Lifetimes and Transition Probabilities for High-Lying Levels in Astrophysically Interesting Atoms Using Multi-Photon Excitation

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In spectroscopy of stellar atmospheres the atomic transitions most often appear as absorption lines. To use these lines for quantitative analysis of the population distribution and abundance determinations, reliable transition probabilities or f-values must be available. A standard technique for this purpose is to combine measurements of the lifetime of the upper level with experimentally determined branching fractions from an intensity calibrated source. Since experimental studies are naturally limited in the number of levels that can be investigated, it is very fruitful to use the experimental data to benchmark detailed and comprehensive theoretical calculations.

We will discuss the recent progress at the Lund Laser Centre, aiming to extend previous studies to more highly excited levels and also to levels with the same parity as the ground configurations. The lifetime measurements are performed using the Time-Resolved Laser-Induced Fluorescence (TR-LIF) technique, and the key element to reach the new levels is by either two-photon excitation (from a single laser) or by two step excitations (from two different lasers). Recent results using two-photon excitations in Cr II and Fe II can be found in [1,2]. Current projects involving two-step excitations (Ti II, Ni II, Mn II and Co II) are performed in collaboration with K. Blogaev at the Bulgarian Academy of Sciences and P. Palmeri and P. Quinet in the theory group at the Université de Mons in Belgium.

References

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