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Plasmonic enhancement in perovskite solar cells: Optimized light absorption and efficiency via modified Ag nanobipyramids

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Abstract   Perovskite solar cells (PSCs), representing third-generation photovoltaic technology, show tremendous potential due to their high efficiencies. However, a primary challenge is enhancing light absorption without increasing the thickness of the active layer

(AL). This study introduces the integration of modified silver (Ag) nanobipyramids (NBPs), applied in CH3NH3PbI3-PSCs, and their light absorption enhancement efficiency was calculated using the finite element (FEM) method. We demonstrate that the plasmonic effects of modified Ag NBPs significantly enhance the Jsc23.01 mA/cm2 and power conversion efficiency (PCE) of the cells by 21.03 %. Further study shows that strategic variations in the depth, layers of Ag NBPs substantially boost light absorption. Finally, we discuss an optimization strategy for the arrangement of modified Ag NBPs within the AL. This research introduces a new concept for advancing light absorption enhancement and PCEs in PSCs, and explores its potential for boosting the performance of various other types of solar cells.

Keywords	**Author Keywords:** Perovskite solar cell (PSC); Ag NBPs; Local surface plasmon resonance (LSPR); Light absorption enhancement; Power conversion efficiency (PCE); Simulation
	Keywords Plus: ELECTRON-TRANSFER; NANOPARTICLES; LAYER; ARRAY; PERFORMANCE; SIMULATION; PROGRESS; DESIGN

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