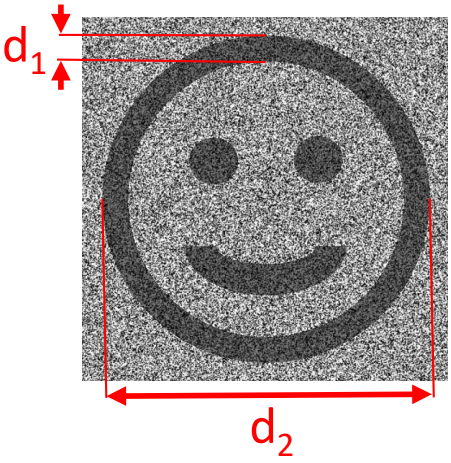
Quiz 11: Fourier optics

Consider a 4f-setup, where both lenses have a focal length f. We place the object at the focal distance before the first lens and a mask between the two lenses. We are observing the image at the focal distance after the second lens. Our object field is radiating at a wavelength λ, and has a field profile as shown below: A smiley face, which is covered by a white noise pattern (a noise with all spatial frequency components in it). We would like to have a mask that can suppress the noise in the image as much as possible, while letting the image of the smiling object through.



1) Describe a mask shape that can perform this task, and give the characteristic size of this mask pattern, depending on f, λ, d_1, and d_2. [6 points]
2) What other main additional effect (aside from noise removal) would such a mask have on the final image? Could this constitute a trade-off on the performance of this noise-removing system? [4 points]

You have 10 minutes!

Make sure that you indicate your name and seminar group on your answer sheet.