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Abstract for an Invited Paper  
for the DAMOP15 Meeting of  
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### **Towards attosecond measurement in molecules and at surfaces<sup>1</sup>**

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- We will present a number of experimental approaches that are being developed at Imperial College to make attosecond timescale measurements of electronic dynamics in suddenly photoionized molecules and at surfaces. A brief overview will be given of some of the unanswered questions in ultrafast electron and hole dynamics in molecules and solids. These questions include the existence of electronic charge migration in molecules and how this process might couple to nuclear motion even on the few femtosecond timescale. How the timescale of photoemission from a surface may differ from that of an isolated atom, e.g. due to electron transport phenomena associated with the distance from the surface of the emitting atom and the electron dispersion relation, is also an open question.
- The measurement techniques we are currently developing to answer these questions are HHG spectroscopy, attosecond pump-probe photoelectron/photoion studies, and attosecond pump-probe transient absorption as well as attosecond streaking for measuring surface emission. We will present recent advances in generating two synchronized isolated attosecond pulses at different colours for pump-probe measurements (at 20 eV and 90 eV respectively). Results on generation of isolated attosecond pulses at 300 eV and higher photon energy using a few-cycle 1800 nm OPG source will be presented. The use of these resources for making pump-probe measurements will be discussed.

Finally we will present the results of streaking measurement of photoemission wavepackets from two types of surface ( $\text{WO}_3$  and a evaporated Au film) that show a temporal broadening of  $\sim 100$  as compared to atomic streaks that is consistent with the electron mean free path in these materials.

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