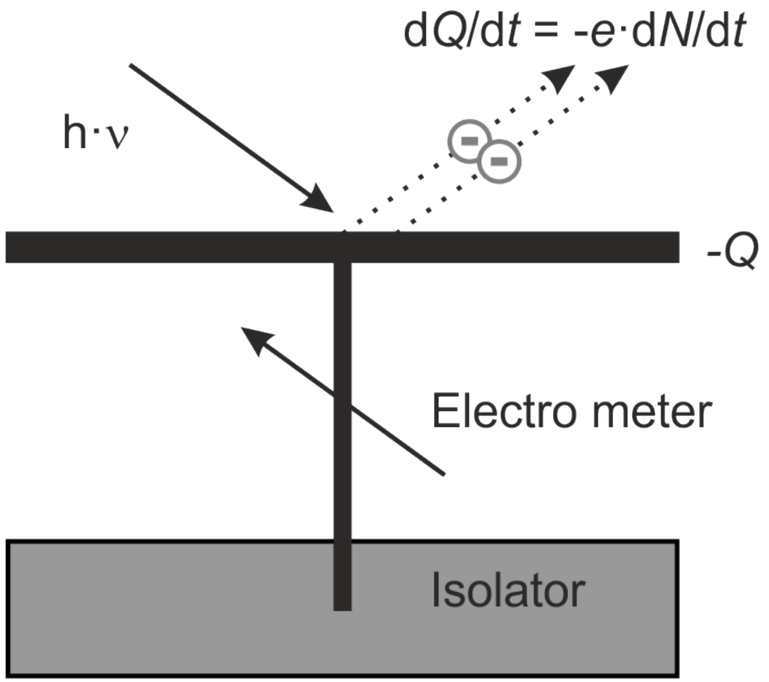
Experimental Physics 3 - Em-Waves,Optics, Quantum mechanics

