# Hyperfine Structure Investigation of Nb I with Optogalvanic Spectroscopy

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Niobium (Nb) is the third element of the 4d shell transition metals and has only one stable isotope with odd mass number 93. It has a nuclear spin of $I = 9/2$ and a large magnetic dipole moment. Although many investigations of the hyperfine structure (hfs) of the isotope $^{93}$Nb have been done in the past using different experimental techniques (see ref. [1] and references therein), our knowledge about experimental hfs constants is still not complete. The aim of present work is to determine experimentally the hfs constants of selected energy levels of atomic niobium.

Laser optogalvanic spectroscopy (OGS) is a very sensitive and powerful tool for recording high-resolution atomic spectra. In the present work Doppler-limited OGS has been applied to measure the hfs of selected spectral lines of atomic niobium (Nb I) in the wavelength region from 750 nm to 870 nm, using a tunable single mode cw Ti:Sa laser (MBR-110, Coherent, output power of 4 W) which is pumped with a cw solid state laser (Verdi 18 W). The relative frequency reference is given (acquired) by a home-made temperature stabilized confocal Fabry-Perot Interferometer (FPI) with a free spectral range of 299.0010 (8) MHz. In order to produce free Nb atoms a hollow cathode lamp is used, which is operated at a current of 30-50 mA and a Ne pressure of about 2 mbar. To reduce Doppler-broadening of spectral lines, the hollow cathode is cooled by liquid nitrogen.

Altogether 38 transitions have been measured, three of which are not listed in the comprehensive Nb wavelength tables of Humphreys and Meggers [2]. Six transitions have been newly classified using the classification program *Class_Iw* [3]. For determination of the hfs constants of the levels involved in the investigated lines, the hfs spectra have been fitted with Voigt profile functions using the program *Fitter* [4].

As results of this work, new experimental magnetic dipole hfs constants $A$ and electric quadrupole hfs constants $B$ will be presented.

The present work is complemented by laser-induced fluorescence measurements, which will be presented in a separate presentation on this conference [5].

References:
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