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Capturing ion induced electron dynamics in 2D materials

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Ion bombardment is a powerful tool for tailoring the properties of materials, inducing structural modifications and enabling nanoscale analysis. However, understanding the fundamental response of matter to ion impact requires access to ultrafast processes that unfold on timescales ranging from femtoseconds to picoseconds. Although laser-based pump–probe techniques have long provided insight into electronic excitations and relaxation pathways, equivalent experiments involving ions have thus far been limited due to the absence of sufficiently short and precisely timed ion pulses.
To conduct such an experiment, ultra-short and precisely timed ion pulses are just as indispensable as certain requirements for the sample system. In our study, we use polymer-free, suspended graphene membranes consisting of three superimposed layers spanning circular openings with a diameter of 150 µm. Further studies will use other 2D materials, such as MoS_2, with vastly different electrical properties, as a transmission-style experiment requires minimal thickness.

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