Lecture 20

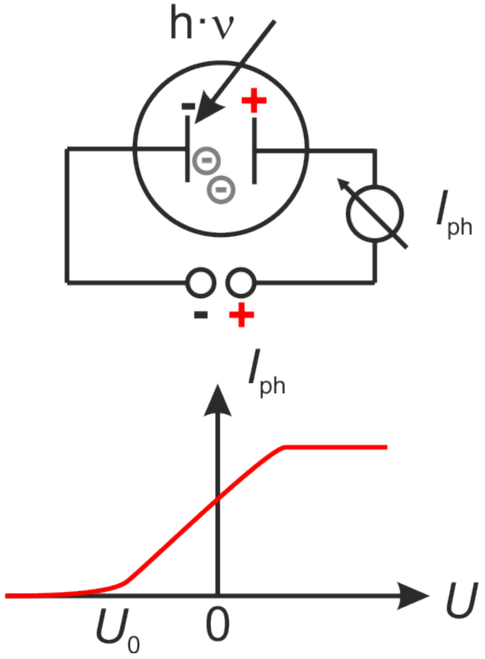
Prof. Dr. Frank Cichos
WS 2022/23

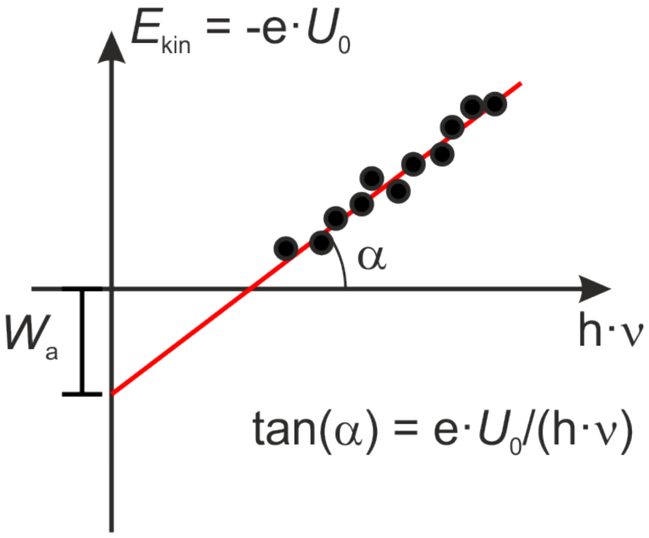
The Birth of Quantum Mechanics

Sneak preview from lecture 19 #1



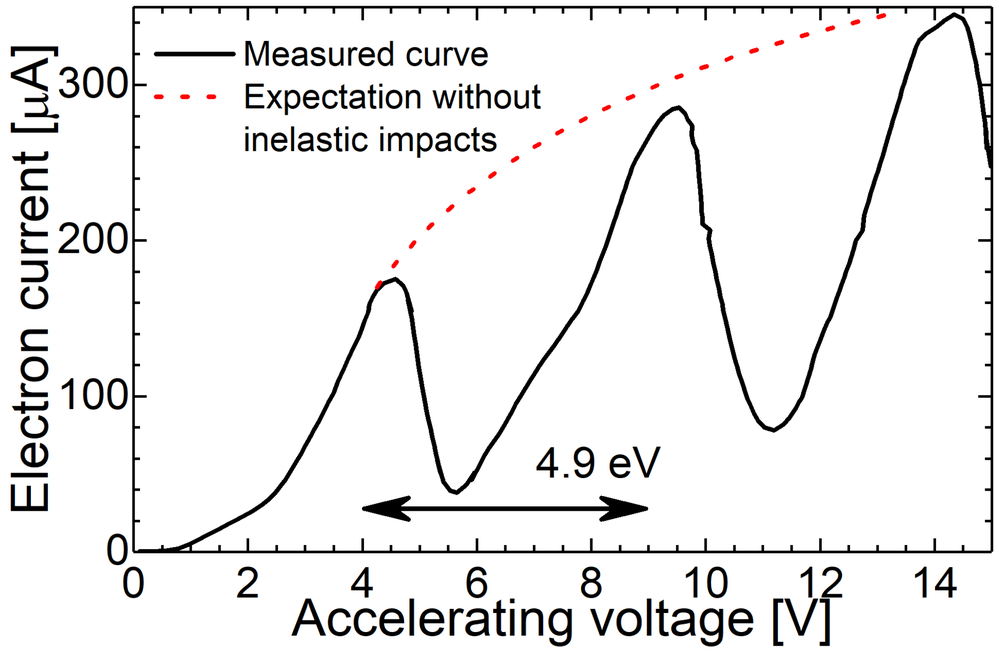
Hallwachs effect …





