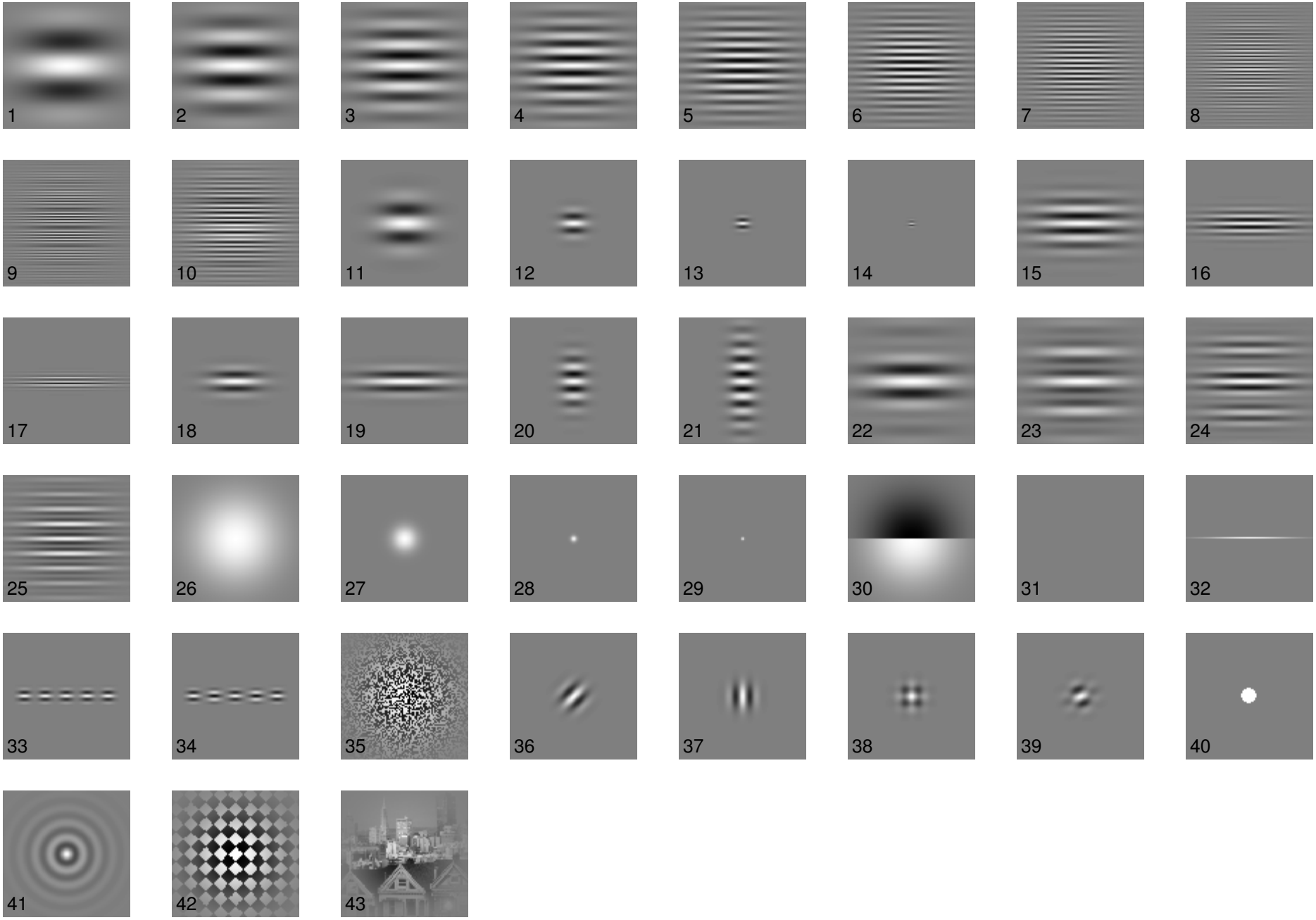
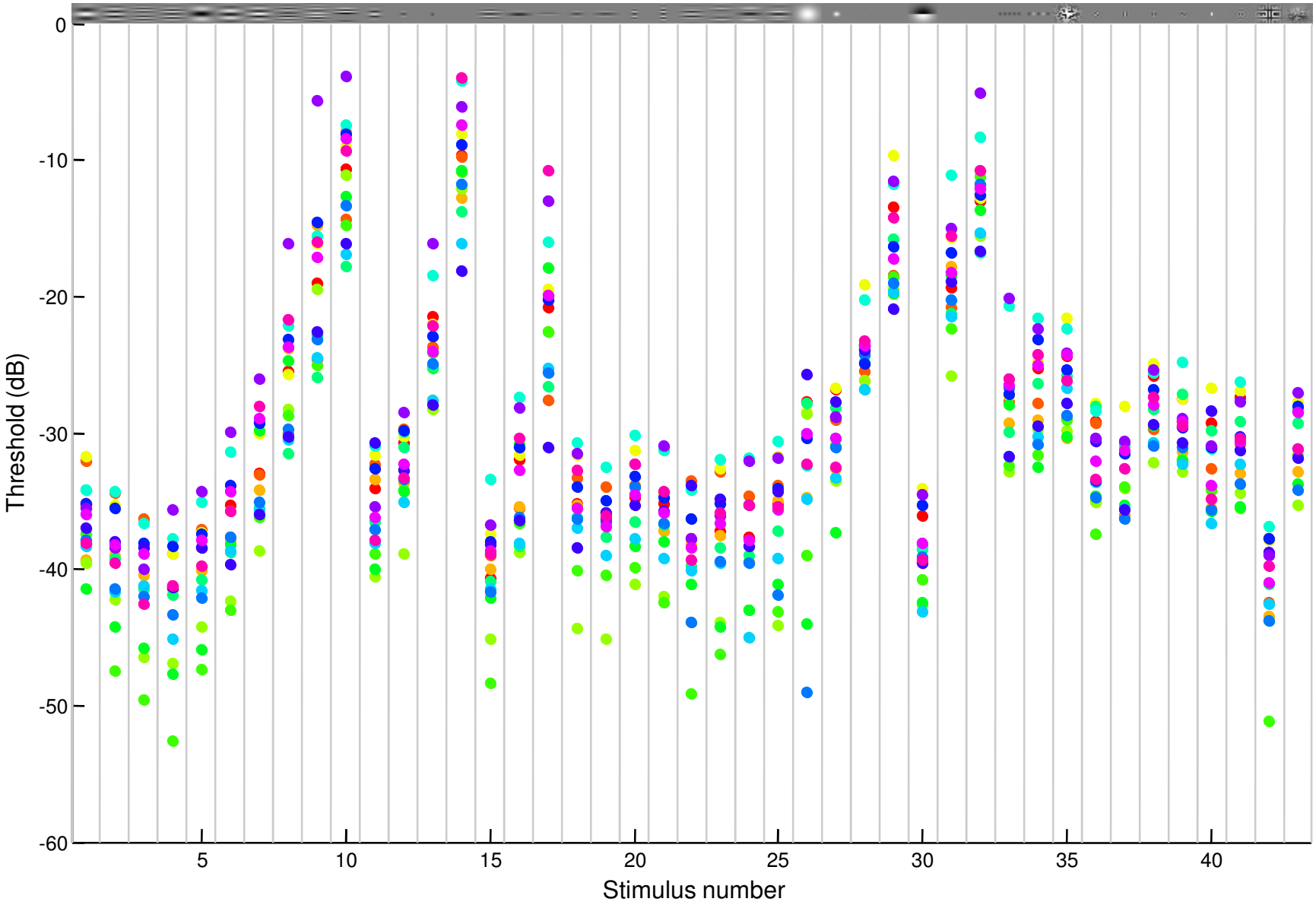
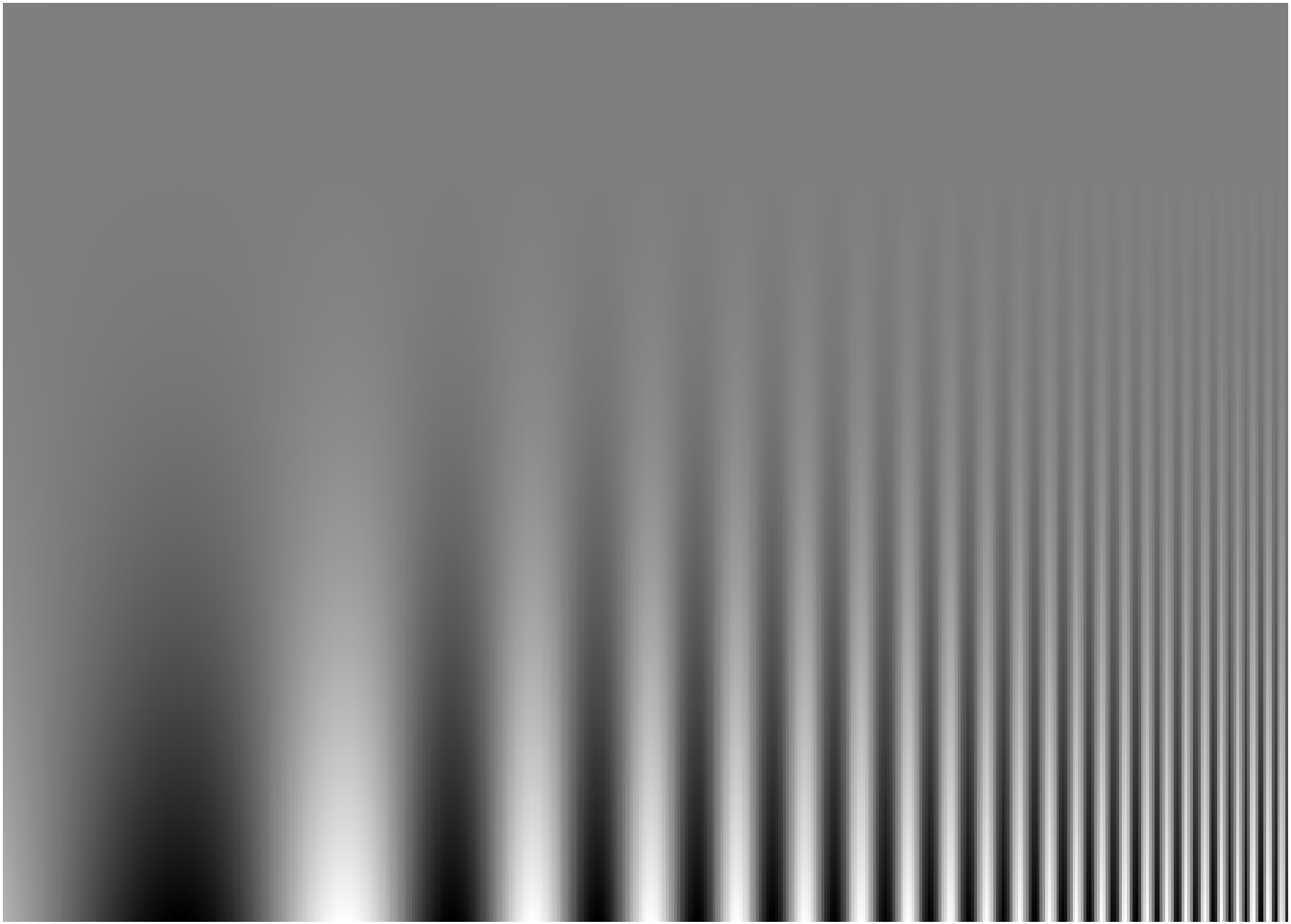
ModelFest Stimuli



