

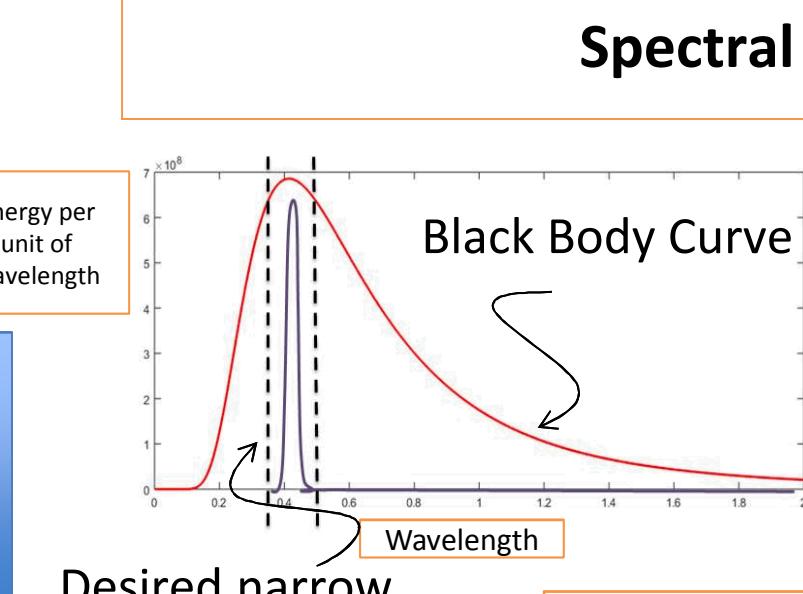
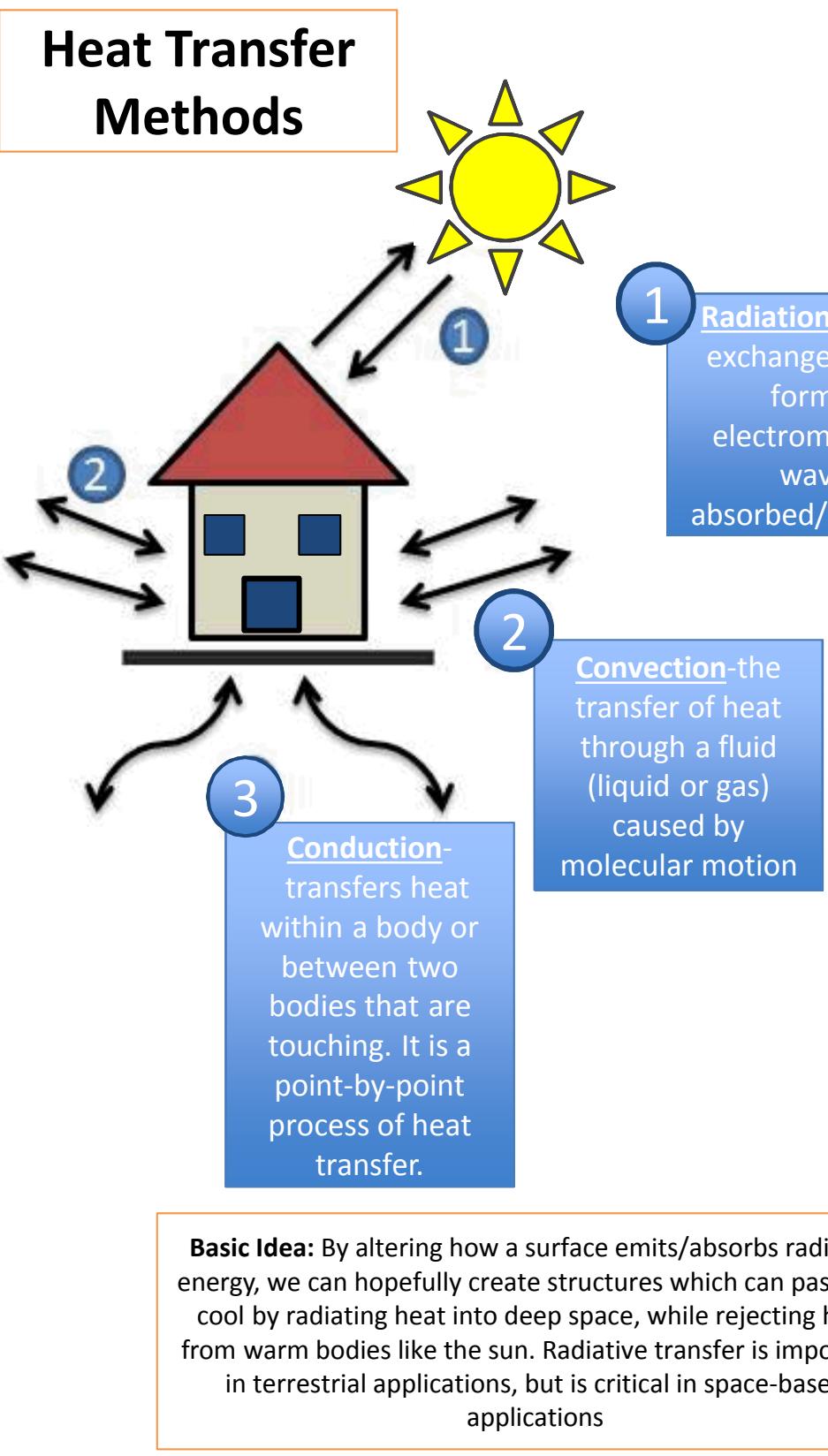
Controlling Thermal Emission for Cooling Applications

