

Department of Physics

Condensed Matter Physics

Clarendon Laboratory, Parks Road, Oxford OX1 3PU



CONDENSED MATTER SPECIAL SEMINAR

Wednesday 14 September at 14.00

Simpkins Lee room, Beecroft Building

“Locally Propagating Electromagnetic Fields in a Cylindrical Cavity”

Dr Smain Amari

Royal Military College of Canada

In this talk, we revisit the old problem of solutions of Maxwell's equations in a lossless metallic cylindrical cavity. By focusing on waves propagating in the azimuthal direction, instead of the axial direction, it is found that solutions are arranged in different branches each of which starts from a root of the Bessel functions $J_1(x)$ (for TE modes) or $J_0(x)$ for (TM modes). Dispersion curves for the modes are given. The lowest branch, to which the dominant axial mode (TE₁₁) belongs, starts from a frequency that depends only on the height of the cavity and not its radius. This azimuthal cut-off frequency goes down to $f_c=0$ in the limit of an infinitely long cavity. The azimuthal propagation constant becomes purely imaginary below cut-off as expected. Furthermore, transverse components of waves in this branch become singular at the centre of the cavity for a range of values of the azimuthal propagation constant. Applications to the design of microwave hardware, mainly filtering structures, will be briefly discussed. Potential consequences of the existence of the singular fields will be discussed.

Host: Mustafa Bakr