

Andrew Ellis: short-term scientific mission to University of Innsbruck

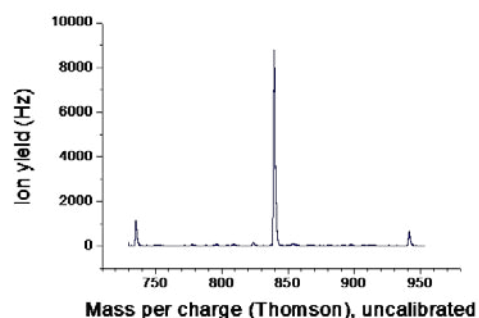
COST STSM ref. number: CM0601-4215

Dates: 18/04/09 to 02/05/09 (actual dates of visit the same as the originally proposed dates)

The STSM was intended to initiate collaboration between Paul Scheier's group at the University of Innsbruck and Andrew Ellis's group at the University of Leicester. Both groups have recently developed complementary research projects focused on studying molecules and clusters in helium nanodroplets. The Innsbruck group has developed world-leading expertise in the study of dissociative electron attachment and have recently applied this to molecules in helium nanodroplets for the first time. A particular aim of the STSM was to explore the impact of low energy electrons on molecules of biological relevance when embedded in helium nanodroplets.

The primary focus of the two-week visit was the analysis of a variety of recently recorded data. These were as follows:

1. *Mass spectra of L-serine in helium droplets.* Mass spectra of L-serine show a strong dependence on the size of the helium droplet. In particular, a small helium droplet doped with a number of L-serine molecules shows a very pronounced magic number peak for the protonated octamer ion, whereas substantially larger droplets do not. This was interpreted in terms of a special stability for the protonated octamer which is not manifested in larger helium droplets because of rapid cooling, but in smaller droplets the cooling is less efficient. This work shows, for the first time, that the protonated L-serine octamer has a particularly high stability. This conclusion is significant given recent speculation that the L-serine octamer may have played a role in the origin of homochirality in key classes of biological molecules in the evolution of the first living systems. A representative mass spectrum is shown above and a manuscript has been drafted which describes this work.



2. *Anionic clusters of amino acids.* The effect of low energy electrons on small clusters of three amino acids, namely glycine, alanine and L-serine, has been explored. Several new observations of electron-induced reaction have been made, along with the identification of cluster anions with a variety of helium atoms attached.

3. *Carboxylic acid clusters in helium nanodroplets.* Positive ions produced from electron impact on these clusters have been investigated in Leicester as well as Innsbruck. In addition, the anions produced at low electron energies have been explored in Innsbruck. A joint publication is in production as a result of this work.

Publications and future collaboration

Three publications based on the above studies are expected from this STSM, and indeed are largely written, with the first to be submitted relatively soon. Possible follow-on experiments were discussed as part of the STSM and it is hoped that a second visit to Innsbruck can be arranged for summer 2009 to continue with the collaboration.