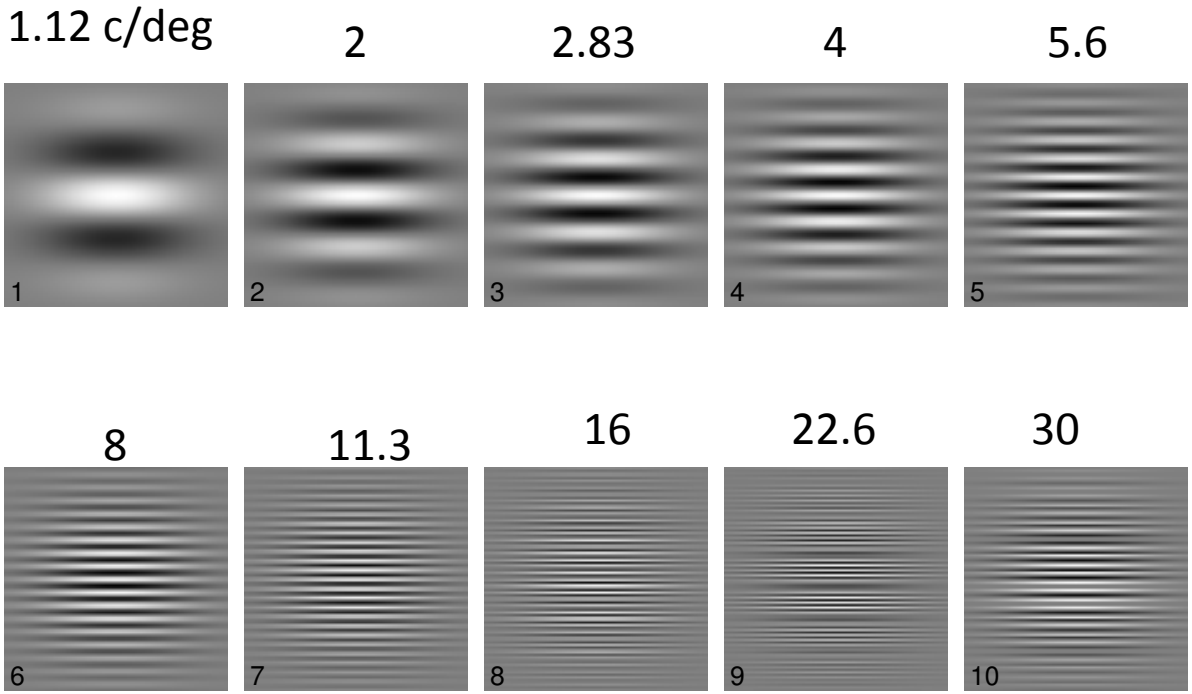
ModelFest Psychophysical Data

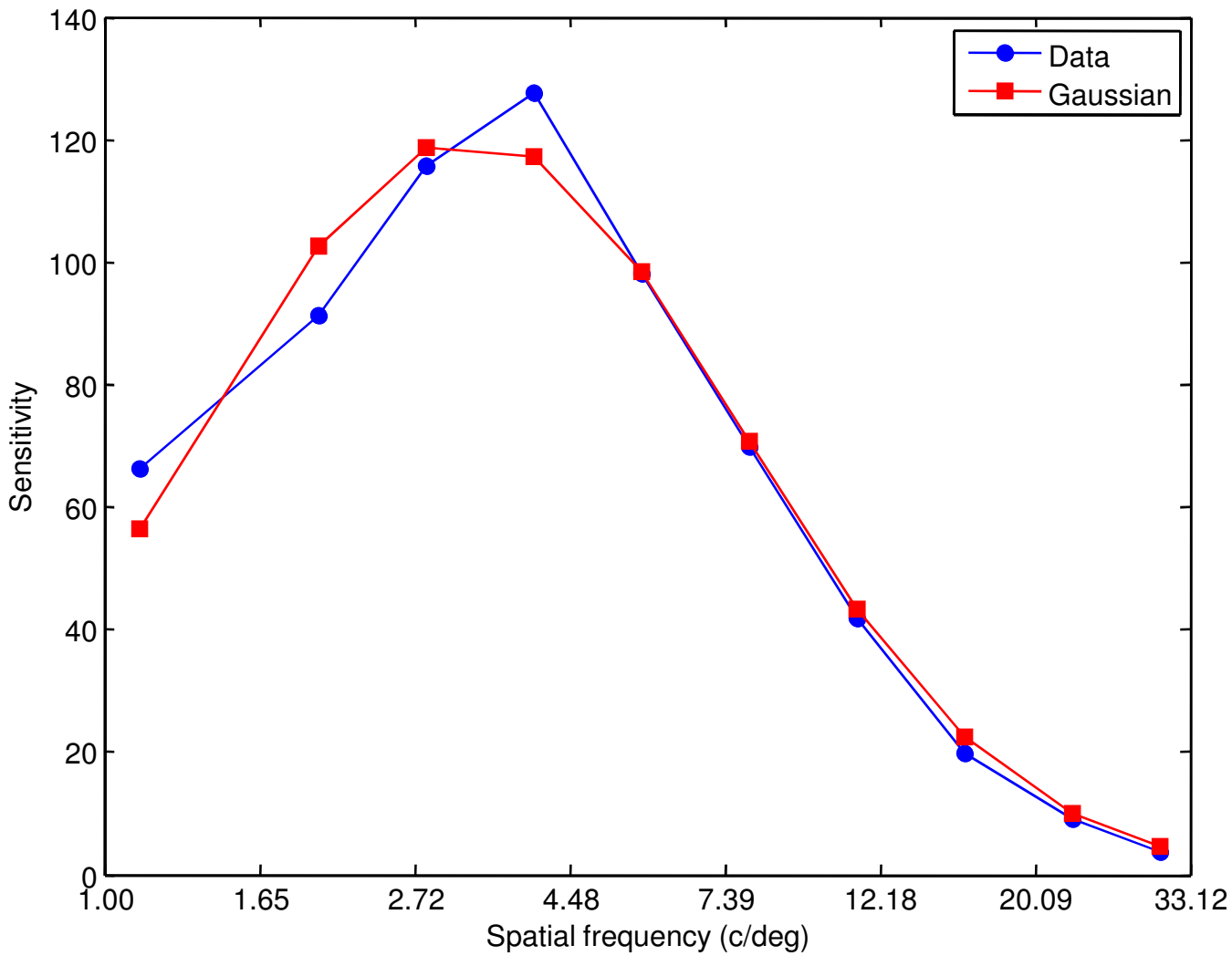


The spatial frequency contrast sensitivity function

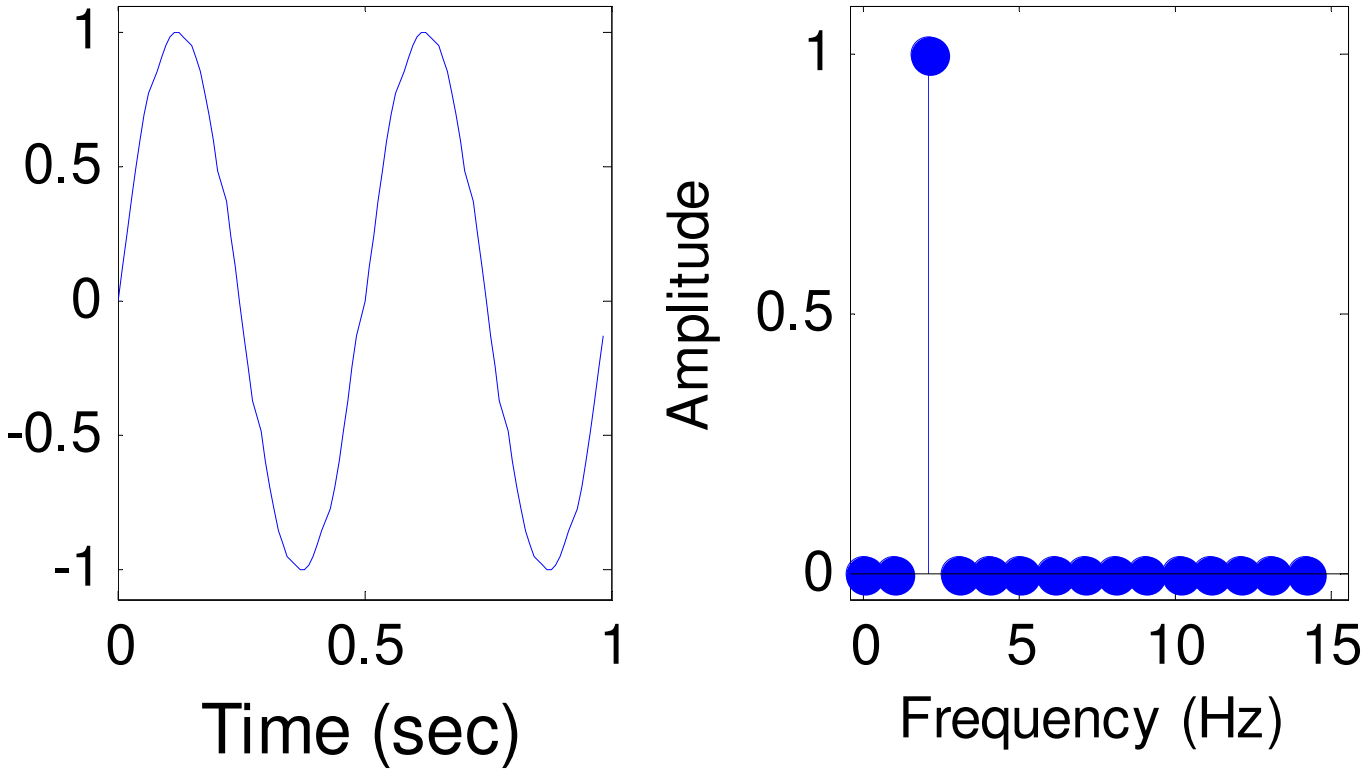


1st 10 ModelFest stimuli measure the contrast sensitivity function

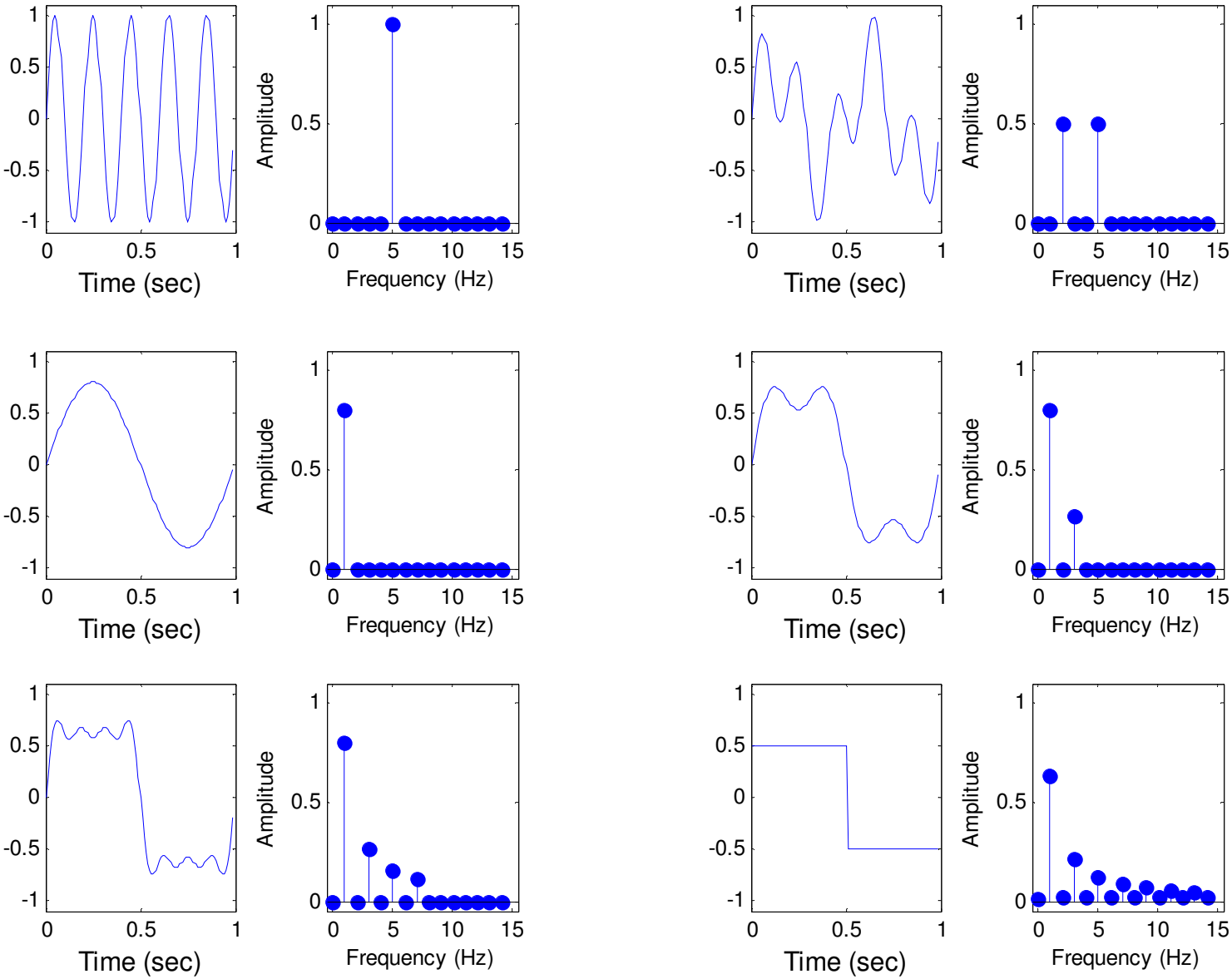



1/Threshold for the first 10 stimuli
