

Institutsseminar

A Twist in the Fluorescence of Cold Molecular Ions in the Gas Phase

Thomas Toft Lindkvist

**Department of Physics and Astronomy,
Aarhus University – Denmark**

The design of new fluorescent proteins and fluorescent markers optimized for higher fluorescence quantum yield or red-tuned emission requires firm knowledge of the factors that govern chromophore photophysics. Using our custom-built instrument, LUNA2 [1], we measure fluorescence from cold molecular ions in the gas phase. Our measurements provide detailed information on potential energy surfaces and Franck-Condon active modes, allowing for direct benchmarking of computational models. However, not all chromophores fluoresce in the gas phase. The isolated chromophore of the all-important green fluorescent protein (GFP) is completely non-fluorescent at room temperature due to an internal twist motion otherwise hindered by the protein. Upon cooling, the fluorescence can be restored as protein steric hindrance is mimicked by reduced thermal motion [2]. Similar twistable motifs also drive the functionality of protein and DNA stains like thioflavin T and thiazole orange. Low-temperature measurements thus enable us to directly probe intrinsic excited-state twisting and chromophore photophysics, and in a bottom-up approach, the impact of the environment and small structural changes.

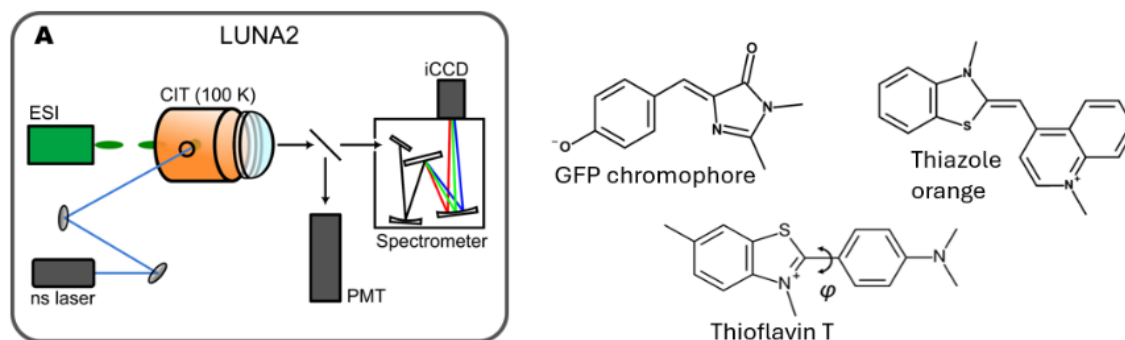


Figure 1: Schematic of the LUNA2 instrument (from Ref. [3]) together with three molecular ions of interest.

References:

- [1] C Kjær, J Langeland, TT Lindkvist, ER Sørensen, MH Stockett, HG Kjaergaard, S Brøndsted Nielsen. *Rev. Sci. Instrum.* **2021**, 92, 033105.
 [2] TT Lindkvist, I Djavani-Tabrizi, LH Andersen, S Brøndsted Nielsen. *Phys. Rev. Lett.* **2025**, 134, 093001.
 [3] TT Lindkvist, AP Rasmussen, N Klinkby, LH Andersen, and S Brøndsted Nielsen. *J. Phys. Chem. Lett.* **2025** 16, 13277-13283.

HS G

15:30 Uhr

15.04.2026