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The use of energetic heavy ions to produce nanometre resolution molecular images in ambient conditions

Molecular imaging with a resolution approaching the size of an individual protein without sample preparation or the use of a vacuum chamber will be possible by 2025. The technology necessary to accomplish this analysis already exists in the form of swift heavy ion accelerators used in hadron therapy and ion beam irradiation facilities. Powerful magnets, electrostatic lenses or simple collimating capillaries can be used to confine the heavy ion beam in air to spot sizes of tens of nanometres. Impinging heavy ions focussed in this manner induce molecular desorption at the surface of a sample to produce a molecular ion signal that can be analysed at atmospheric pressure using a differentially-pumped mass spectrometer.

The development of this imaging technology in parallel with recent advancements in ambient mass spectrometry technologies that are being developed, for example, for use during surgical procedures will offer an unprecedented understanding of the underlying molecular distribution at a subcellular level.

Applications of this new technique are foreseen in the fields of biology, medicine, forensics, cultural heritage and materials science.

Summary

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