Data
Gaussian
Sensitivity
Spatial frequency (c/deg)
140
120
100
80
60
40
20
0
1.00
1.65
2.72
4.48
7.39
12.18
20.09
33.12

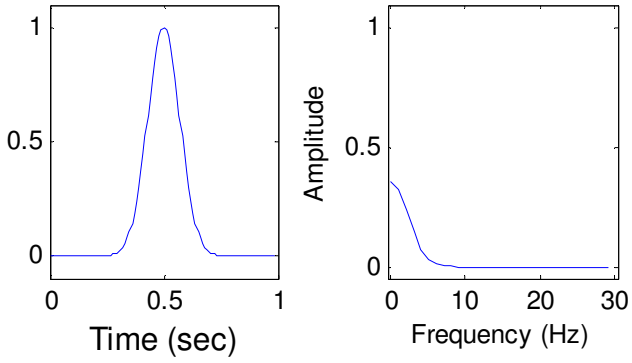
The 1-D Fourier Transform



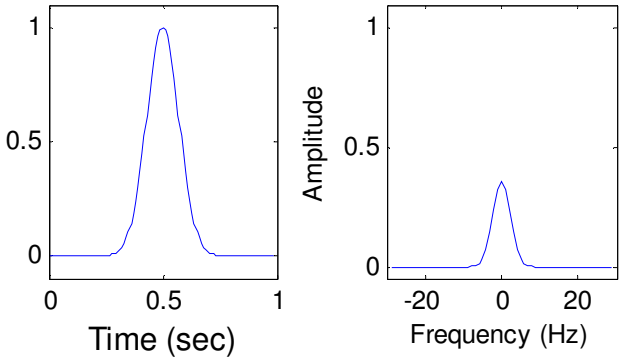
The 1-D Fourier Transform



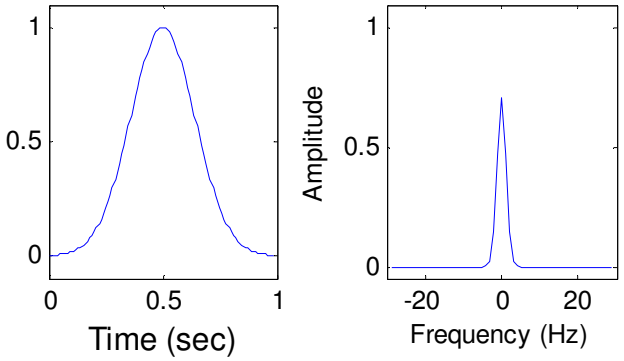
Fourier transform of a Gaussian is a Gaussian



