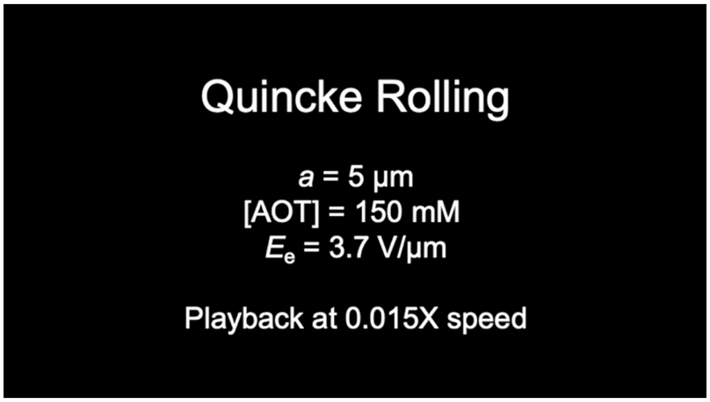
Tiny Spheres Do the Electric Jiggle

Some micrometer-sized spheres undergo unexpected oscillations when placed in an electric field—a motion that engineers could exploit to make tiny robots.

By **Sophia Chen**

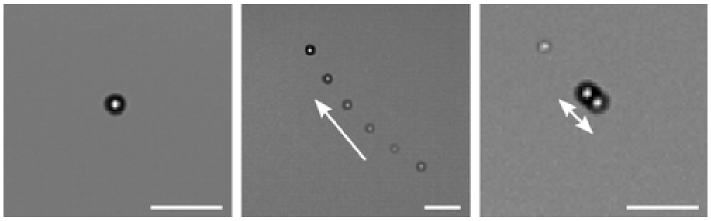
Engineers have begun designing micrometer-sized particles that move and change shape without external propulsion. One technique for creating this so-called "active matter" is to subject dielectric particles in a fluid to a strong electric field, which researchers have shown causes the particles to spontaneously rotate. The dynamics of this system, however, are poorly understood. Now Kyle Bishop of Columbia University, New York, and colleagues experimentally observe that dielectric particles suspended in a liquid above a flat electrode will oscillate back and forth in a manner unexplained by commonly used models [**1**].



Video 1: Researchers show that micrometer-diameter dielectric spheres can oscillate back and forth when subjected to an electric field.
Credit: Z. Zhang *et al.* [**1**]

In their experiment, the team dispersed plastic spheres with diameters from 1 to 50 μm in a weakly conducting hydrocarbon solution that contained a surfactant. They sandwiched some of the solution between two pieces of conducting glass and watched what happened with a microscope.

The team observed that some spheres began rolling like a golf ball when the electric field exceeded some value, which depended on the fluid's viscosity and the polarizability of the sphere. This motion came from a nonsymmetric charge distribution over the sphere. Increasing the field further, the team observed that other spheres started oscillating back and forth like pendula.



Credit: Z. Zhang *et al.* [**1**]

Modeling the system, the researchers predict that the oscillations start when the so-called boundary layer around a sphere—a layer of liquid where the balance of ions and their motion differs from the bulk—is as thick as the radius of the sphere. For larger spheres, this layer becomes too thin for the spheres to enable oscillations.

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REFERENCES

1. Z. Zhang *et al.*, "Quincke oscillations of colloids at planar electrodes," **Phys. Rev. Lett. 126, 258001 (2021).**