… and photoelectric effect

Sneak preview from lecture 19 #2

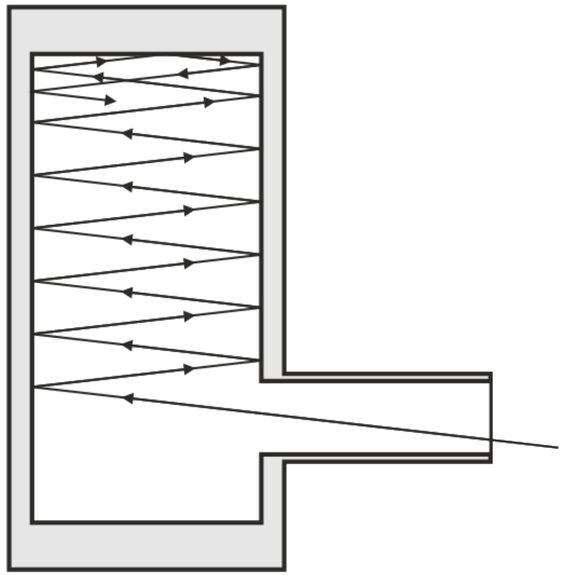


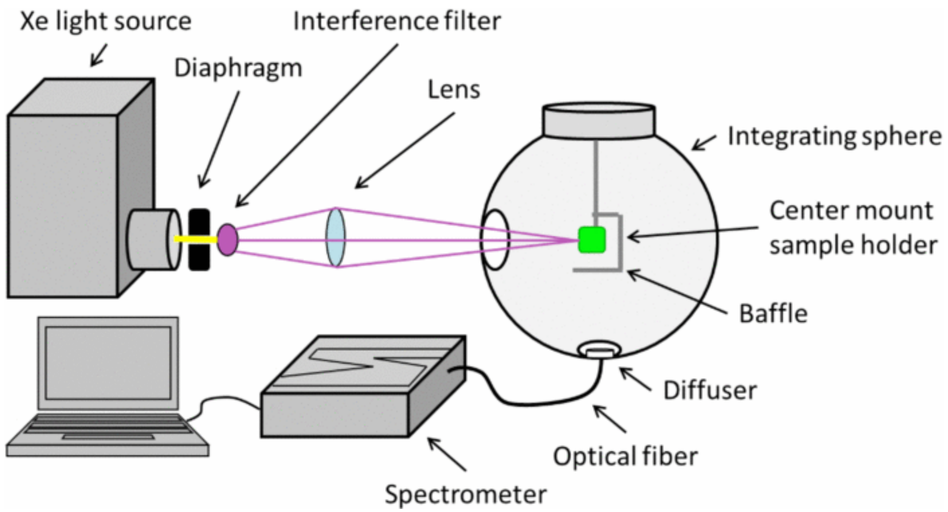
Franck-Hertz experiment

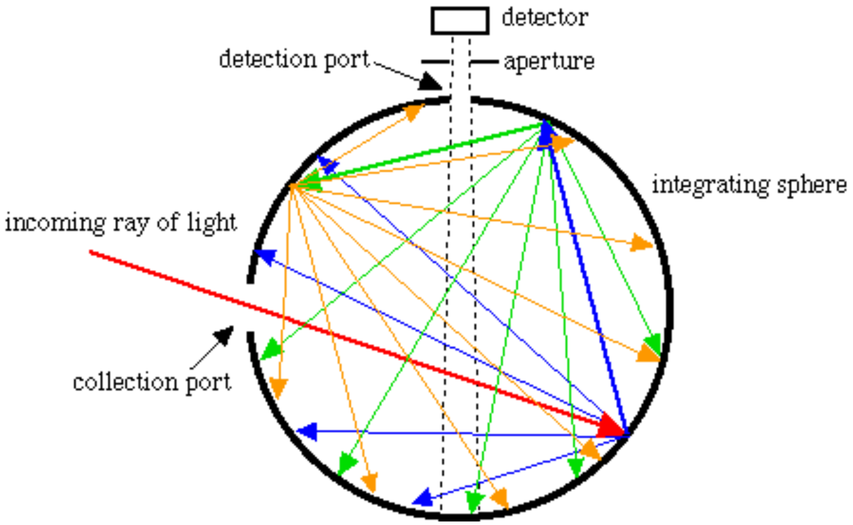
Reduction of electron current due to inelastic scattering.

