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Fully calibrated lanthanide atomic data for 3D kilonova modeling

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With the detection of multiple neutron-star merger events in the last few years, the need for a more comprehensive understanding of nuclear and atomic properties has become increasingly important. Despite our current understanding, there are still large discrepancies in the opacities obtained from different codes and methods. These discrepancies lead to variations in the location and strength or absorption and emission features in radiative transfer models and prevent a firm identification of r-process products. To address this issue, we developed an optimisation technique for energy levels and oscillator strengths consistent with available experimental data. With this novel method, we can increase the accuracy of calculations while reducing the computational cost, finally making it possible to apply the method to all lanthanides instead of focusing on single ions.

We will report on converged large-scale atomic structure calculations of all singly and doubly ionised lanthanides with greatly improved transition wavelength accuracy compared to previous works. The impact of our new atomic data set on realistic 3D radiative transfer calculations and prospects of r-process signature identification will be investigated.

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Primary author: FLOERS, Andreas (GSI Helmholtzzentrum für Schwerionenforschung)

Co-authors: Dr COLLINS, Christine (GSI Helmholtzzentrum für Schwerionenforschung); Prof. MARTÍNEZ-PINEDO, Gabriel (GSI Helmholtzzentrum für Schwerionenforschung); Prof. SAMPAIO, Jorge (LIP, Lisboa, Portugal); Prof. PIRES MARQUES, José Manuel (LIP, Lisboa, Portugal); Dr SHINGLES, Luke (GSI Helmholtzzentrum für Schwerionenforschung); Mr FEREIRRA DA SILVA, Ricardo (LIP, Lisboa, Portugal)

Presenter: FLOERS, Andreas (GSI Helmholtzzentrum für Schwerionenforschung)

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