Investigation of Fourier Transform Spectum of Niobium in Argon Discharge in the near-infrared

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The aim of present work is to classify the spectral niobium lines in the near-infrared region by means of hyperfine structure. The most extensive wavelength lists for niobium [1] are limited to wavelengths below 1 090 nm for Nb I and 700 nm Nb II. In the NIST Atomic Spectra Database [2] only wavelengths below 890 nm are listed. The present work extends the wavelength range to the near infrared up to 1 700 nm.

Nb with the atomic number 41 has only one stable isotope, ^{93}Nb, which is characterized by a nuclear spin quantum number of I=9/2 [3]. In the present work, Nb spectrum produced in hollow cathode discharge lamp has been recorded in the wavelength range from 833 nm to 1 700 nm (from 5 900 cm^{-1} to 12 000 cm^{-1}) using a high resolution Fourier transform spectrometer (Bruker IFS 125HR) at the Laser Centre of the University of Latvia. The hollow-cathode discharge was running in an argon atmosphere. Both Niobium and Argon lines were observed in the spectrum.

In total 829 spectral lines were detected. Using the Classification Programme [4], which contains a list of levels from [1, 5-11], 103 lines could be classified as Nb I transitions and only one line as Nb II transition. 43 of these Nb I transitions and the Nb II transition were classified for the first time; 36 of the classified Nb I transitions and the Nb II transition have not been listed in the literature before. Furthermore 347 lines are assigned as Ar I lines and 234 as Ar II lines, of which 41 and 20, respectively, were assigned for the first time. Remaining 144 spectral lines could not be classified, 10 of which could be assigned as Nb lines, because of their hyperfine pattern. Seven of unclassified lines have been observed also in the La-Ar-spectrum in [12] and therefore are very possibly Ar lines.

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