

# Physics-L2 Electromagnetism

## Approximative program

Chap 1: Electrostatics

Chap 2: Magnetostatics

Chap 3: Time-dependent regime-Induction phenomena

Chap 4: Maxwell equations

**Chap 5: Dielectric media and applications**

Chap 6: Conducting media and applications

Chap 7: Magnetic media and applications

week	Magistral lectures
1	Electrostatics
2	Electrostatics
3	Electrostatics
4	Electrostatics
5	Magnetostatics
6	Magnetostatics
7	Induction
8	Induction
9	Maxwell equations
10	Maxwell equations
<b>11</b>	<b>Dielectric media</b>
<b>12</b>	<b>Dielectric / Metallic media</b>
13	Metallic Media
14	Magnetic media

# Classical Light-matter interaction in a dielectric medium-Spectroscopy-L2

## 1) Macroscopic description

- a. Bound charges – Dielectric Volumic Polarization
- b. Maxwell equations and wave equation
- c. Resolution: dispersion –absorbtion –optical index

## 2) Microscopic description: The Drude-Lorentz model

- a. Electron elastically bound to the nucleus: driven oscillator
- b. Expression of the volumic Polarization – dielectric succceptibility
- c. Frequency dependence of the dielectric functions

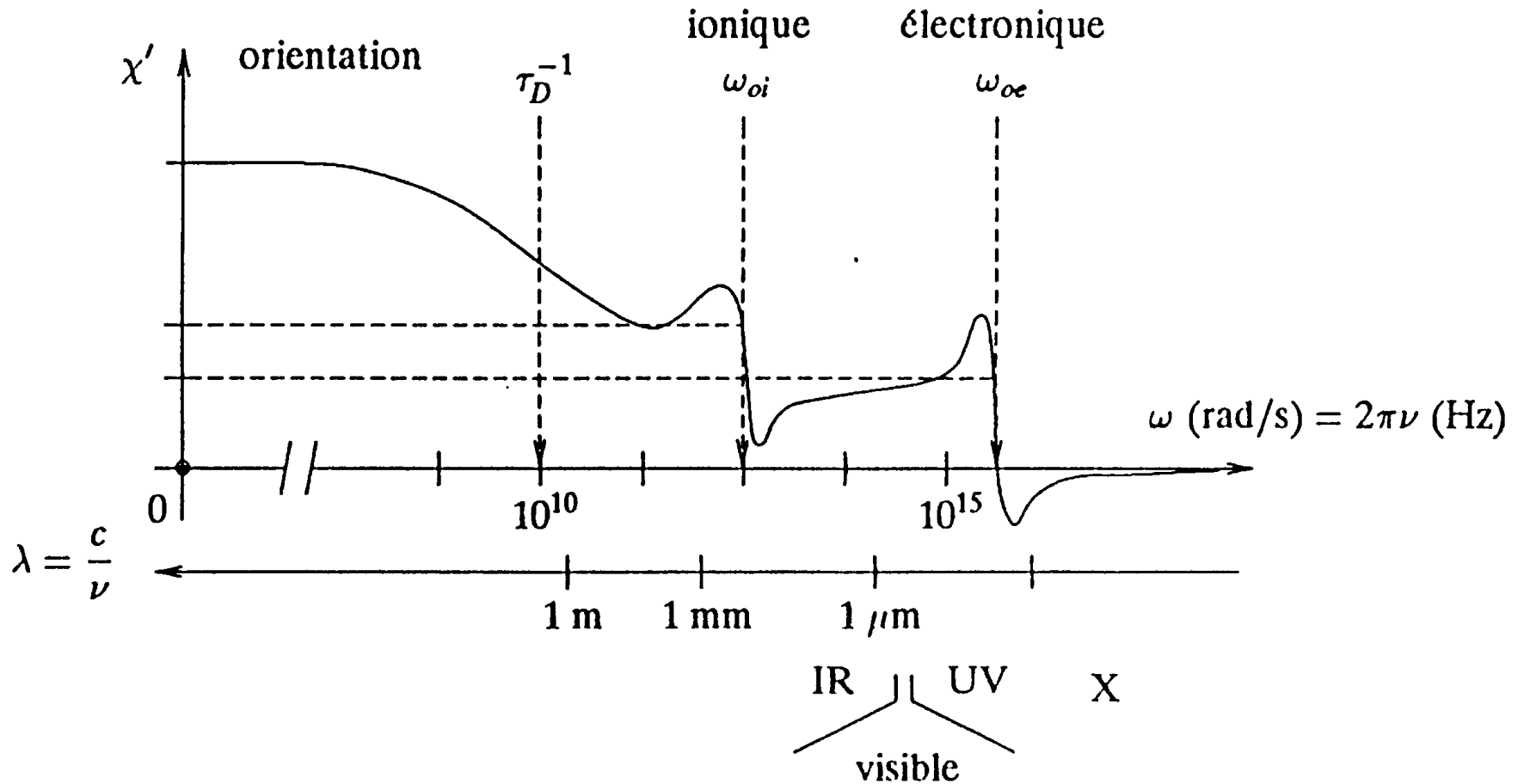
## 3) Applications in Spectroscopy

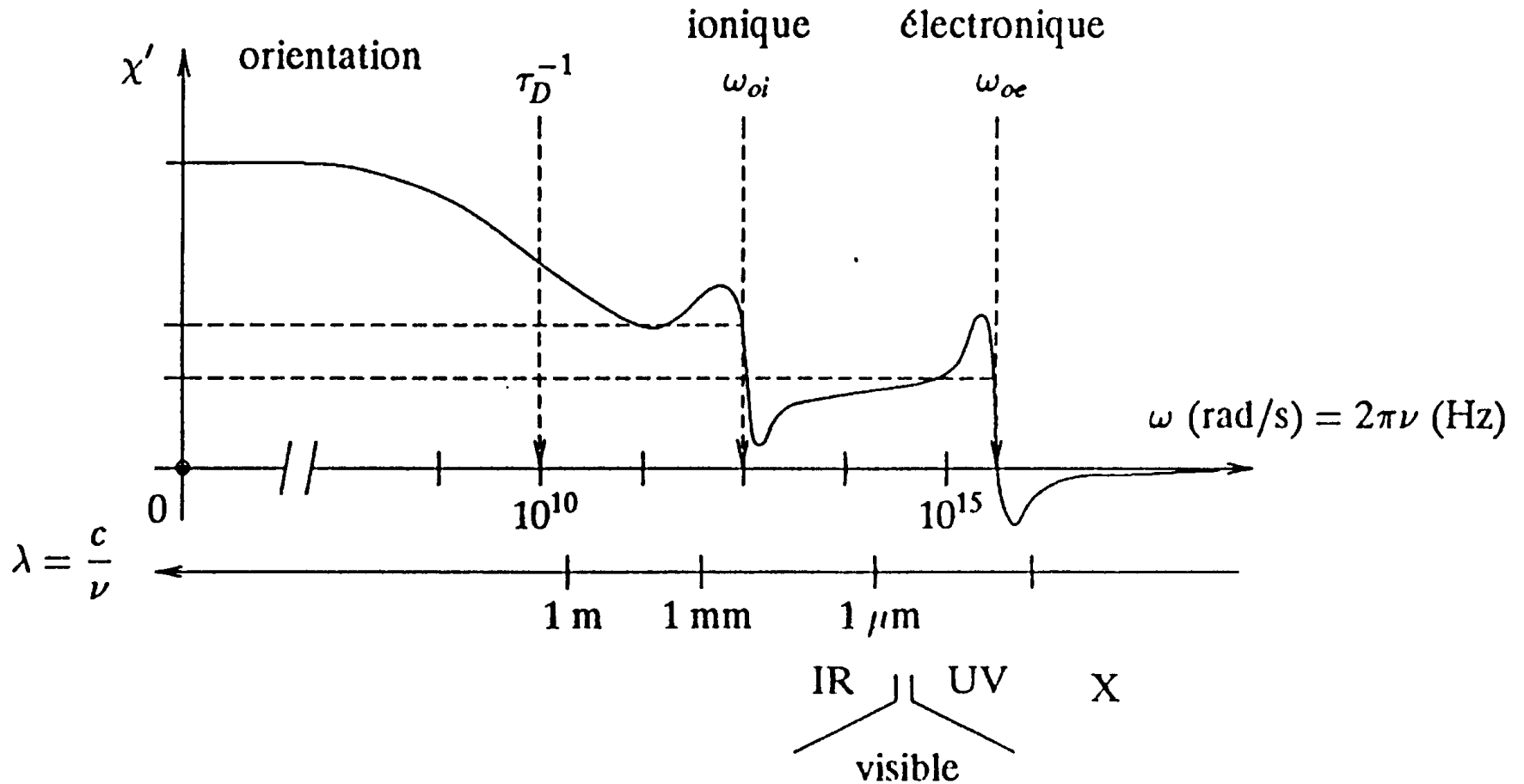
- a. The different order-size dipoles and total dispersion/absorption spectrum
- b. Beer-Lambert law
- c. Dispersion and Cauchy law
- d. Limit of model; quantum description