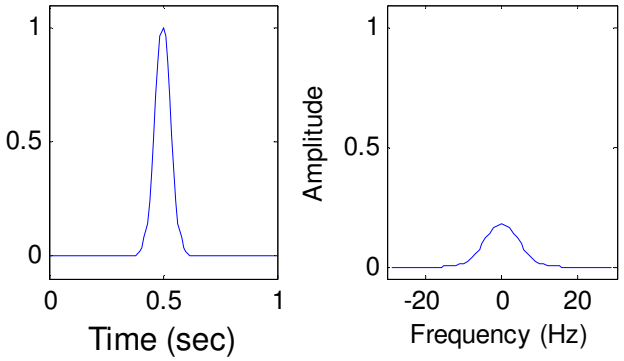
Including
'negative' frequencies



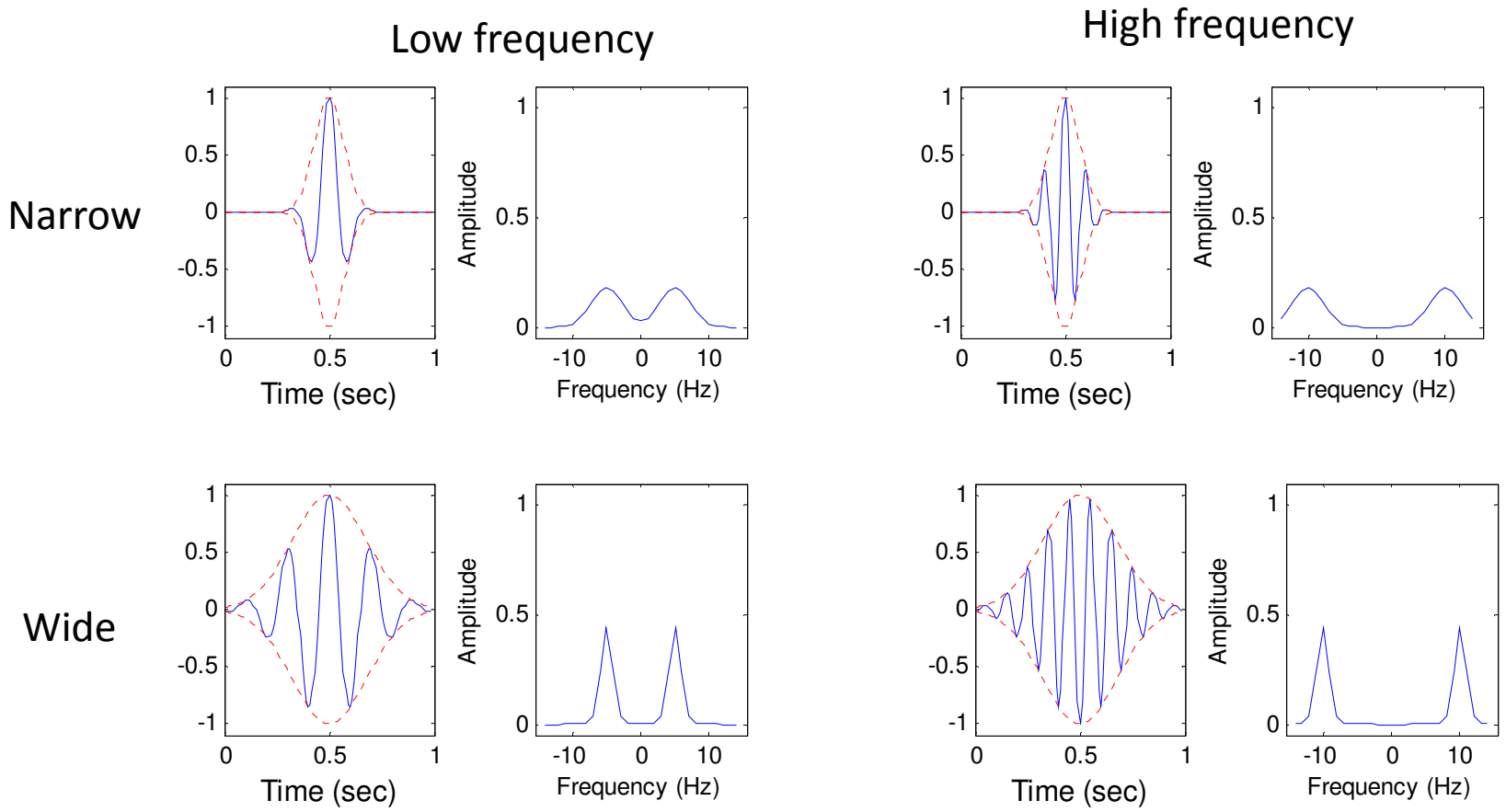
Wide



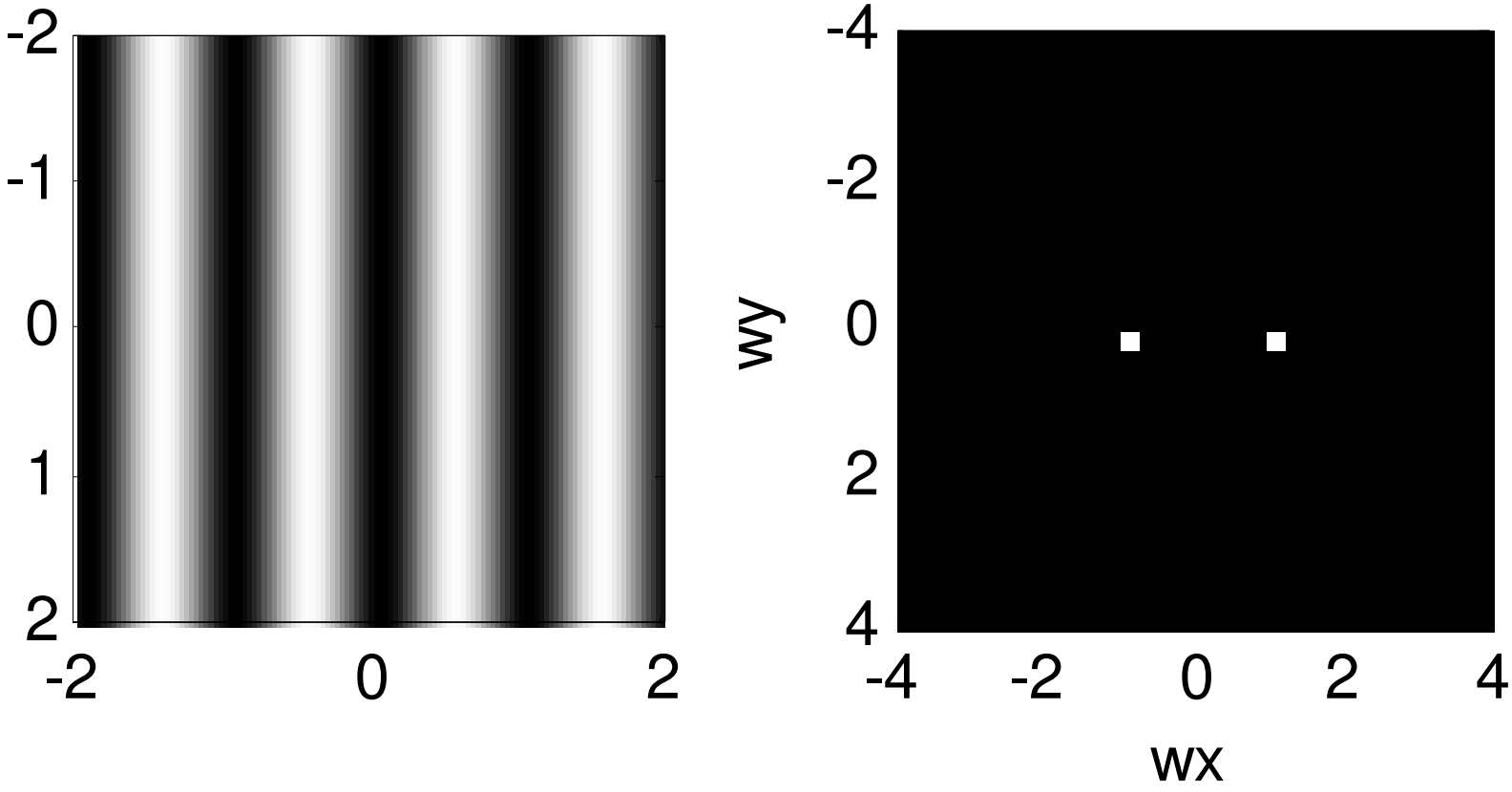
Narrow



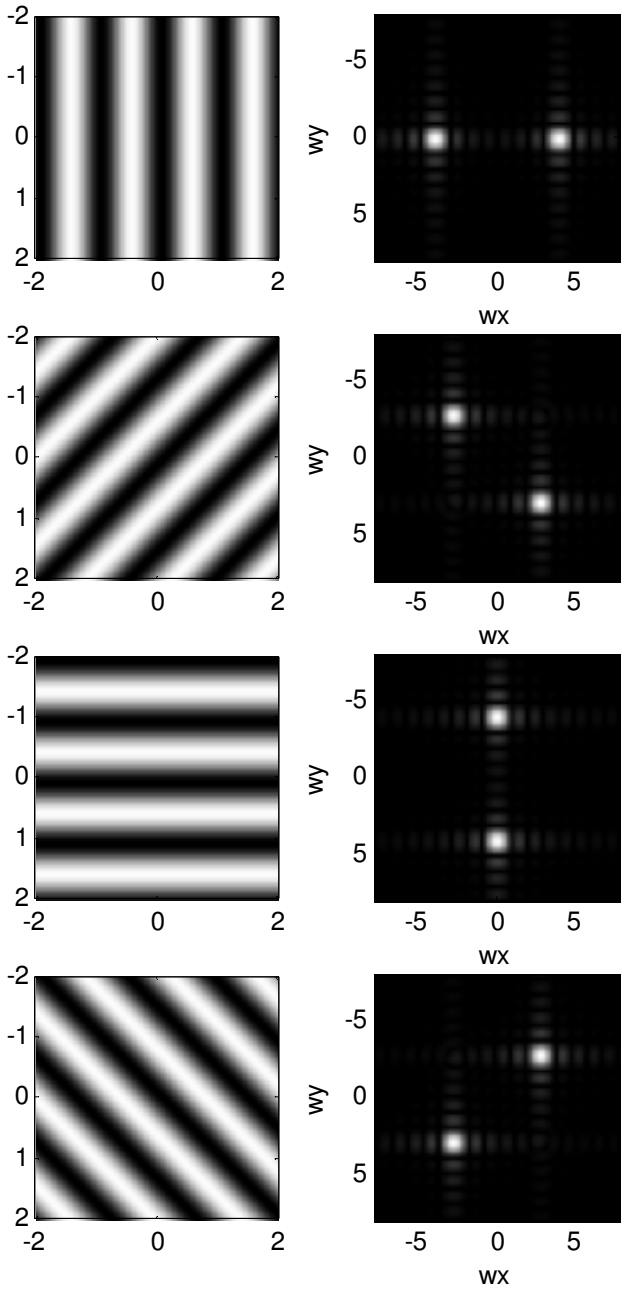
Fourier transform of a Gabor is a Gaussian centered at the ‘carrier frequency’



