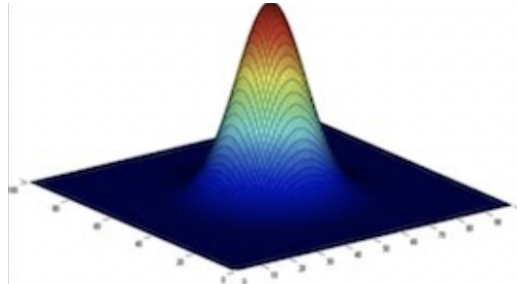The response of a camera system to the point source is the point spread function. In practice, due to multiple factors like Diffraction, Lens Aberration, and Image sensing PSF often looks like a Gaussian Distribution, has a substantial value at the center, and falls off.

Gaussian PSF :

$$F(x, y) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}}$$


On sampling this, we get the Gaussian PSF kernel for Sigma = 10000 with dimensions (750, 1000):
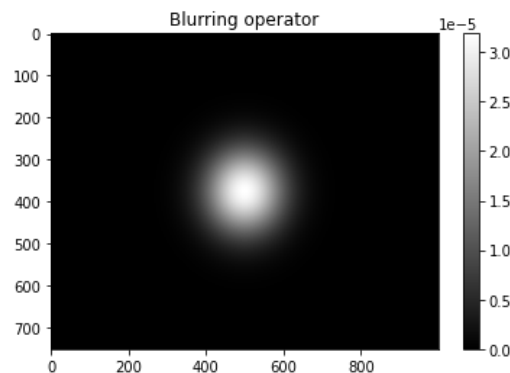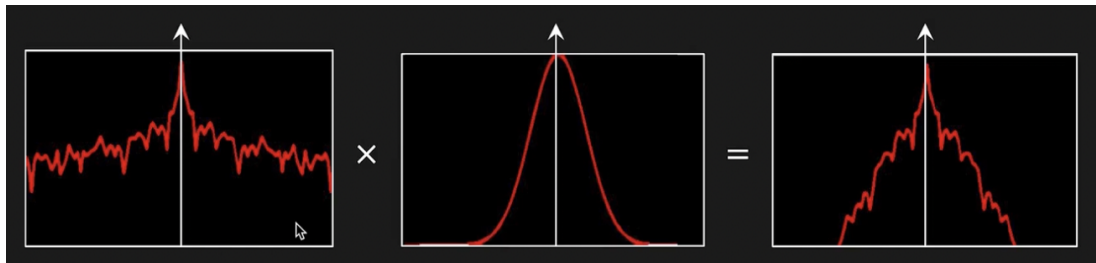

PSF in case of Defocus/Blur :

Defocus is linear and shift-invariant and can be expressed as convolution.

When a focused image is convolved with the Gaussian PSF ends up giving us the Blurred or defocused image. Now, by deconvolution, we can get the focused image back from the Blurred image.
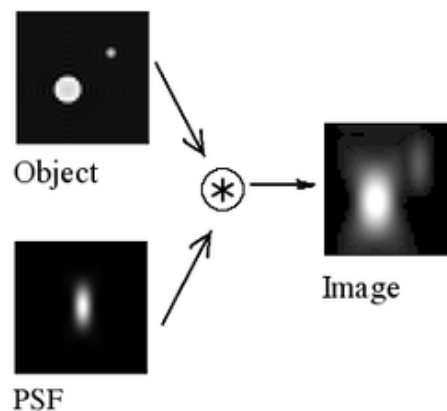
Convolution is multiplication in the frequency domain.

Coming to the frequency domain, take the Fourier transform of all the three, and let us see their relation. Defocusing is just the low pass filtering.

$$FT(image) \times FT(Gpsf) = FT(blur\ Image)$$