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Why does thermodynamic equilibrium matter when measuring transition probabilities?

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High-quality transition probabilities (oscillator strengths, log(gf)) are of vital importance in the analysis of astronomical spectra. Along with spectral line wavelengths and widths, they allow astronomers not only to determine the chemical composition of stellar and exoplanetary atmospheres, but also to gain some insight into their temperature and electron density.

For more than 30 years, the Plasma Spectroscopy Laboratory at the University of Valladolid (Spain) has been developing different techniques for the generation and diagnosis of plasma light sources with which to measure atomic parameters (transition probabilities, Stark widths). Our instrument has a resolving power of 200 000 at 200 nm and is able to measure in the 200-900 nm spectral region.

In this talk, I will explain in a comprehensive manner the different experimental methods available for the measurement of transition probabilities. Each method is chosen according to whether thermodynamic equilibrium on the plasma used as a light source is present or not. The final aim of this presentation is to make the work of experimental plasma spectroscopy more accessible to researchers and astronomers in need of high-quality atomic data and to create a common language that can be used as a foundation upon which to foster future collaborations.

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