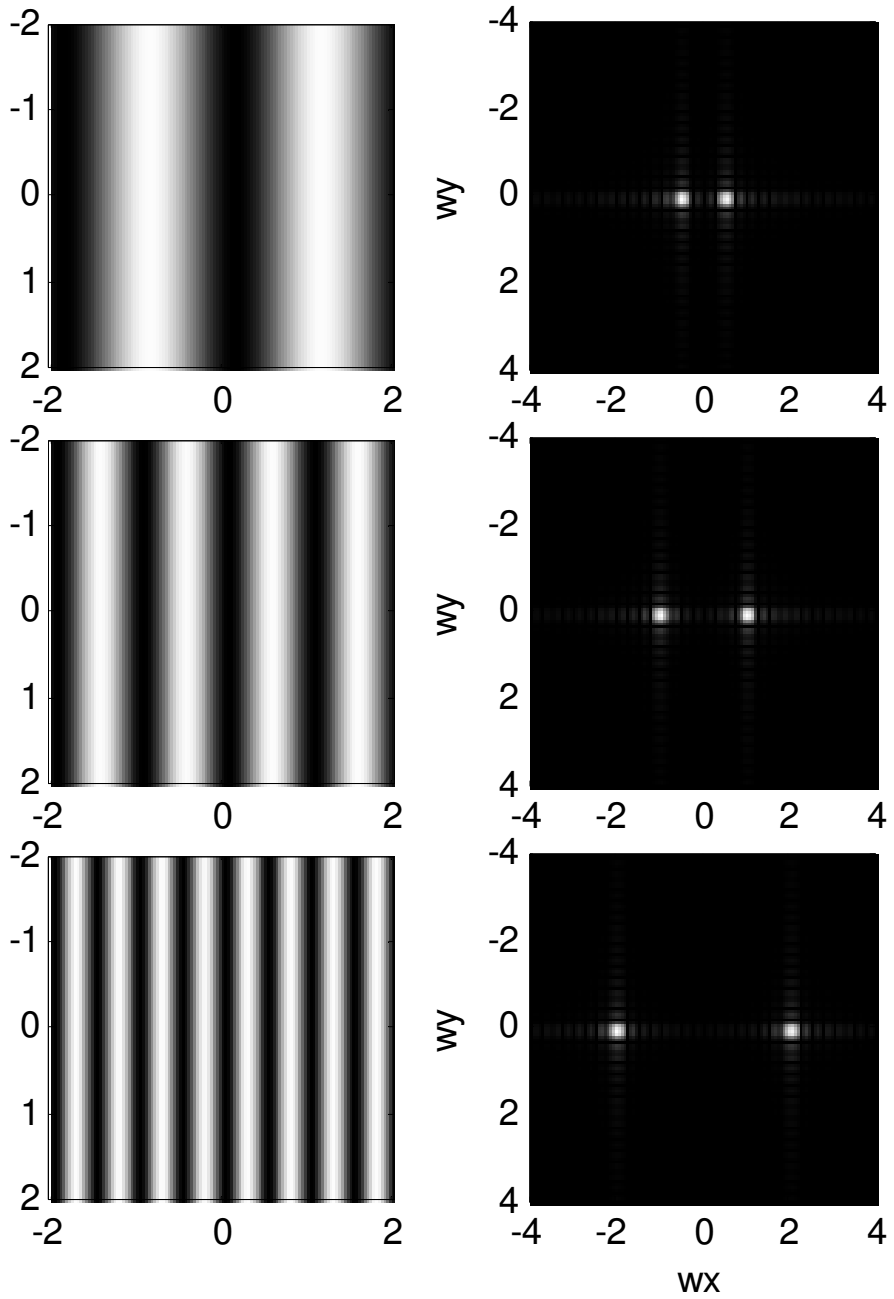
2D Fourier Transform



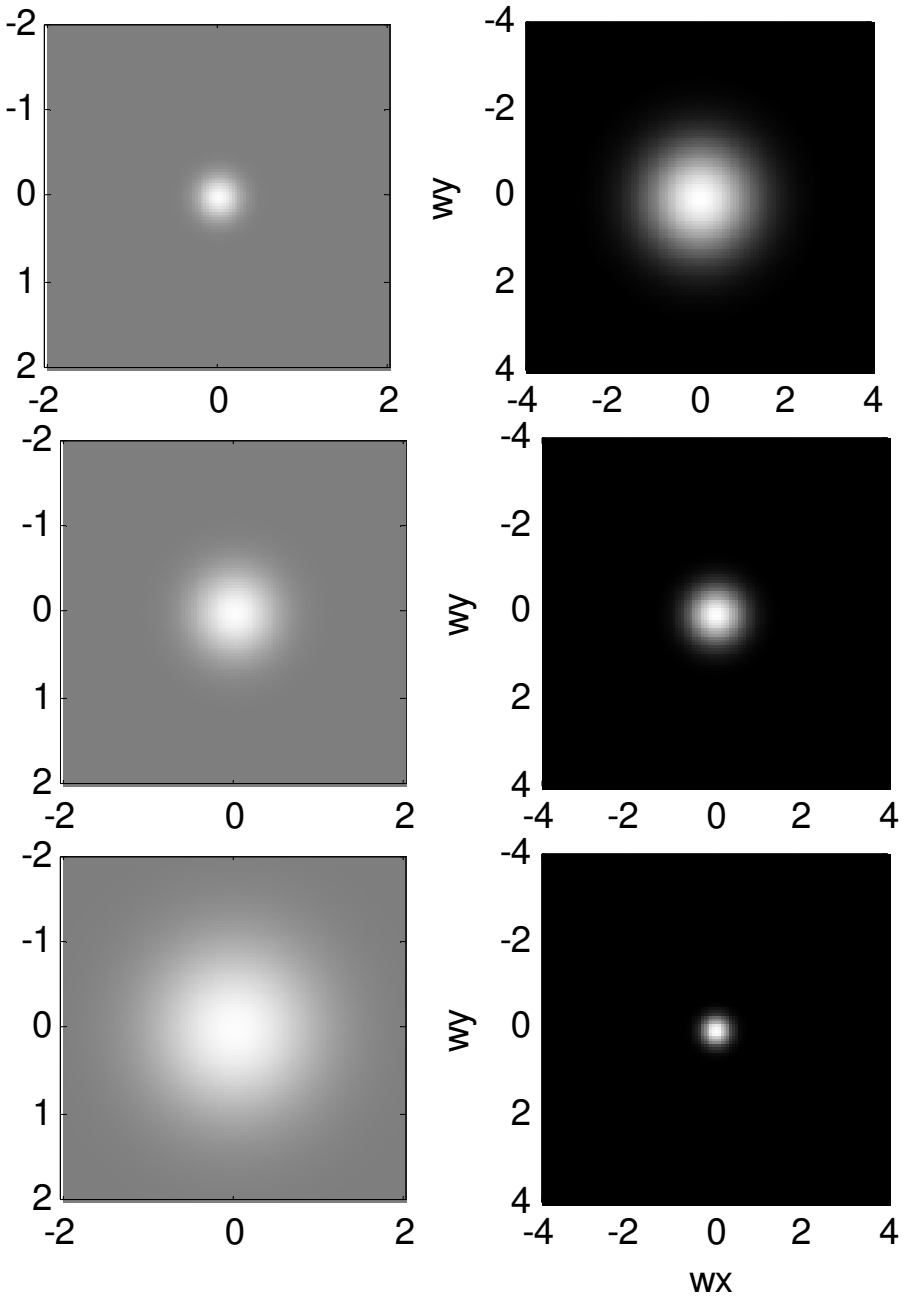
Gratings: Orientation



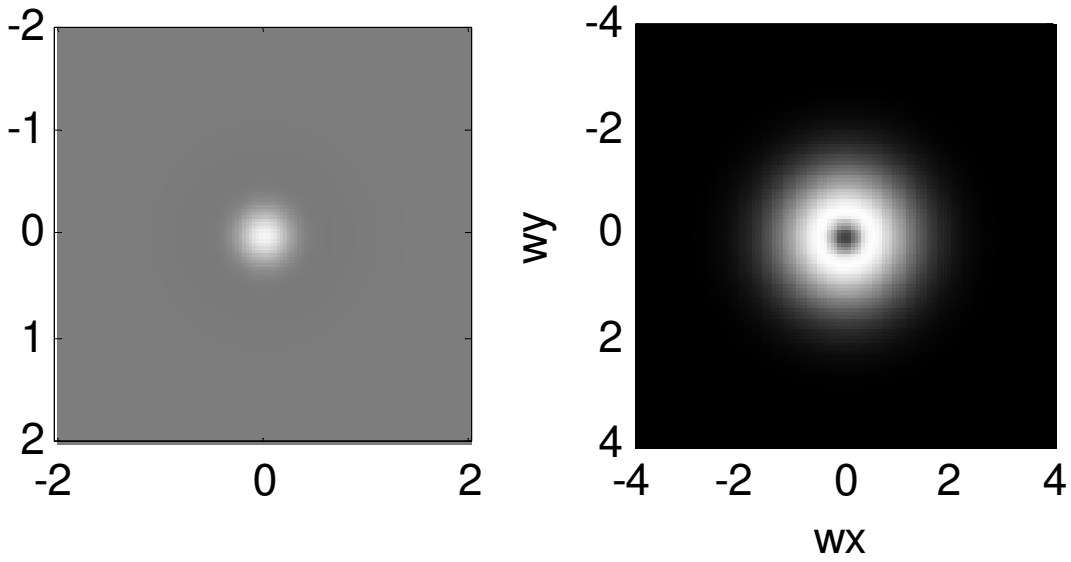
Gratings: Spatial Frequency



FFT of a Gaussian is a Gaussian



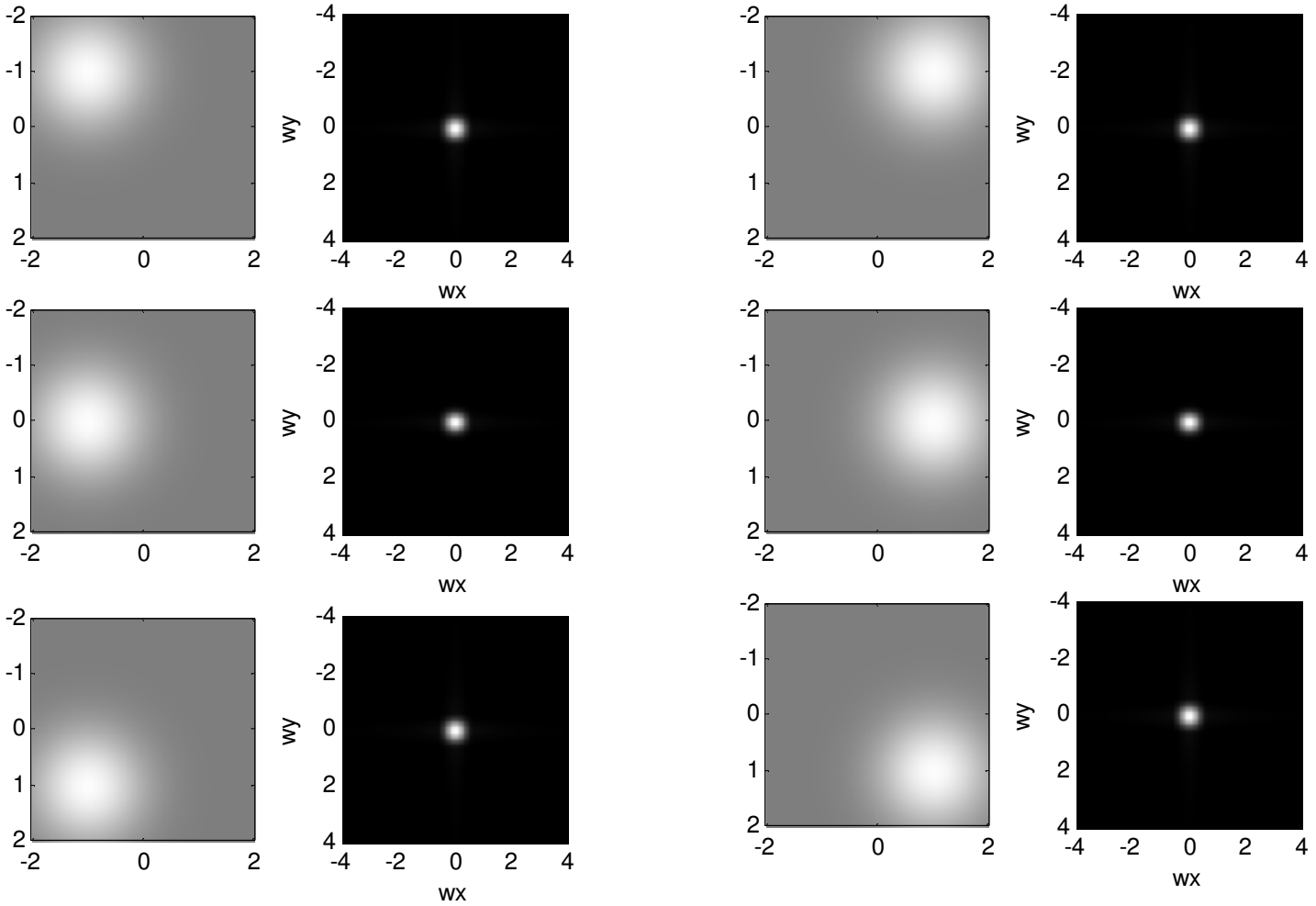
Difference of Gaussians



