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Thermodynamic study of ultrafast laser-field emission at nanostructured cathodes

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Strong laser-field electron emission enhanced by nanostructures is a growing topic of study, owing to its ability to generate high brightness beams. Experiments have shown that the nanoblade structure, a wedge shape, notably outperforms nanotips in the peak fields achieved. These higher fields result in a brighter emission. In this paper we study the thermodynamics of the electron system restricted to a nanostructure. Thermal diffusion of deposited energy near the apex of the structure is dominated by the electronic distribution on the electron-phonon timescale. We show analytically through use of the temperature-squared heat equation that the nanoblade, owing to its larger opening angle and higher dimensionality, thermomechanically outperforms the nanotip.

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Footnotes

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Yes

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