https://lp.uni-goettingen.de/get/text/1612

Cavity radiator and integrating or Ulbricht sphere







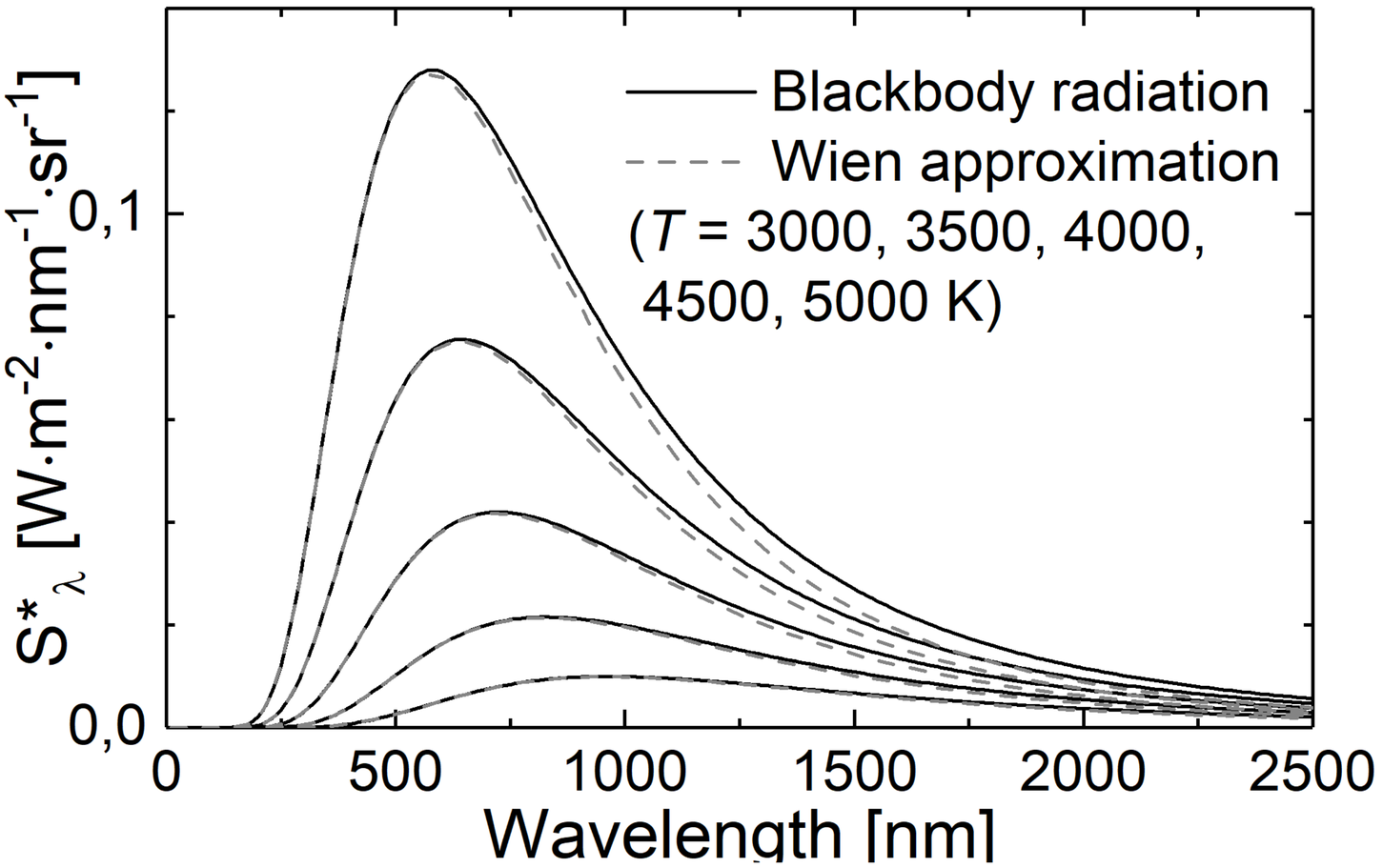
Integrating sphere or Ulbricht sphere

- Total radiant flux collection of
  - emitted and scattered by sample
  - entered through inlet port
- Direction-independent collection

Leyre et al., *Rev. Sci. Instrum.* **85** (2014) 123115

https://physics.stackexchange.com/questions/107152/why-must-an-integrating-sphere-be-a-sphere