Abstract: The aim of this experiment is to see if structuring a surface can control both the directional and spectral emission from that surface. Micro-structured surfaces consisting of infrared waveguide arrays were fabricated and characterized using an HDR. Measured reflection maps demonstrate both directional and spectral control of emission.



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$$B_\lambda(T) = \frac{2 \hbar c^2}{\lambda^5} \frac{1}{e^{\frac{\hbar c}{\lambda k T}} - 1}$$

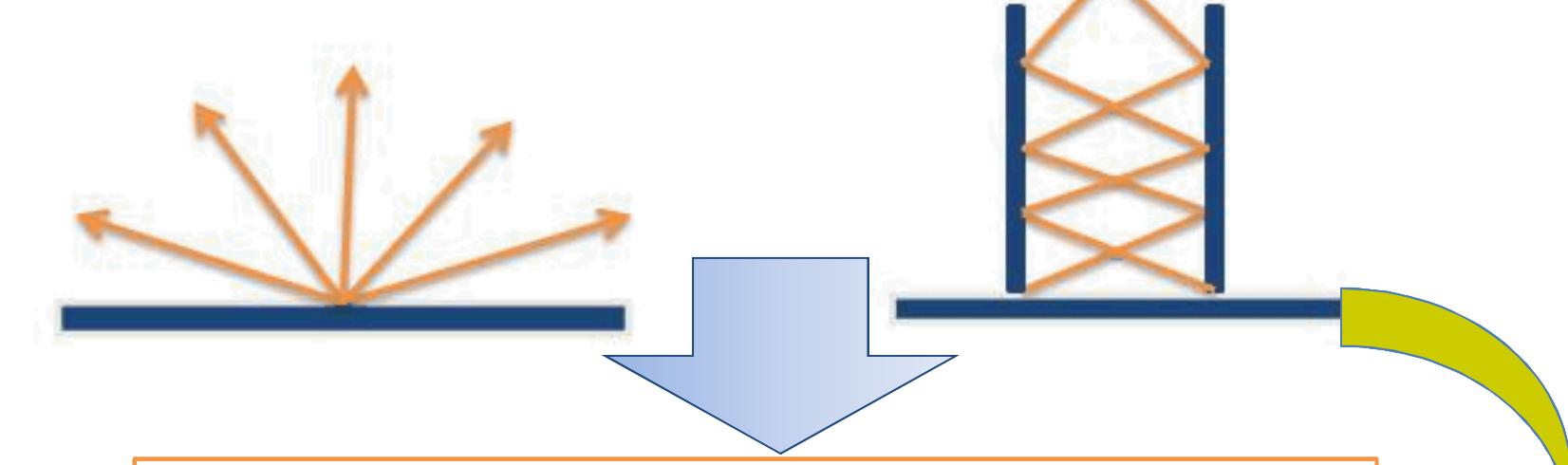
Plank's Law is used to explain the spectral-energy distribution of radiation emitted by a blackbody and in thermal equilibrium.