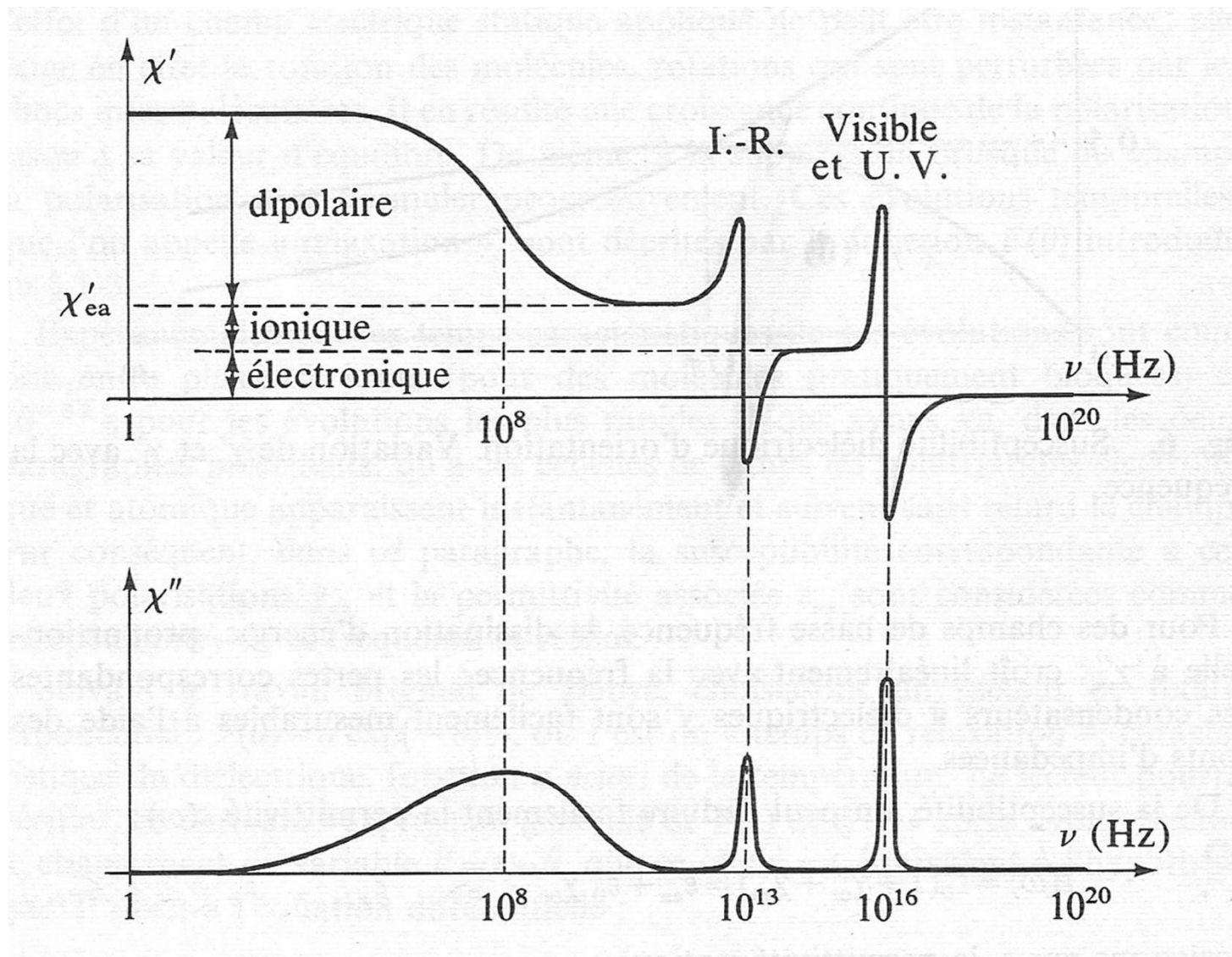
## 4) Propagation of E-M wave in an optical fiber or a waveguide (if time Tutorial)



Niels Bohr and Max Planck in 1930







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# Classical Light-matter interaction in a metallic medium-Conductivity-L2

## 1) Electric conductivity

- a) Resistance- Conductance-Ohm Law
- b) Conductivity Theory with static electric field: The Drude Model
- c) Effects of a Time-dependent electric field

## 2) Propagation of an electromagnetic field in a metallic medium

- a) Maxwell equations
- b) General Wave equation and dispersion relation

## 3) Reflection and transmission at the interface of a metallic medium

- a) Fresnel coefficients
- b) Influence of the frequency-Limit cases
  - b1) Low frequency and skin effect
  - b2) High frequency- Plasma domain
  - b3) General overview