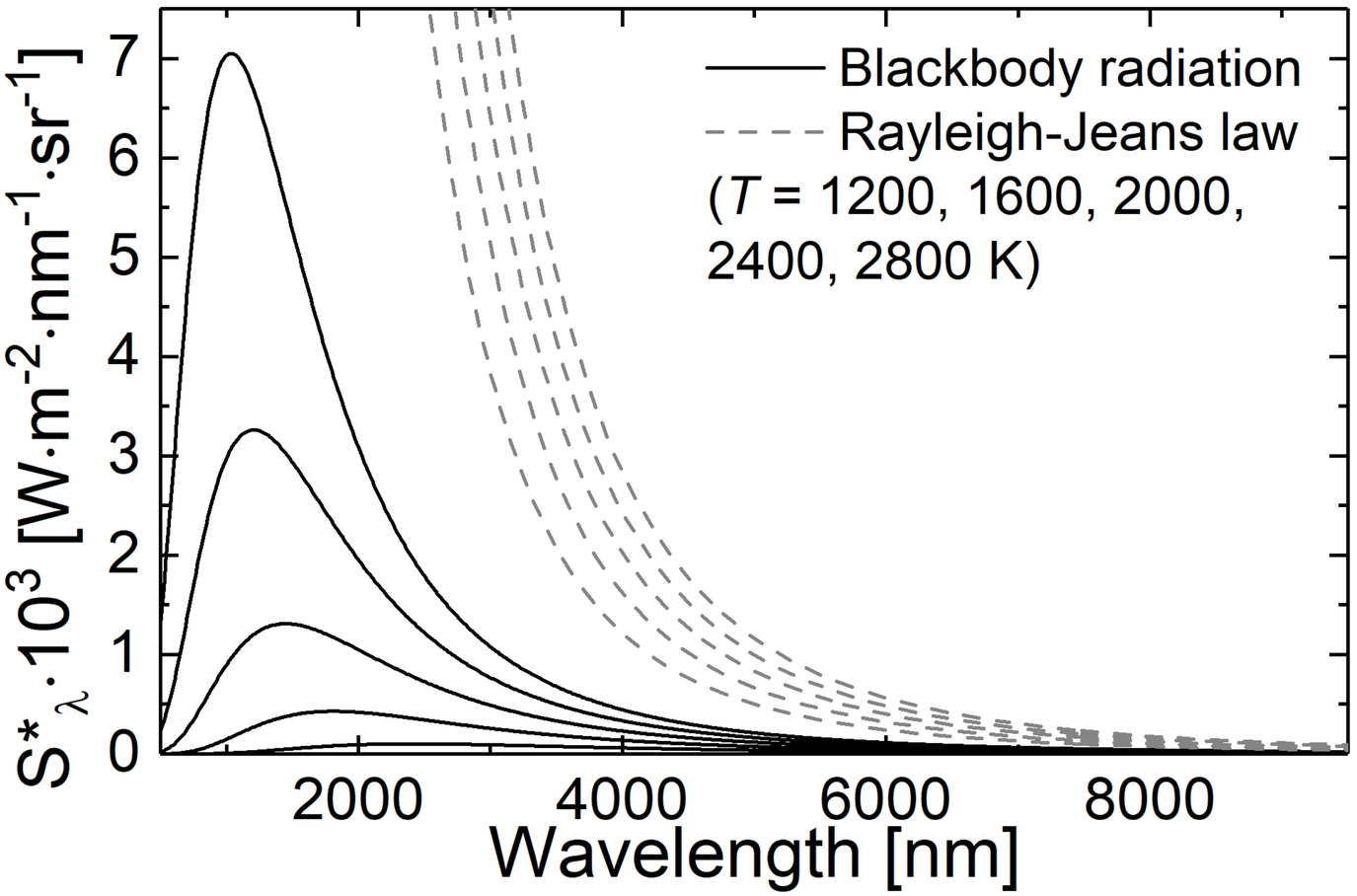
Wien’s displacement law or Wien approximation



