2D Signal Sampling Tutorial Exercise

Exercise
Consider the 2D signal:

$$\psi(x,y) = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2+y^2}{2}}.$$

1. Estimate its Fourier Transform.

2. Suppose that we want to sample this signal using a hexagonal lattice Λ given by:

$$\mathbf{V} = a \begin{bmatrix} \frac{\sqrt{3}}{2} & 0 \\ \frac{1}{2} & 1 \end{bmatrix}.$$

   Choose an appropriate scaling factor α so that aliasing effect is not severe. For example, choose α so that $\Psi(f_1, f_2) = 0.1$ at the border of the Voronoi cell of Λ^*.

3. Determine the sampled signal and its spectrum.