By thinking of receptive fields in the Fourier domain, we can get an intuition about what spatial frequencies and orientations that the receptive field is sensitive to.

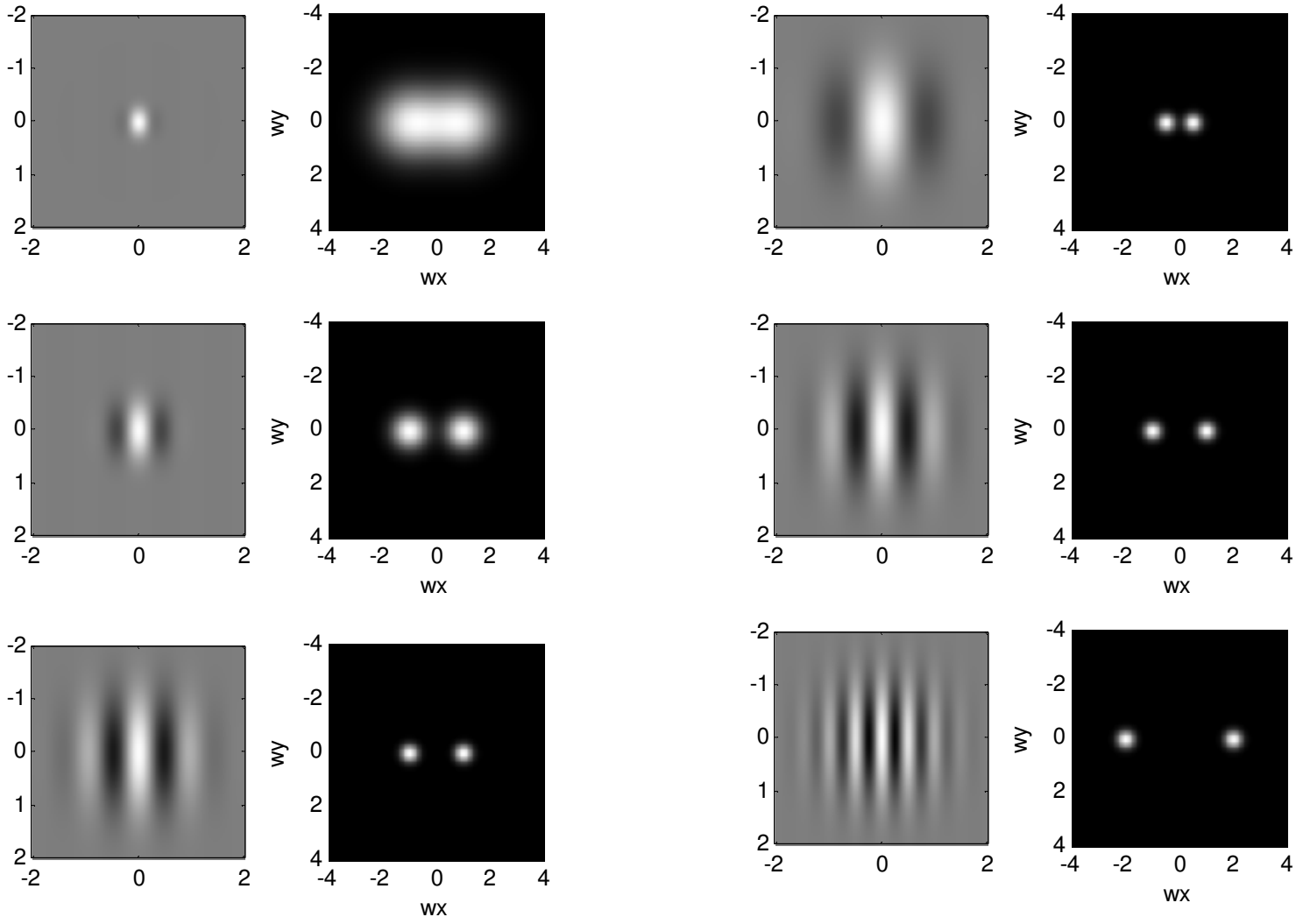
This is a ‘band-pass’ filter – sensitive to intermediate spatial frequencies but not selective to orientation

