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FTIR laboratory measurement of O I spectra in 0.77–12.5 μm spectral range

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Compared with the visible and ultraviolet ranges, fewer atomic and ionic lines are available in the infrared spectral region. Atlases of stellar spectra often provide only a short list of identified lines and modern laboratory-based spectral features for wavelengths longer than 1 micron are not available for most elements. In spite of the fact that oxygen is one of the most abundant elements in the universe, very few studies of their spectra in infrared region have been reported. The normal system of O I terms available in the NIST atomic spectra database was established more than a half-century ago. The present work attempts to address the above issues. We exploited the great advantages of time-resolved Fourier transform spectroscopy, such as its constant high resolution and energy throughput, to record high-resolution spectra of oxygen in a wide domain of 800-13000 cm^{-1} (0.77-12.5 μm). With the help of recent high-accuracy direct measurements of the 3p level in the UV, we performed a re-optimization of O I level energies. This re-optimization uses 146 O I lines in the infrared (including 59 lines not measured previously in the laboratory) to yield more accurate energies of levels with n=4-7, l≤6. For some of these levels, we experimentally found fine structure splitting for the first time. The line classification was performed using relative line strengths expressed in terms of transition dipole matrix elements calculated with the help of quantum defect theory (QDT). To verify our QDT calculations of dipole transition matrix elements, we checked several QDT-calculated oscillator which strengthened against the results of other authors. The method showed the good agreement with the vast majority of the data listed in the NIST ASD.

Biography

Zanozina Ekaterina has completed her PhD from Voronezh University and State Research Center of Russian Federation Troitsk Institute For Innovation and Fusion Research. She is now a Post-doctoral Researcher in J Heyrovsky Institute of Physical Chemistry AV ČR in Prague. In the Department of Spectroscopy, she actively participates in solving problems, which mainly include the identification of infrared spectra of atoms and complex analysis of spectral data. She is the author of 11 publications in impacted journals with 37 citations. She presented her results at six international conferences focusing mainly on spectroscopic issues. Her research interests include Rydberg states of atoms and molecules; interaction of electromagnetic radiation with atoms; mathematical and computational physics; time-resolved FTIR spectroscopy and transition probabilities.

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