Desired narrow emission peak

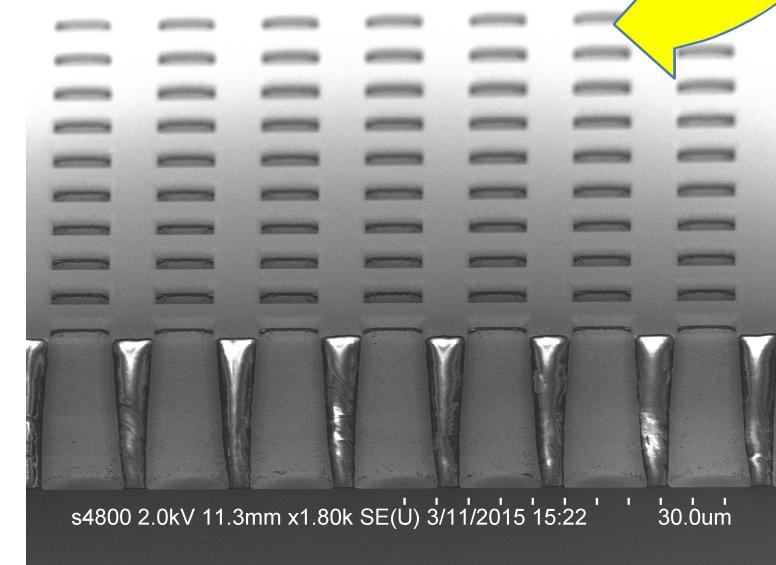
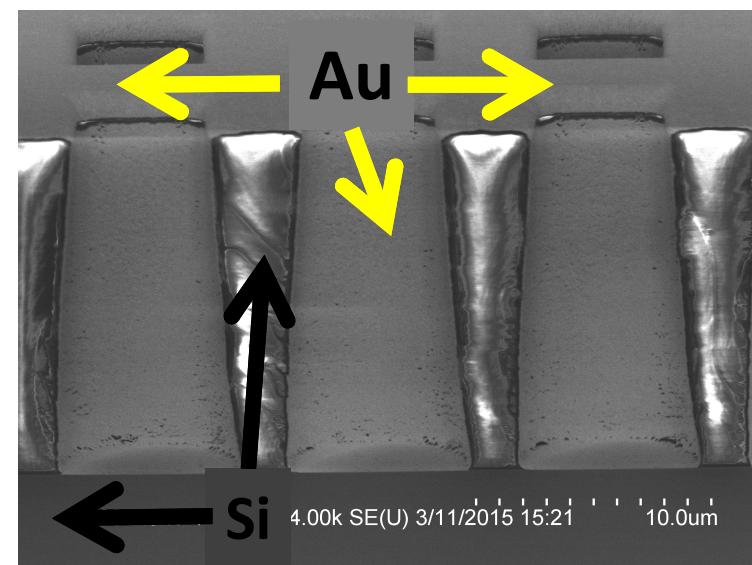
Emission from a planar surface: Planar surfaces emit/absorb at all angles.

