation by atoms and subsequent detection of charges or fluorescence radiation. Among the important techniques that fulfill these selection criteria we find :

- laser excited atomic fluorescence spectrometry in various atom sources such as the electrothermal atomizer, inductively coupled plasma, glow discharge or laser plasma plume
- laser-enhanced ionization spectrometry in flames
- resonance ionization mass spectrometry combined with thermal, sputter or laser atomization

Principles, analytical characteristics and performances of the different techniques will be presented for different fields of application. Performances will be evaluated relative to commercially available techniques.