

Researchers' theory predicts the lifespan of liquid droplets

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Researchers at the University of Warwick have developed a new understanding of how liquids evaporate into vapour, pointing to potential applications for engineering design.

The team, supported by the Engineering and Physical Sciences Research Council (EPSRC) and the Leverhulme Trust, say they have developed a theory which means they can predict the lifespan of liquid droplets.

Being able to do so could open up new opportunities in both natural and industrial settings where the lifespan of droplets will impact on the behaviour and efficiency of processes.

Current theories state that the droplet's diameter-squared decreases in proportion to time (classical law); however, this period only accounts for a small portion of the drop's evolution. As the diameter approaches the unobservable micro- and nano-scale, molecular dynamics have to be used as virtual experiments and these show a crossover to a new behaviour, with the diameter now reducing in proportion to time (nano-scale law).

Research at Warwick has shown that this behaviour occurs due to complex physics in the vapour flow, which can result in jumps in temperature across just a few molecules as large as 40 degrees. This behaviour is counter-intuitive to our daily experiences (on the macroscale), where we are used to temperatures changing relatively gradually, but must be accounted for to accurately predict the final

stages of an evaporating drop's life.

Prof Duncan Lockerby from the School of Engineering at the University of Warwick said: "The main achievement here is the theory's ability to quickly predict the drop's lifetime and create a modelling framework that maintains accuracy from typical engineering scales down to cutting-edge nanoscale applications."

Dr. James Sprittles from the Mathematics Institute at the University of Warwick said: "It is fascinating that intuition based on everyday observations are a hindrance when attempting to understand nanoscale flows, so that, as in this research, one has to lean on theory to enlighten us."

Provided by Engineering and Physical Sciences Research Council

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