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Lisbon, 03 March 2008

REFERENCE: Short Term Scientific Mission, COST CM0601
Beneficiary: Paulo LIMA-O-VIEIRA, New University of Lisbon (PT)
Host: Paul Scheier, Institut für Ionenphysik
Period: from 09/02/2008 to 16/02/2008 Place: Innsbruck (AU)
Reference code: COST-STSM-CM0601-03413

SCIENTIFIC REPORT

PURPOSE OF VISIT

The proposed visit to the University of Innsbruck was focused on the experimental studies of electron interactions with clusters of amino acids (precursor molecules to amino acids such as ammonia and acetic acid) embedded in superfluid helium droplets. Reaction products formed upon electron impact ionisation or electron attachment were studied by means of mass spectrometry.

DESCRIPTION OF THE WORK CARRIED OUT DURING THE VISIT

During this STSM, it was possible to analyse some of the data previously collected by the Innsbruck group on dissociative electron attachment to musk ketone and other derivatives. During this stay was also possible to look at the mechanism of picking up gas phase molecules such as CO₂ and to get the preliminary results on biomolecules (such as acetic acid) into superfluid He droplets to form complex targets at ultra-low temperatures (0.37 K), which are then probed by means of mass spectrometry through electron interactions. For both, positive and negative ion formation, mass spectra have been recorded showing that clusters are easily formed by embedding single molecules in the helium droplets.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

The main results obtained were:

- Positive ionisation from electronically excited He* at energies higher than 20 eV and via formation of He⁺ at electron energies above 24.6eV; for this latter particular case, charge hopping to the centre of the droplet and exothermic charge transfer to the embedded molecule are subsequent steps of the ionisation process;
- Free electron attachment to clusters of molecules embedded in superfluid He droplets has been studied exhibiting several additional resonances in the attachment cross section compared to the free electron attachment to bare molecules. We observe stabilisation of the transient negative parent ions which are otherwise unstable for bare neutral molecules, and also a relative increase of the yield of the fragment anions at high electron energies compared to previous studies with isolated molecules.

FUTURE COLLABORATION WITH HOST INSTITUTION

This research programme will continue through the exchange of post-graduate students . This research will be developed to study (i) other molecular targets with the main goal of aminoacids and larger molecues (ii) other relevant molecular targets that may also play an important role from the biological point of view such as acetic acid.

PROJECTED PUBLICATIONS/ARTICLES RESULTING OR TO RESULT FROM THE GRANT

At least one joint publication is to be submitted shortly. Other publications will emerge during the next months as soon as we compile and analyse the relavant data recorded.

Paulo Limao-Vieira