STEADY-STATE MEASUREMENTS OF NEAR-FIELD RADIATIVE HEAT TRANSFER BETWEEN ULTRA-FLAT THIN-FILM SiO₂ PLATES

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Abstract:
The total radiative heat transfer between two objects is limited by Planck’s radiation law. However, when the gap spacing between the two objects becomes smaller than the characteristic thermal wavelength, it is possible to greatly surpass this limit. The research goal this semester is to understand the theory behind this enhancement when two SiO₂ plates are separated by a nanosized gap and draw conclusions based upon theory.

Experimental Setup:

Theoretical Results:

200nm Vacuum Gap at Various Thin-Film Thicknesses:

100nm Vacuum Gap at Various Thin-Film Thicknesses:

The figures above are theoretical calculations based on fluctuational electrodynamics. They show the near-field radiative heat flux for a 200nm and 100nm vacuum gap at different SiO₂ thin-film thicknesses on the left and the enhancement factor over the blackbody limit on the right.

Applications:
• Solar Energy
• Thermophotovoltaics

Ongoing Work:
Continuing steps include moving on to the experimental phase of the experiment. Another possible route for the future is to gather the theoretical results of different thin-film materials such as Hafnium Oxide (HfO₂) and Gallium Oxide (Ga₂O₃) and conduct experiments with this material to further understand near-field radiative heat transfer.