Contribution ID: **26** Contribution code: **CC02** Type: **Talk**

Storage ring studies of carbon cluster thermal electronic radiation

Thursday, January 8, 2026 4:00 PM (15 minutes)

Highly excited molecules and clusters can emit visible and infrared radiation from thermally excited electronic states. This radiation, known as recurrent fluorescence, is particularly intense for carbon clusters and carbon-based molecules due to their high stabilities which allows them to store large amounts of excitation energy and thereby have the possibility to promote electrons to optically active excited states.
Photon emission time constants range from the typical infrared timescales of milliseconds down to a few tens of microseconds, depending critically on the electronic structure of the system. The thermal photon emission channel provides an efficient, but very system-dependent cooling of the molecules/clusters and can as an important stabilizing factors in the collision-poor interstellar medium.
Recurrent fluorescence radiation has been studied at several electrostatic storage rings. In these devices the radiative cooling is measured in parallel with unimolecular decays or thermal electron detachment from anions. I will present measurements from such devices on radiation from fullerenes, from pure carbon cluster ions for sizes below the fullerene size limit of $N \approx 30$, and for carbon-based molecules of astrophysical interest.

[1] K. Hansen, The stabilization of cyanonaphthalene by fast radiative cooling, Nature Communications **15** (2024) 8442

[2] Shimpei Iida, Wei Hu, Rui Zhang, Piero Ferrari, Kei Masuhara, Hajime Tanuma, Haruo Shiromaru, Toshiyuki Azuma, and Klavs Hansen, Thermal radiative cooling of carbon cluster cations C_N^+, $N = 9, 11, 12, 17 - 27$, Mon. Not. R. Astron. Soc. **514** (2022) 844–851

[3] Piero Ferrari, Ewald Janssens, Peter Lievens, Klavs Hansen, Radiative cooling of size-selected gas phase clusters,
Int. Rev. Phys. Chem. **38** (2019) 405-440

[4] F.-Q. Chen, N. Kono, R. Suzuki, T. Furukawa, H. Tanuma, P. Ferrari, T. Azuma, H. Shiromaru, V. Zhaunerchyk, K. Hansen, Radiative cooling of cationic carbon clusters, C_N^+, $N = 8, 10, 13 - 16$, Phys. Chem. Chem. Phys.} {\bf 21} (2019) 1587-1596

Author: Prof. HANSEN, Klavs (Tianjin University)

Presenter: Prof. HANSEN, Klavs (Tianjin University)

Session Classification: Contributed talks

Track Classification: CC02: ISM and Astrochemistry