Directional Control

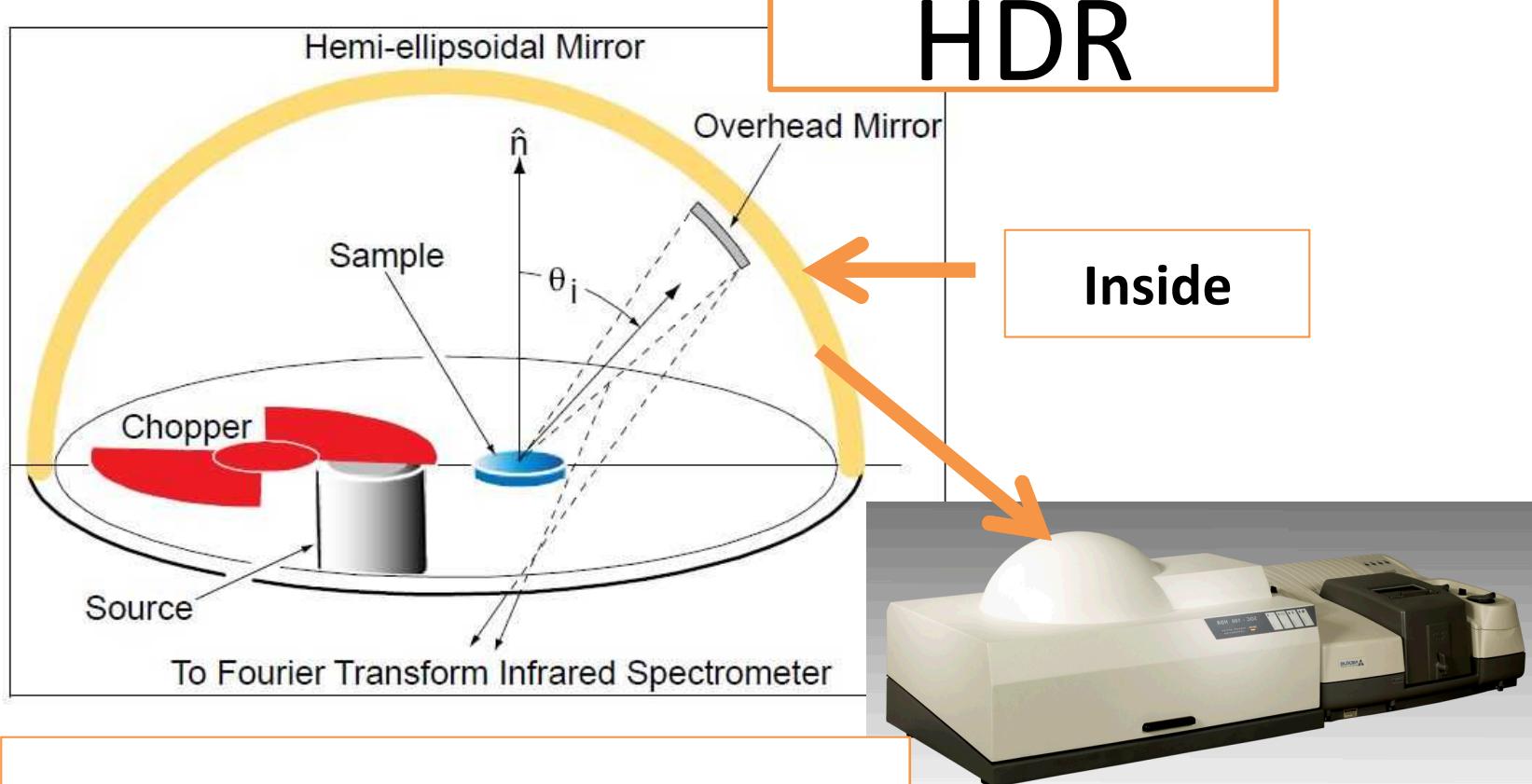
Emission from a structured surface: structured surfaces can restrict the allowable emission/absorption angles.



SEM Pictures of Structured Surfaces:



HDR



Hemispherical Directional Reflectometer (HDR) is an instrument for measuring the hemispherical directional spectral reflectance. Data is displayed in a reflection map (R-Map) plotting absorption strength as a function of angle and wavelength.

Sample
R-Maps

