ENGINEERING PHYSICS

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Standing Modes in a Cavity

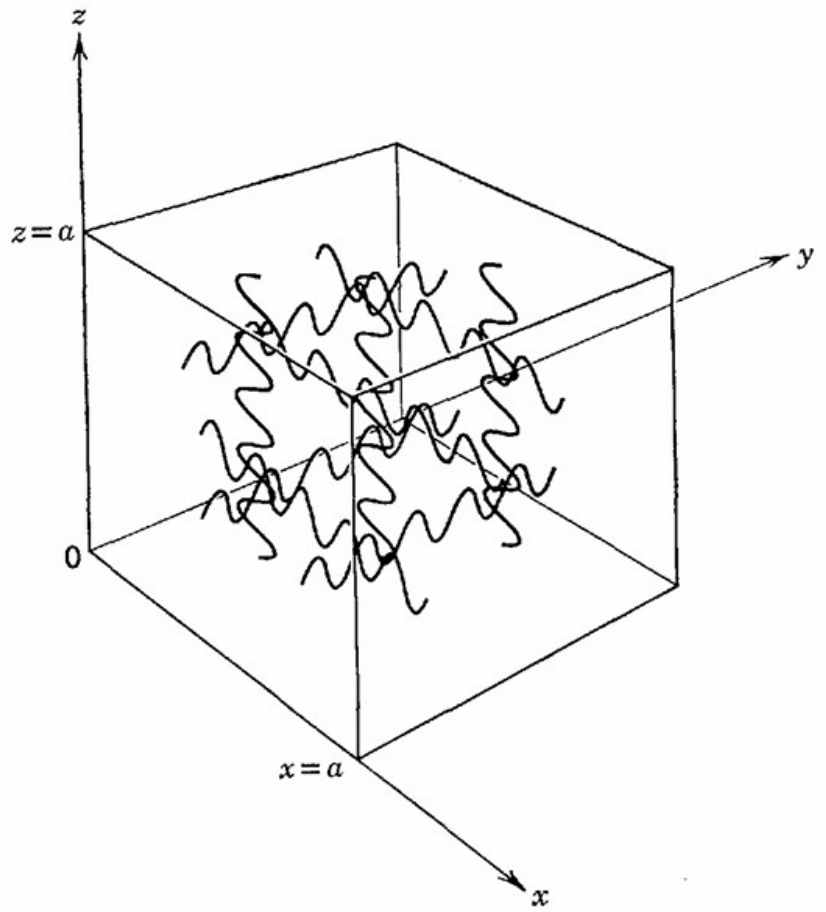
PES UNIVERSITY ONLINE

Class #4

- *Setting up the standing modes*
- *Calculation in 1D and 3D*
- *Mode counting*
- *Key points*

