Lecture 2. Model of harmonic oscillator

Laser-Matter Interaction

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Approximations

- Light is classical electromagnetic wave
- Electric-dipole approximation
- Approximation of continuous media
- Linear optical approximation
- Isotropic medium
- No dissipations

What do we overlook accepting these approximations?
Let’s look around...

Why do we always observe larger refraction for light of shorter wavelength?

Why does refraction coefficient correlate with the mass density of media?

Conducting and non-conducting parts have different optical properties. Conductors are very often good mirrors. Why?
Let’s calculate $\varepsilon$

Assumption:
Medium is an ensemble of oscillators which emit or absorb light at fixed frequencies.

https://sites.ualberta.ca/~pogosyan/teaching/ASTRO_122/lect6/lecture6.html
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Non-dissipative approximation is not that useless

$n \neq 1, k = 0$

Take-home message

Harmonic oscillator is simple, but useful concept for qualitative modelling of light-matter interaction.

Although theories based on this very simple concept are very naive, such a model can be efficiently used for the development of intuitive understanding of the physics of light-matter interaction.
Non-dissipative approximation is not that useless

\[ n \neq 1, k = 0 \]