Lecture 17: Absorption of solar radiation by matter

Beer Lambert law: $u(E,x) = u(E,0) \exp(-\alpha(E)x)$ $\alpha =$ linear absorption coefficient [m⁻¹]

Absorption of visible light causes electronic excitations. What happens to the extra electronic energy?

- Excited state relaxes via vibrational transitions \Rightarrow HEAT. Solar Thermal Conversion
- Excited charge moves \Rightarrow ELECTRICITY. **Solar Photovoltaic Conversion**
- Excited charge changes chemical potential energy \Rightarrow CHEMICAL ENERGY. Solar Fuels







Limit to solar conversion efficiency:

Carnot engine between T_{sun} and $T_p. \Rightarrow \eta$ = 95%. Not possible: radiative energy transfer from Sun to Earth is irreversible.

Ideal solar energy converter: Radiative energy transfer from Sun, coupled to heat engine

