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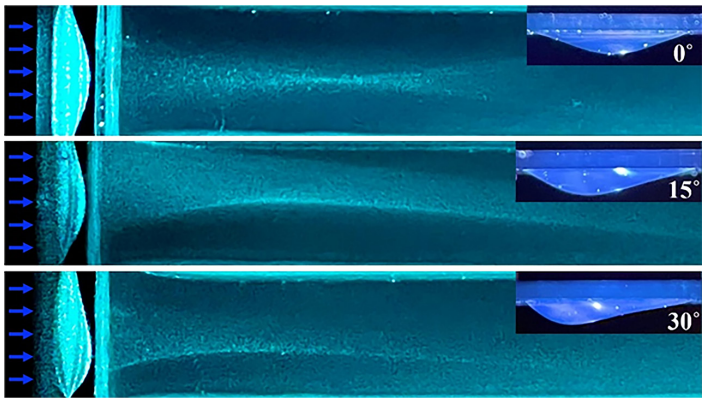
Changing the shape of uncured ultraviolet resin droplets allows simple generation and control of non-diffracting, self-accelerating beams.



Non-diffracting, self-accelerating beams are used in remote spectroscopy, microparticle manipulation, and biomedical imaging. Generating self-accelerating beams often requires expensive or complicated optical devices, but Zhang et al. demonstrated a simple method.

The authors' technique involves pendant droplets made of ultraviolet resin. The natural curvature of the hanging droplets, which is governed by the interplay between surface tension and gravity, can be used to generate self-accelerating beams. These non-diffracting beams of light bend into large angles, which makes them superior to conventional Airy beams.

"Our findings greatly reduce the complexity of the synthesizing process of nonparaxial, self-accelerating beams," said author Qiyue Zhang. "Our method is based on an everyday natural phenomenon – the formation of liquid droplets. The idea is very simple yet beautiful, and the experiment can be done even by a high school student like me with proper training."

When the resin droplets are uncured, the team could modify their shape in real time, allowing dynamic control of the beams. Changing the tilt of the surface on which the droplets were hanging caused the light beam to propagate along different curved trajectories.

This method could readily replace existing devices used to generate self-accelerating beams in the optical field. The researchers also believe it could be applied beyond optics to shape other types of waves, such as microfluidic jets and surface acoustic waves.

The light beams in this work were one-dimensional. Next, the authors will use this droplet-based method to generate two-dimensional self-accelerating beams, which will entail superimposing two orthogonally arranged droplet lenses.

Source: "Generation of nonparaxial self-accelerating beams using pendant droplets," Qiyue Zhang, Peng Zhang, Huizhong Xu, Weining Man, and Zhigang Chen, *APL Photonics* (2023). The article can be accessed at https://doi.org/10.1063/5.0133410.