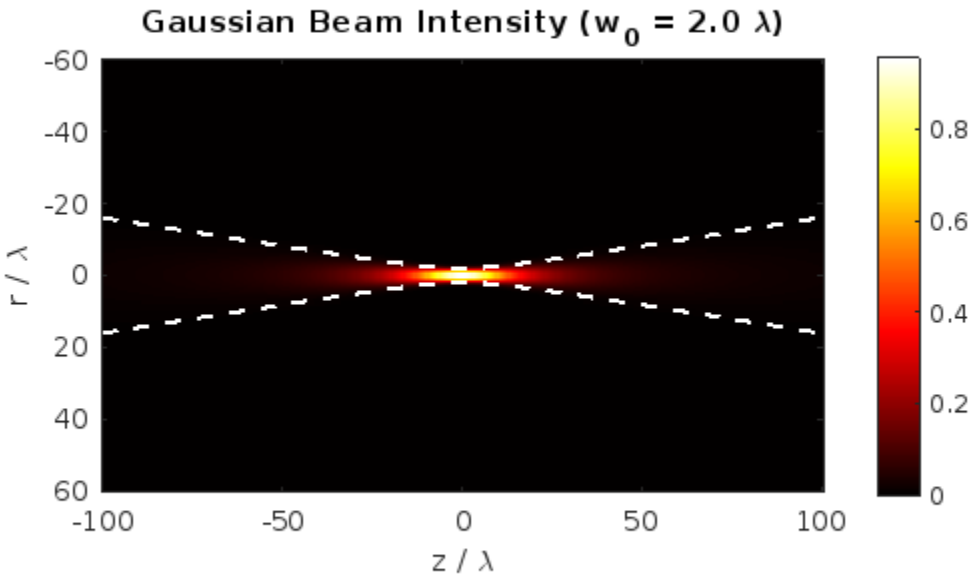
```
close all; clear;

% Parameters
lambda = 1;       % Wavelength
E0 = 1;           % Peak electric field amplitude
w0 = 2 * lambda;  % Beam waist

% Meshgrid for coordinates
z = linspace(-100, 100, 300) * lambda;
r = linspace(-60, 60, 200) * lambda;
[Z, R] = meshgrid(z, r);

% Constants and derived parameters
k = 2 * pi / lambda;          % Wave number
zR = pi * w0^2 / lambda;      % Rayleigh range
w = w0 * sqrt(1 + (Z / zR).^2);       % Beam radius
Rz = Z .* (1 + (zR ./ Z).^2);         % Radius of curvature
xi = atan(Z / zR);                    % Gouy phase

% Gaussian beam electric field
E = E0 * (w0 ./ w) .* exp(-R.^2 ./ w.^2) .* ...
    exp(-1i * (k * Z + k * R.^2 ./ (2 * Rz) - xi));

% Plot intensity (|E|^2)
figure;
imagesc(z/lambda, r/lambda, abs(E).^2);  % Intensity plot
axis equal tight;
colormap hot;
colorbar;
xlabel('z / \lambda');
ylabel('r / \lambda');
title(sprintf('Gaussian Beam Intensity (w_0 = %.1f \\lambda)', w0/lambda));

% Overlay beam envelope
hold on;
plot(z/lambda, w0 * sqrt(1 + (z / zR).^2) / lambda, 'w--', 'LineWidth', 1.5);
plot(z/lambda, -w0 * sqrt(1 + (z / zR).^2) / lambda, 'w--', 'LineWidth', 1.5);
```



Published with MATLAB® R2024b