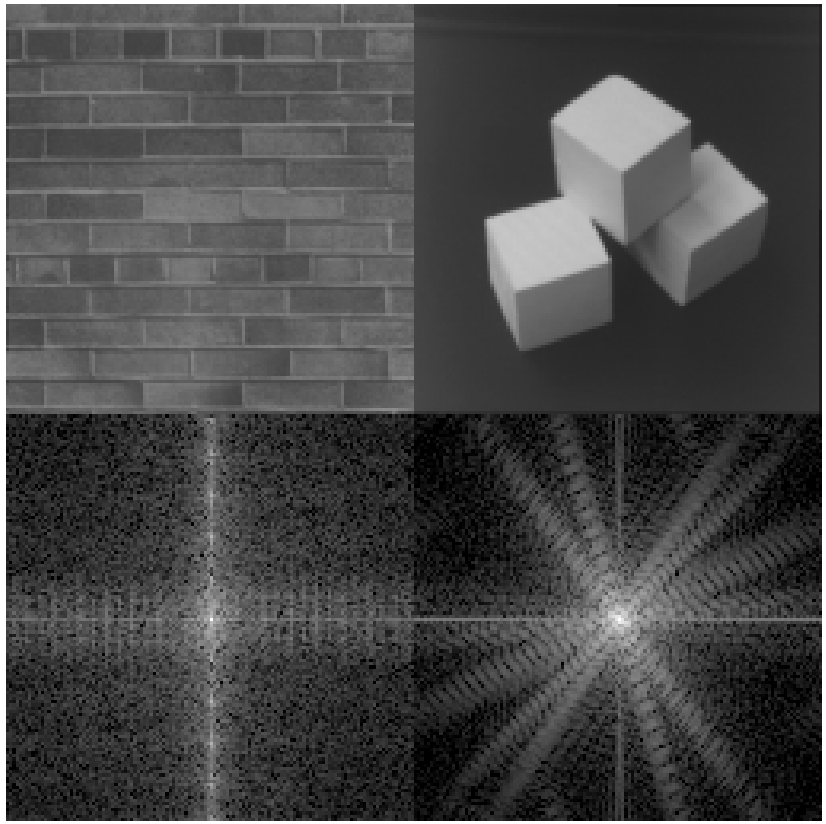
Spatial position

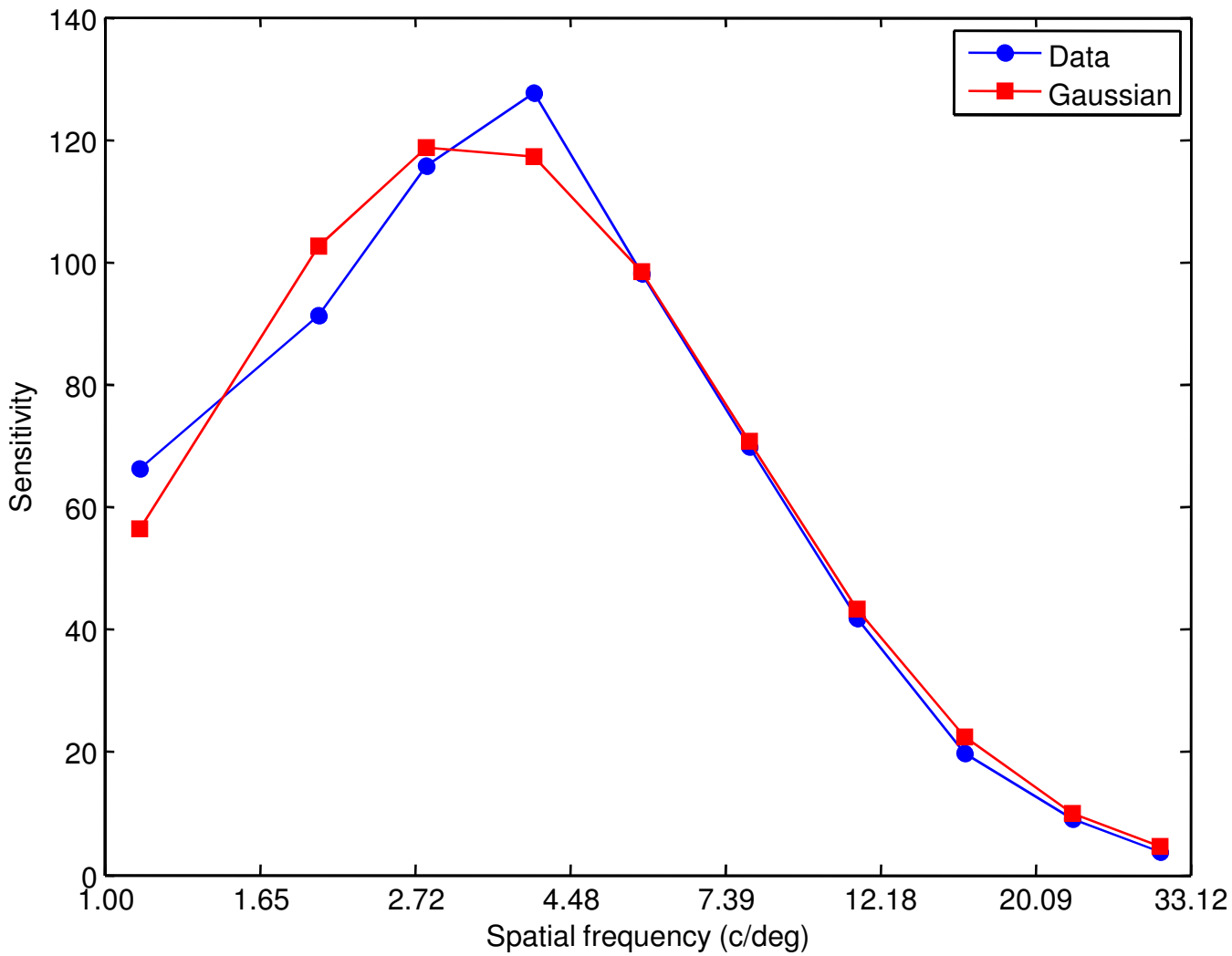


Since the (amplitude of the) Fourier transform is not dependent on spatial position, we don't have to think about where the receptive field is when we think about its preferred spatial frequency and orientation

FFTs of Gabors






1/Threshold for the first 10 stimuli
Data
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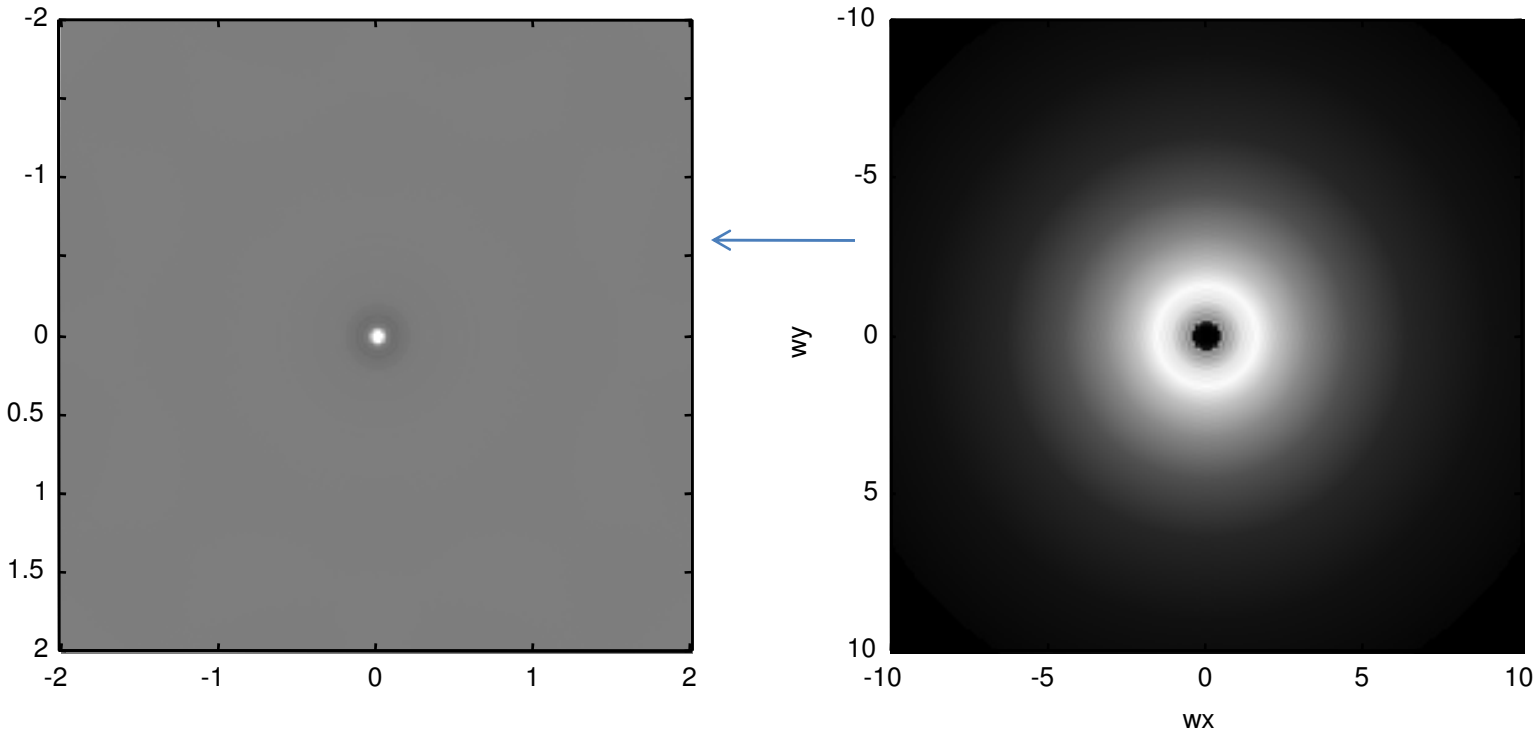
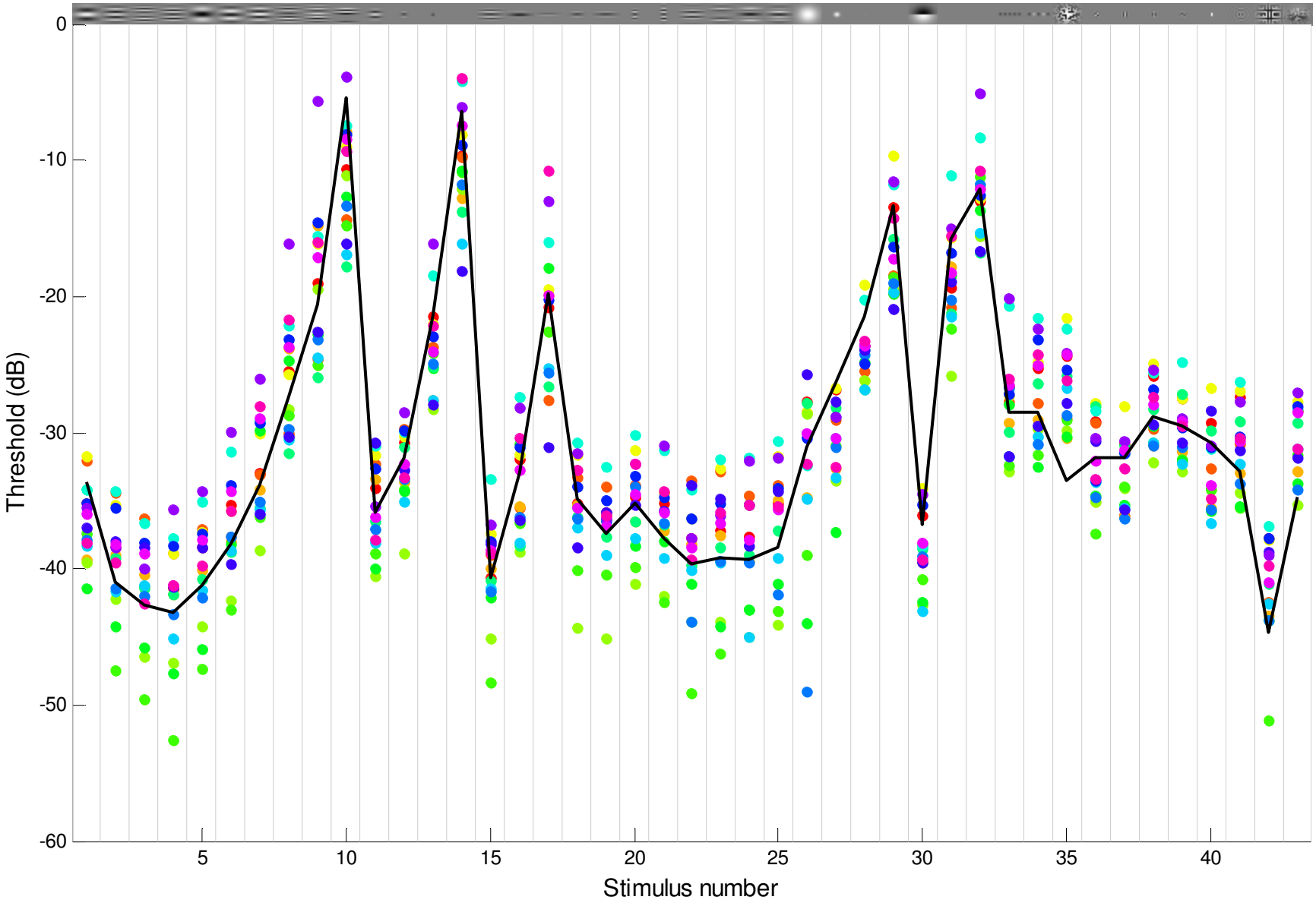
140
120
100
80
60
40
20
0
1.00
1.65
2.72
4.48
7.39
12.18
20.09
33.12

