ESR #5 Molecule formation through PAH fragmentation in the gas phase
Host Institute: Leiden Observatory, Leiden University

Host Country: The Netherlands

Start date: No later than summer of 2017.

The candidate will be employed at Leiden Observatory and will aim for a doctorate degree under the supervision of profs. Xander Tielens and Harold Linnartz.

Project description

Interstellar PAHs are extensively processed by UV photons in the ISM, weeding out less stable species. Indeed, the IR spectral signatures of PAHs show variations from source to source and within sources. These variations are thought to reflect changes in the composition of the interstellar PAH family driven by the local physical conditions. In particular, photochemistry may dominate the composition of the interstellar PAH family and be an important source of small hydrocarbon radicals and chains and other carbon compounds in photon-dissociation regions and in the diffuse ISM. The graduate student will characterize photo-fragmentation reactions of a large set of structurally different PAHs upon excitation by VUV and UV/VIS radiation from dye lasers, synchrotrons (DESIRS/SOLEIL) and free electron lasers (FELIX/FELICE/FLARE) using a mobile ion trap time-of-flight mass spectrometer. The photo-fragmentation channels – typically sequential H-atom, H2, C2, or C2H2 loss – ultimately result in a bare carbon skeleton, which may isomerize to form e.g. fullerenes and fullerene cages, as well as fragment to smaller and smaller graphene-like structures. The chemical steps are backed-up by theoretical simulations and the astronomical implications will be assessed. In particular, identified complex molecule formation paths will be implemented in astrochemical models. Secondments are planned to Universität zu Köln (Germany) for 4 months to acquire experience in the use of ion traps and to Hiden Analytical (UK) for 2 months for mass spectrometry training.

Group description The interstellar medium group at Leiden Observatory (http://ism.strw.leidenuniv.nl/research.html#moluni) studies the origin and evolution of the organic inventory of space and combines that with studies on the structure and evolution of the interstellar medium of galaxies. In addition, we have an active program on the coagulation of dust particles, to aggregates, pebbles, and larger bodies in the general ISM and in protoplanetary disks. The scheduled experiments take place in the Sackler Laboratory for Astrophysics (www.laboratory-astrophysics.eu). Leiden Observatory is actively involved in a large number of astronomical observing facilities, both ground and space based. The astrochemistry groups have a very active research program concerning Polycyclic Aromatic Hydrocarbon molecules in Space, analysis and interpretation of space-based infrared data, simulations of inter- and circumstellar conditions, controlled growth of pure or mixed interstellar ice analogs and simulation of chemical processes that occur in and on top of the ice.

Institute description Leiden University is a prominent research university in Europe, situated for decades in the top 100 of best Universities world wide, with approximately 17000 students and 4000 staff members. The University consists of 6 faculties, a School of education, and a campus in The Hague and focuses on the independent practice of research-oriented work in an academic setting. Leiden Observatory is one of the largest academic observatories in the world and ranked in the top 5. It has a very active research programme with 25 scientific staff, 45 post-docs, 80 graduate

students and 40 master students. Bachelor and master courses are ETCS courses. See also www.strw.leidenuniv.nl.

Ideal candidate The position is open to students with the equivalent of a masters degree in physics or physical chemistry. The successful student should have hands-on experience in experimental physics preferably in one or more of the following areas: UHV vacuum technology, (Nd:YAG-dye) lasers, mass spectrometry, specifically TOF and ion trap, experimental control and data-acquisition schemes. A sound background in molecular physics is required, as is a good working knowledge in English. Certain restrictions on nationality apply related to mobility requirements from the Marie Curie Program.

Working conditions and benefits The appointment is for 4 years and is anticipated to end with a Ph. D. degree at the Leiden University. The initial appointment is for one year and your performance will be evaluated after 6 months. After a positive evaluation, the appointment will be extended for the full period. The monthly gross salary of the first two years will be in accordance with the EC Marie Sklodowska-Curie rates and will be paid by the host organization. The third and fourth year follow the Dutch CAO for PhD students. The salary will be subjected to tax according to applicable national regulations.