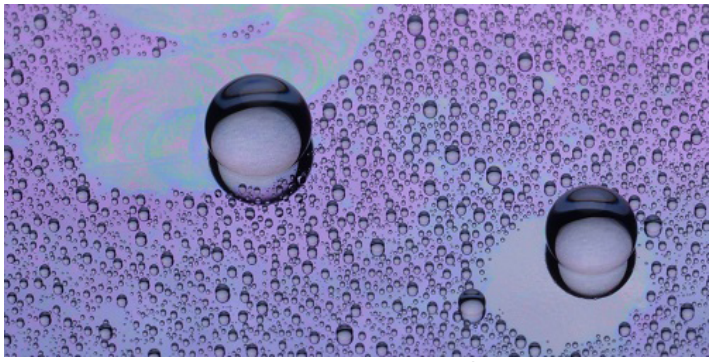
Droplets Dance After They Merge

Water droplets can exhibit complex collective motions when they condense on a thin oil film.

By **Ryan Wilkinson**

Active-matter systems have constituents that consume energy in order to move or to exert forces. From swarms of bacteria to flocks of birds, many such systems exist in nature. In the lab, creating an active-matter system typically requires an intricate setup and constituents that can convert light, biochemical energy, or chemical energy into motion. Now Dan Daniel at the King Abdullah University of Science and Technology, Saudi Arabia, and his colleagues have uncovered a physical system that lacks both requirements [**1**]. They say that such a system could have important heat-transfer and water-harvesting applications.

The researchers applied a thin film of oil to a silicon surface patterned with micrometer-sized pillars, which they then cooled to 4 °C. In under a minute, water droplets began condensing on the film, with neighboring droplets moving toward one another before coalescing. Around 25 minutes later, the largest droplets started to dance, moving like a serpent in a series of self-avoiding sinuous curves before twirling in circles. The motion then continually switched between serpentine and circular for about 4 hours until the droplets stopped dancing.



Credit: F. Wardani/King Abdullah University of Science and Technology

Video 1: The large water droplets that form on an oil-covered surface can display both serpentine and circular motions. **Credit: M. Lin *et al.*** [**1**]

Daniel and his colleagues showed that their results were generalizable by observing similar droplet dynamics for hot water vapor condensing on an oil-covered nanotextured surface. Calculations performed by the researchers indicate that the energy released by a large droplet continuously merging with much smaller droplets is sufficient to drive the motion. Redistribution of oil caused by the dancing droplets induces the switching between serpentine and circular dynamics.

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REFERENCES

1. M. Lin *et al.*, "Emergent collective motion of self-propelled condensate droplets," **Phys. Rev. Lett. 132, 058203 (2024).**