Correct representation of
- short wavelength flank
- Peak wavelength

Underestimation of
- long wavelength flank

Rayleigh-Jeans law

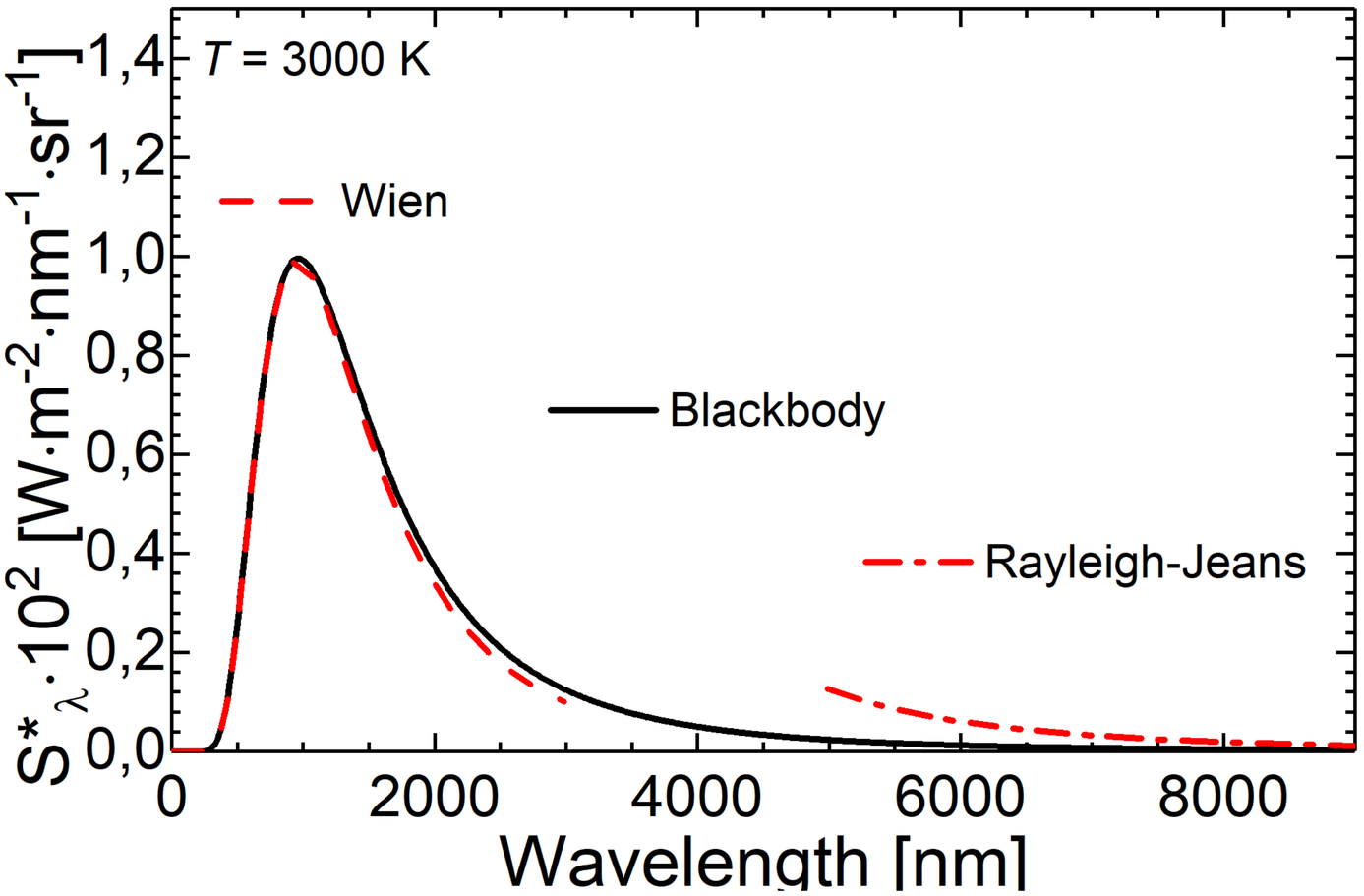


Correct representation of
- Long wavelength flank

Failed to describe
- Peak wavelength

Leads to ultraviolet catastrophe

The gap between Wien approximation and Rayleigh-Jeans law



How to close the gap between *Wien approximation* that correctly describes the short wavelength flank and the *Rayleigh-Jeans law* that sufficiently describes the long wavelength flank?

Planck’s law of radiation