

BACK SCATTER

Grape balls of fire!

Creating plasmas from sliced grapes in a common microwave oven has been a fun parlor trick and YouTube mainstay for more than a decade. (See, for example, <https://www.youtube.com/watch?v=wA4uZGRENas>.) In practice, as long as the grapes—or any other similarly sized pair of ion-rich aqueous spheres—are in contact, cutting is unnecessary. Isolated spheres, however, never spark. Traditional explanations for the plasma formation almost invariably invoke a mechanism, such as surface plasmon resonances, that relies on high surface conductivity, but new research is exploring bulk optical mechanisms such as Mie resonances. At 2.45 GHz, the typical frequency of consumer microwave ovens, water has an index of refraction above 8 and relatively small absorption. That makes each

grape, with a diameter of about 1.5 cm, the right size, composition, and shape for resonant scattering and produces a concentrated electric field at their point of contact.

A Canadian collaboration between Aaron Slepko at Trent University and Pablo Bianucci at Concordia University is investigating the Mie-resonance hypothesis by comparing experimental observations with simulations of lossy whispering-gallery modes in aqueous dielectric spheres and dimers at microwave frequencies. Such passive subwavelength focusing of microwave radiation may find applications in biomedicine, omnidirectional antenna design, and tip-enhanced near-field microscopy. (Image submitted by Aaron Slepko and Hamza Khattak.)

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