THEORETICAL INTERPRETATION OF THE U^+ ION ENERGY LEVELS AND IDENTIFICATION OF VUV TRANSITIONS

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The singly ionized uranium ion U^+ is known to be present in the oldest stars of the Galaxy and the strongest line of ist spectrum (U II) is used for evaluation of the age of the Universe [1]. Its energy levels were investigated by J. Blaise *et al* in 1994 [2], based on a set of experimental spectra from different origins, over a large spectral range but with a limited amount of data in the vacuum ultraviolet (VUV). The complexity of the energy level scheme could not be handled in the corresponding theoretical studies by parametric calculations at that time, due to limitation of computer capacities. Therefore, configuration interactions could not be taken into account properly.

In the present work, new parametric calculations have been performed by means of Cowan's codes [3] for odd parity configurations ($5f^3\ 7s^2 + 5f^3\ 6d7s + 5f^3\ 6d^2 + 5f^4 7p + 5f^5$), which include the ground state $5f^3\ 7s^2\ ^4I_{9/2}$ of the U^+ ion. The resulting least squares fit of radial integrals minimizing the differences between experimental and calculated energies led to a standard deviation of 57 cm^{-1} for 222 experimental levels and 22 free parameters. For the even parity, calculations including the $5f^4(7s+6d) + 5f^2(6d+7s)^3$ configurations led to a standard deviation of 84 cm^{-1} with 125 experimental levels and 22 free parameters. The higher even configurations $5f^3 7s7p$ and $5f^3 6d7p$ were calculated separately to avoid increased difficulties for unambiguous correspondence between theoretical and experimental levels.

Assuming a typical stellar atmosphere effective temperature of 4825K [1], estimates of the partition function obtained from *ab initio* level energies and from parametric calculations were compared and showed a difference of about 20%.

On the experimental side, spectral lines belonging to the U II spectrum have been identified on spectra emitted by a sliding spark source with uranium anode and recorded using the high resolution 10.7 m vuv spectrograph of the Meudon Observatory. A list of classified lines with available calculated transition probabilities will be reported.

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