The Gaussian Beam

Presentation for
Femtosecond and Attosecond Pulses (P-704)

A R Bathri Narayanan

UM DAE Centre for Excellence in Basic Sciences

November 25, 2024

Prelude

A paraxial wave is a plane wave travelling along the z direction (e^{-ikz}) with wavenumber $\frac{2\pi}{\lambda}$ for wavelength λ, modulated by a complex envelope A($\mathbf{r}$), being a slowly varying function of position. The complex amplitude is

$$U(\mathbf{r}) = A(\mathbf{r})e^{-ikz}$$

The envelope is taken to be approximately constant within a neighborhood of size λ, so that the wave locally maintains its plane- wave nature but exhibits wavefront normals that are paraxial rays.

The Gaussian Solution

Properties of the Gaussian Beam

Intensity

Intensity

Power

Power

Beam Width

Beam Divergence

Depth Focus

Phase

Wavefronts

Wavefronts

Characterisation of Gaussian Beam

To Summarize

Beam Quality

Beam Quality

Take-Home Messages

Thank You!!