Atomic-structure calculations for ultracold gases of lanthanides

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Laser-cooling and trapping of atoms and ions require the knowledge of atomic properties like level energies or transition Einstein coefficients. In the case of lanthanides, a relatively small proportion of Einstein coefficients have been measured in the visible and infrared windows. It is thus necessary to calculate Einstein coefficients of many transitions, in order to characterize the feasibility of laser-cooling and trapping for a given species.

In the last 10 years, I have developed in collaboration with Jean-François Wyart a method to calculate Einstein coefficients for spontaneous emission, using least-square fitting with the coefficients available experimentally. That method is implemented in our new code "FitAik", which works in interaction with the well-known atomic-structure codes written by Robert Cowan. In my presentation, I will illustrate those calculations with the erbium ion Er^+, which is relevant in the context of laser-cooling and trapping.