A new electromagnetic theory is developed, which enables the efficiency calculation for solar cells with absorber layer much thinner than the typical wavelength of sun light.

**Significance and Impact**

The model allows design and optimization of new generations of solar cells with higher efficiency and less material consumption for cost-effective photovoltaics.

**Research Details**

- Emission leaving a solar cell is calculated using Fluctuation-Dissipation theorem by including all near-field optical effects.
- The balance between absorption and emission is used to calculate the solar cell efficiency.
- The theory is applied to an ultra-thin solar cell to demonstrate the effect of electromagnetic design on cell performance.