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## Electrocrystallisation of water/ice nano-droplets

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Elucidating water-to-ice freezing, especially in “No Man’s Land” ( $150\text{ K} < T < 235\text{ K}$ ) is fundamentally important (e.g., predicting upper-troposphere cirrus-cloud formation) –and elusive. An oft-neglected aspect of tropospheric ice-crystallite formation lies in inevitably-present electric fields’ role. Exploring nucleation in No Man’s Land is technically demanding, owing to rapid nucleation rates, to mention nothing of difficulties of applying relevant electric fields thereto. Here, we tackle these intriguing open questions, via non-equilibrium molecular-dynamics simulation of sub-microsecond formation of ice Ic nano-crystallites from aggressively-quenched supercooled water nano-droplets in the gas phase, in external static electric fields. We explore droplets’ nano-confined geometries and the entropic-ordering agent of external electric fields as a means of realising cubic-ice formation. We also discuss stability of ice and water nano-droplets in a variety of electric fields.

### Significance statement

Realising cubic ice is very challenging experimentally, as is probing of No Man’s Land. Here, we show a reproducible way of obtaining cubic ice, as well as probing the intriguing vagaries of field-mediated entropic ordering.

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