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Spectrum and Energy Levels of Mo VI

Joseph Reader

National Institute of Standards and Technology, Gaithersburg, MD, USA

Joseph.Reader@nist.gov

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Molybdenum continues to be of interest for controlled fusion reactors as it is used as a first wall material in a number of tokamaks and may play a role in the construction of ITER. In the plasma edge and divertor regions, the spectra of moderately ionized atoms will be especially important. In response to this application we investigated the spectrum and energy levels of Mo VI. This ion belongs to the Rb isoelectronic sequence and as such has a simple one-electron spectrum ($4s^24p^6nl-4s^24p^6n'l'$) as well as a more complicated spectrum arising from inner-shell excitations ($4s^24p^54d^2$ and $4s^24p^54d5s$).

An extensive description of the one-electron spectrum was given by Edlén et al. [1] in 1985 based on observations with a sliding-spark. By using long-wavelength yrast-type transitions observed by Romanov and Striganov [2] with a Penning discharge, Edlén et al. [1] determined an accurate value for the ionization energy. However, Kancerevicius et al. [3] re-observed the spectrum with a low-inductance spark. They extensively revised the identification of transitions arising from inner-shell excitations [4] as well as some odd-parity levels of the one-electron spectrum [1]. As a result, several levels used by Edlén et al. [1] for the ionization energy were called into question and thus also the value for the limit itself. This was derived from the 6h, 7i, and 8k levels.

A few years ago we re-observed the spectrum of Mo VI with a sliding-spark discharge and the 10.7-m normal- and grazing-incidence spectrographs at NIST. The observations covered the range 200-5300 Å. Although we revised a number of the even levels of the one-electron spectrum, we did confirm the identification of the 5g-6h multiplet of Edlén et al. [1] This had been used by them to connect the 6h, 7i, and 8k levels, established by Romanov and Striganov, [2] to the main set of one-electron levels. We also observed most of the lines given by Romanov and Striganov [2] and confirmed those used to determine the 7i and 8k levels. The ionization limit of Edlén et al. [1] was thus confirmed. However, a number of Romanov and Striganov's line identifications had to be revised.

More recently, in an effort to complete our work on this spectrum, we re-visited the line identifications for transitions to the $4s^24p^64d$ ground configuration from the $4s^24p^54d^2$ and $4s^24p^54d5s$ configurations [3] and the energy levels of these configurations. Although almost all of these levels were confirmed, a few revisions were called for. Improved values were obtained for all of the energy levels and a new least-squares fit for the odd configurations was carried out.

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