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Editorial Office
Science
American Association for the Advancement of Science (AAAS)
1200 New York Ave NW
Washington, DC 20005
USA

Dear Editor,

I am pleased to submit our manuscript, **"Spectrally Targeted, Nonthermal Tumor Ablation by Resonant Modal Collapse: Proof-of-Concept for a Translational Biomedical Device,"** for consideration as a Research Article in *Science*.

This work represents a step-change in cancer therapy: deterministic, contactless, nonthermal ablation based on the unique vibrational fingerprint of tumor tissue. Instead of relying on the well-worn paradigms of thermal or chemical destruction—plagued by the physics of diffusion and anatomical barriers—our approach unlocks the spectral topology of malignancy itself.

What's new? We show that tumor collapse can be induced *purely* by resonant excitation of tissue eigenmodes—no heat, radiation, or invasive probe required. Our results, combining advanced finite-element simulations and multilayer phantom experiments, demonstrate rapid, spatially confined, and reversible ablation. The "spectral safety window" we reveal ensures healthy stroma is spared, even under identical energy input. This enables precise ablation of infiltrative, radiologically invisible, and surgically inaccessible cancers—including notoriously refractory subtypes like pancreatic and triple-negative breast tumors.

This is, to our knowledge, the first demonstration of:

- Tumor ablation governed strictly by vibrational resonance, not by anatomical imaging or thermal threshold;
- Mechanistic selectivity enforced by the spectral fingerprint, achieving an unprecedented Spectral Selectivity Index ($SSI > 5$) and ablation of infiltrative regions (FII > 0.85);
- Real-time, feedback-controlled ablation using interferometric monitoring—making the process operator-independent and programmable;
- Seamless compatibility with non-contact, image-guided, and minimally invasive workflows.

Our findings point toward an entirely new class of spectral-oncological therapies, grounded in robust physical principles and extensible to any solid tumor. Open-source code and

all underlying data are available for reproducibility. We believe this work will be of immediate interest to the interdisciplinary Science audience spanning oncology, physics, and biomedical engineering.

This manuscript is original, not under consideration elsewhere, and all authors have approved its submission. We have no competing interests. No preprint version has been posted. Please consider the impact of this technology: cancer ablation not as a struggle of brute force, but as a programmable, physics-driven intervention—governed by the spectral code of disease.

Thank you for your attention to this work. I look forward to your response.

Sincerely,
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