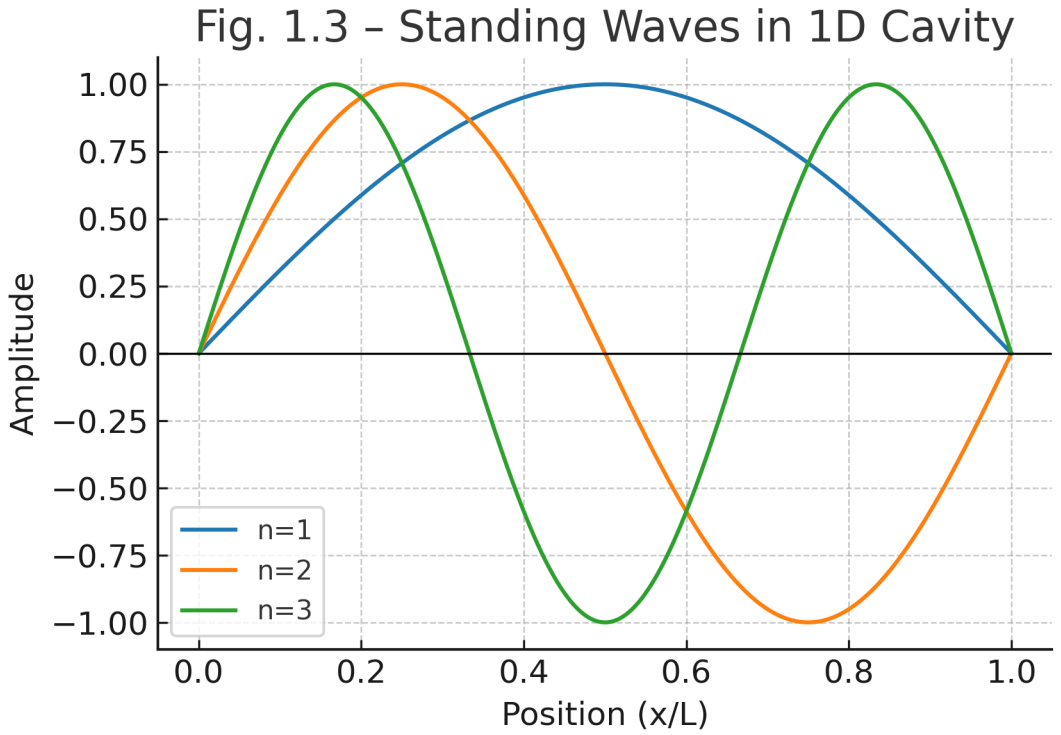
Setting up the standing modes

- Consider a cubic-shaped cavity with sides ‘a’
- Radiation inside a cavity with conducting walls forms standing EM waves.
- Boundary condition: Electric field vanishes at the walls → nodes at surfaces.



1D Cavity

- **Standing wave:**
- **Boundary condition:**
- **Allowed wavelengths**
- **Allowed frequencies:**



3D Cavity

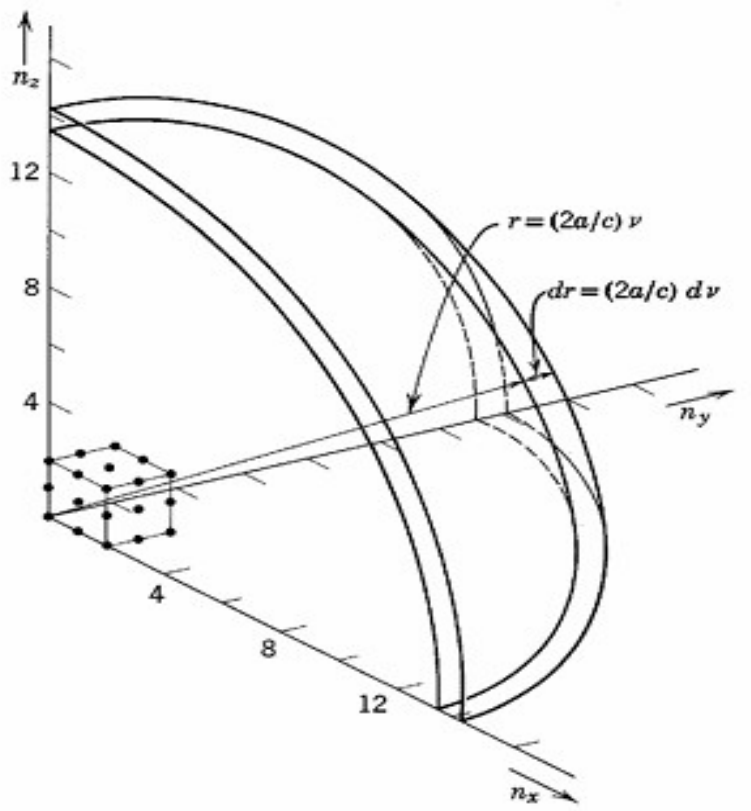
For cubic cavity (side a):

Mode Counting

Number of allowed modes between v and :

is cavity volume

Factor of 2 included for two polarizations



Key Points

- Modes are discrete due to boundary conditions.
- In 1D: equally spaced harmonics.
- In 3D: mode density grows as v^2.
- Forms basis of Rayleigh-Jeans and Planck's law.

THANK YOU

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