

Measurements of Lifetimes and f -Values In Highly-Charged Positive Ions

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Measurements have been made of the lifetimes and f -values of metastable levels of singly- and highly-charged positive ions (HCI). These contribute to the optical absorption, emission and energy balance in the ISM, stellar and solar atmospheres, etc. These ions and charge states are important for interpretations of data obtained from HST, EUVE, FUSE, Chandra and Newton missions. The vast majority of the millions of transition probabilities are presently being calculated by theory. However, the use of theory alone, unchecked by experimental verification, can lead to orders of magnitude error in the calculated electron densities and temperatures determined from diagnostic line ratios. The experimental lifetime measurements are carried out using the 14.0 GHz electron cyclotron ion source at the JPL facility. [1,2] The ECR ion source provides microampere current of ions such as $O^{(1-6)+}$ and $Mg^{(1-6)+}$. Ions are injected into a Kingdon ion trap and stored for times longer than the metastable lifetimes. Decay channels include intercombination, E2, M1 and 2E transitions. The UV photons are filtered by an interference filter and detected by a UV grade photomultiplier tube using a UV grade optical system. For wavelengths less than 180 nm, a cesium-iodide coated microchannel plate enhanced for UV performance is used. The Kingdon trap was constructed in collaboration with Texas A & M University. [3] Base vacuum is 4×10^{-10} Torr, hence quenching corrections are negligible.

We have previously reported [1] lifetimes for the $^2P^o-^4P$ intercombination transitions of C^+ and have recently presented lifetime measurements of the 1S_0 M1 transition of O^{2+} at 232 nm. [4] The measured lifetime of 541 ± 40 ms is in good agreement with previous measurements and a number of theoretical calculations. Additional metastable lifetimes have been measured and will be presented for Mg^{+6} , Fe^{9+} , Fe^{10+} and Fe^{13+} metastable states. Additional lifetime measurements are planned for *SIII*, *Ne V*, *Fe II* and *Fe XIII*.

References:

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