COST P9 short term scientific mission – report

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The stay in Innsbruck involved the installation of a He-nanodroplet source to the existing three sector field mass spectrometer. The nanodroplet source was modified such that the nanodroplet beam passes an effusive beam of nucleobases (uracil) evaporated from an oven. The oven had to be placed sufficiently far away from the nanodroplet beam, to reduce the thermal contact. The vapour was guided from the oven to the crossing region by a copper tube. An additional LN_2 cooled heat-shield ensured proper operation of the nanodroplet source.
Ìn the next step it will be investigated how uracil molecules, picked up by He-nanodroplets, will rapidly cool down inside the droplet. To this end, the nanodroplet beam will be crossed with a low-energy electron beam (<100 eV). A multiple sector-field mass-spectrometer will then be used to investigate cluster ionization and decay by studying mass distributions and kinetic energy releases.

The investigation of single vibrationally cold nucleobases as well as cold clusters of nucleobases is an extension of ongoing research within the COST P9 network:
In Groningen, until now mainly the interaction of (vibrationally excited) DNA building blocks with keV ions was studied. The Innsbruck research dealt with similar systems and their interaction with low energy electrons. In an ongoing (COST supported) collaboration between Groningen and the group of Bernd Huber in Caen, the ion induced ionisation and fragmentation of (vibrationally hot) clusters of nucleobases is studied.
The possibility of producing cold single nucleobases will help to answer the question in how far the results obtained on evaporated molecules are representative for biological systems at room temperature – can the thermal excitation be neglected?
Another question deals with cold biomolecular clusters: can Watson-Crick pairs still form in liquid He?

First experiments using the modified setup are planned for the early summer.