The effects of ion-molecule reactions on organics on a comet

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**Description:** The Rosetta mission was an ESA (European Space Agency) mission to orbit and deploy a lander onto the surface of comet 67P/Churyumov-Gerasimenko. During the Philae landing and operations on the comet, the Open University’s Ptolemy instrument successfully acquired mass spectra and returned the data to Earth. Initial evaluation of the Ptolemy mass spectrum indicates the presence of water, carbon-dioxide and a high abundance of organics from the cometary surface. A consequence of the non-nominal landing was that the organics were not separated by gas-chromatography as intended but detected as a mixture of compounds to form a complicated mass spectrum.

During the landing sequence organics was also detected by the COSAC mass spectrometer on Philae whilst the ROSINA mass spectrometer was also making simultaneous measurements of the coma on the Rosetta spacecraft some 30 km from the surface. However, comparisons between these data sets are complicated by ion-molecule reactions occurring in the Ptolemy ion trap mass spectrometer as well as the FED (Field Effect Device) ion source – unique features of the Ptolemy instrument. Guided by the results from the landing and theoretical modelling, the project will analyse individual compounds to understand the effects of ion-molecule reactions on individual species. These will be analysed on the Ptolemy qualification model in the lab and can then be used to simulate the complex mixture of cometary organics. An understanding of the ion-molecule reactions and comparison of the various mass spectrometer data sets will provide further information of the organics on the comet surface. In addition is possible that the organics are themselves products of ion-molecule reactions produced from the pristine comet material and interaction with sunlight. Thus providing insight to the chemistry occurring on the comet.

**Qualifications required:** A first class or upper second class degree.