

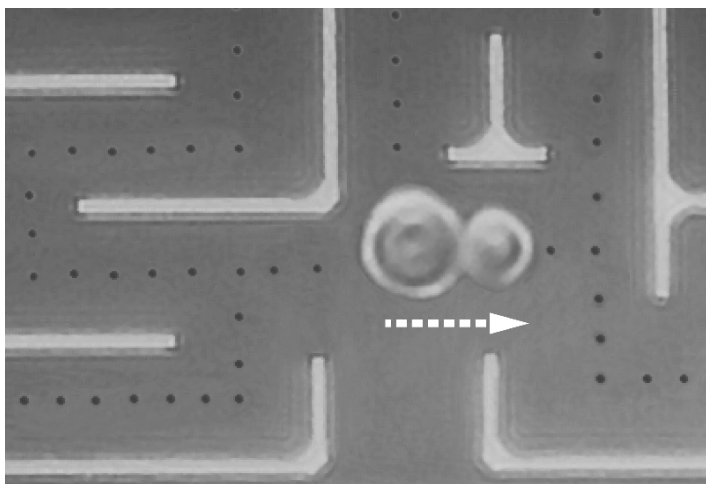
“Pac-Man” Mechanism for Moving Tiny Droplets

Movies of a new technique for moving tiny droplets across a surface are reminiscent of an iconic maze-based video game.

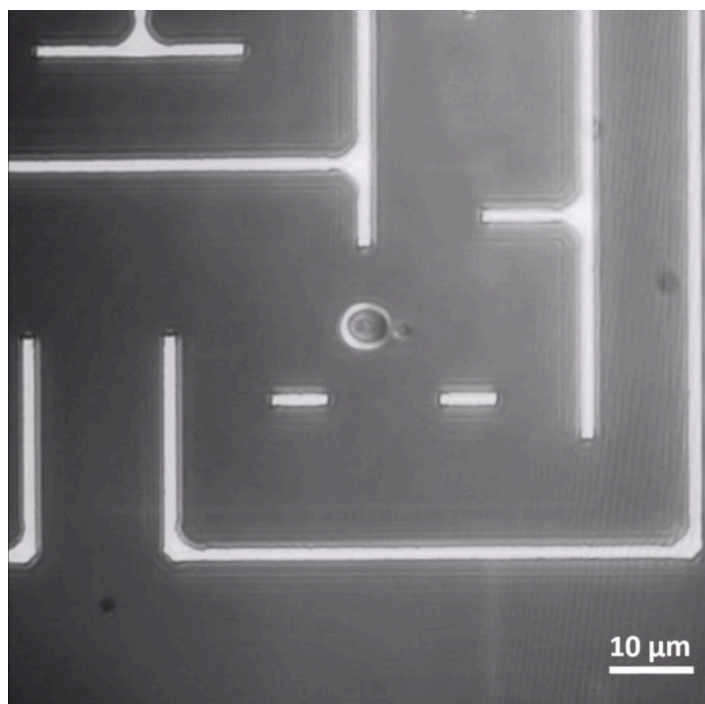
By **David Ehrenstein**

In a popular 1980s video game, Pac-Man is a yellow disk that moves around a maze eating small dots. Similarly, a new technique makes a micrometer-sized liquid droplet move over a surface by “eating” smaller droplets placed in its path [1]. Dimos Poulidakos and his colleagues at the Swiss Federal Institute of Technology (ETH) in Zurich developed the mechanism to perform tasks in future lab-on-chip technologies. The system allows an experimenter to move a droplet in any direction on a surface that is open to the air and to use the droplet to pick up and move small, solid particles.

Each step in the droplet’s motion is induced by a merger with a



Chomp chomp. A Pac-Man-like liquid droplet moves by merging with a smaller droplet placed in front of it. Researchers can repeat this process to maneuver the micrometer-sized droplet through a maze and pick up solid particles along the way (see videos below).
Credit: J. Chaaban/ETH Zurich



A liquid droplet is guided through a maze.
Credit: J. Chaaban *et al.* [1]

second, smaller droplet placed in front of the main droplet by a small, precisely controlled nozzle. Such a merger occurs in about 100 milliseconds, after which the researchers can plop down a new secondary droplet in order keep the main “Pac-Man” droplet moving forward. Overall, the droplet doesn’t grow because it continuously loses liquid to evaporation, and the liquid is replenished at the same rate by the secondary droplets.



Besides maneuvering, the droplet can also perform tasks such as cleaning off a “dirty” surface covered with tiny particles or carrying a small solid “package” from one place to another. The droplet system might prove useful in bringing together ingredients for material fabrication or chemical reactions in a lab-on-a-chip device.

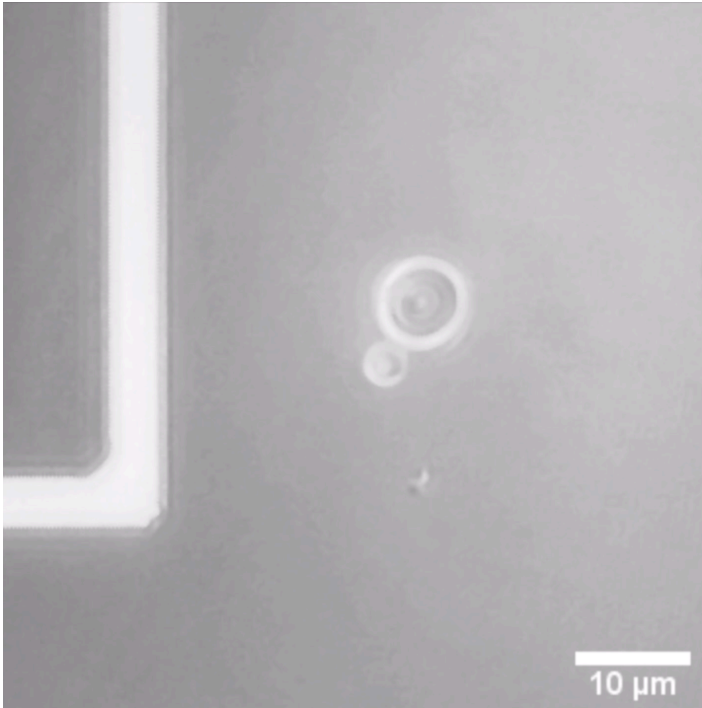
David Ehrenstein is the Focus Editor for *Physics*.

REFERENCES

1. J. Chaaban *et al.*, “Omnidirectional droplet propulsion on surfaces with a Pac-Man coalescence mechanism,” *Phys. Rev. Fluids* **5**, 123602 (2020).

A liquid droplet picks up particles from a glass surface.

Credit: J. Chaaban *et al.* [1]



A liquid droplet transports a solid particle from one place to another. (In the video, “self-propelled droplets” refers to the Pac-Man mechanism.)

Credit: J. Chaaban *et al.* [1]