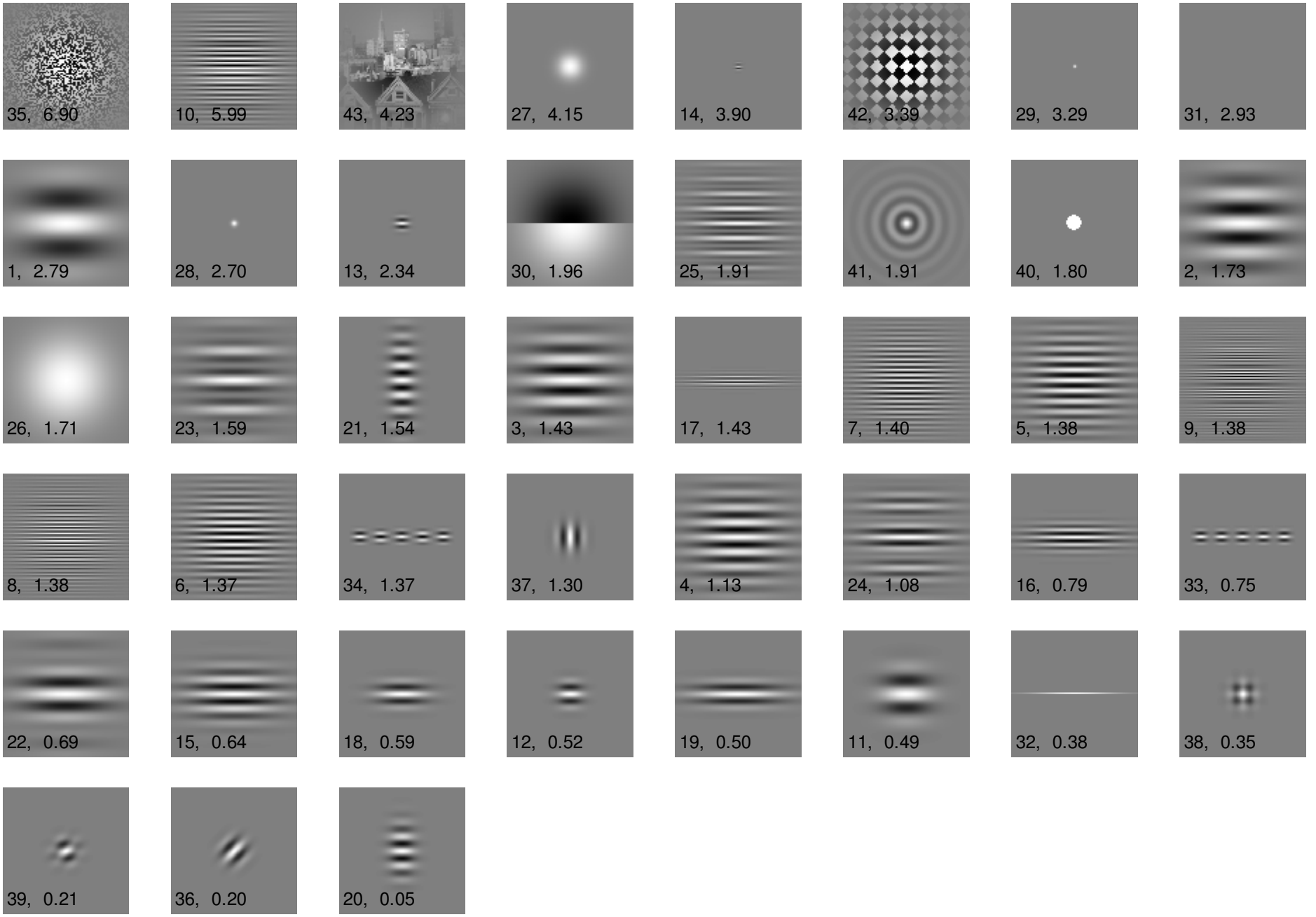
The ‘inverse Fourier transform’ was used to create a receptive field based on the contrast sensitivity function



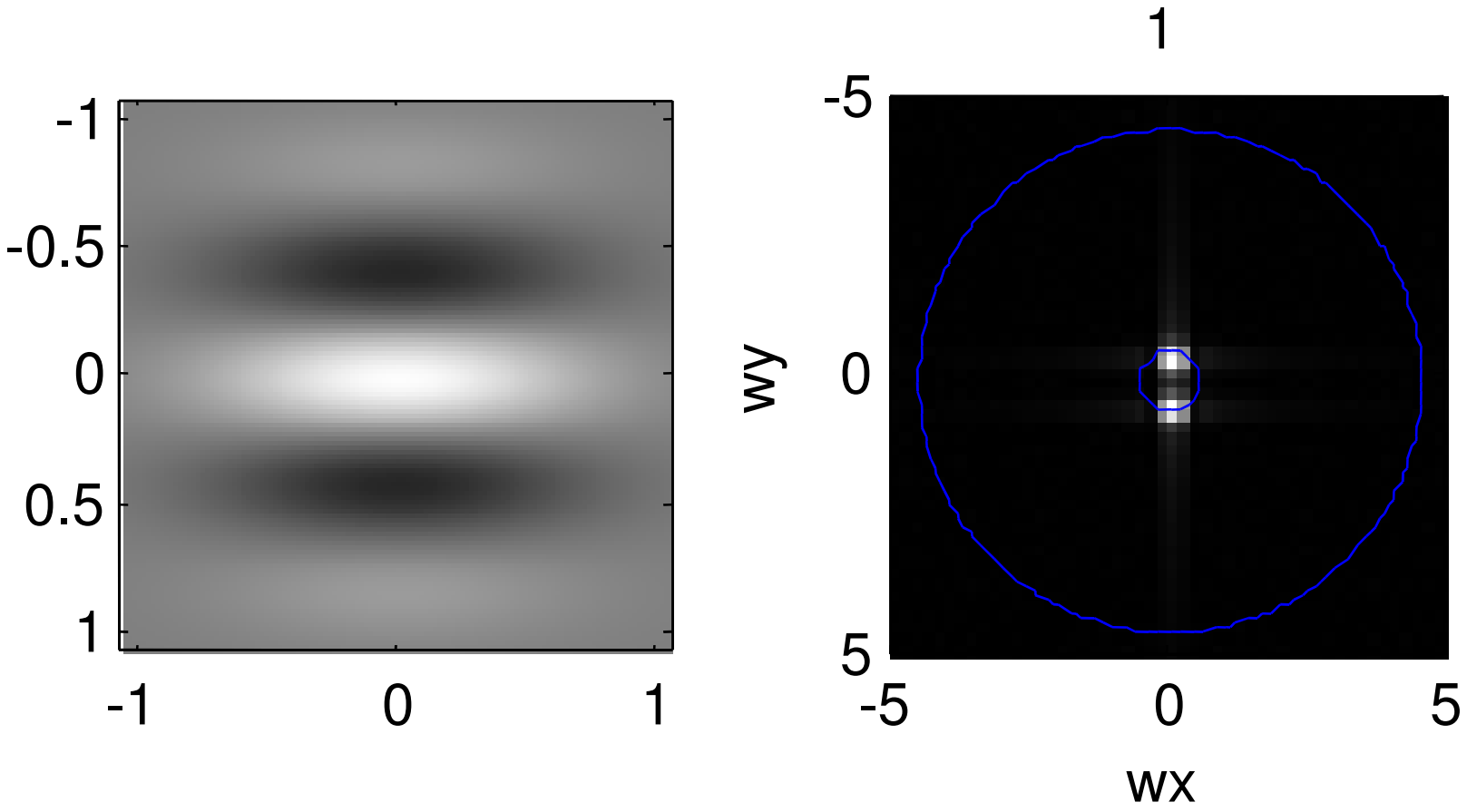
Predictions from the best fitting ‘Contrast Energy’ model (3 parameter fit)

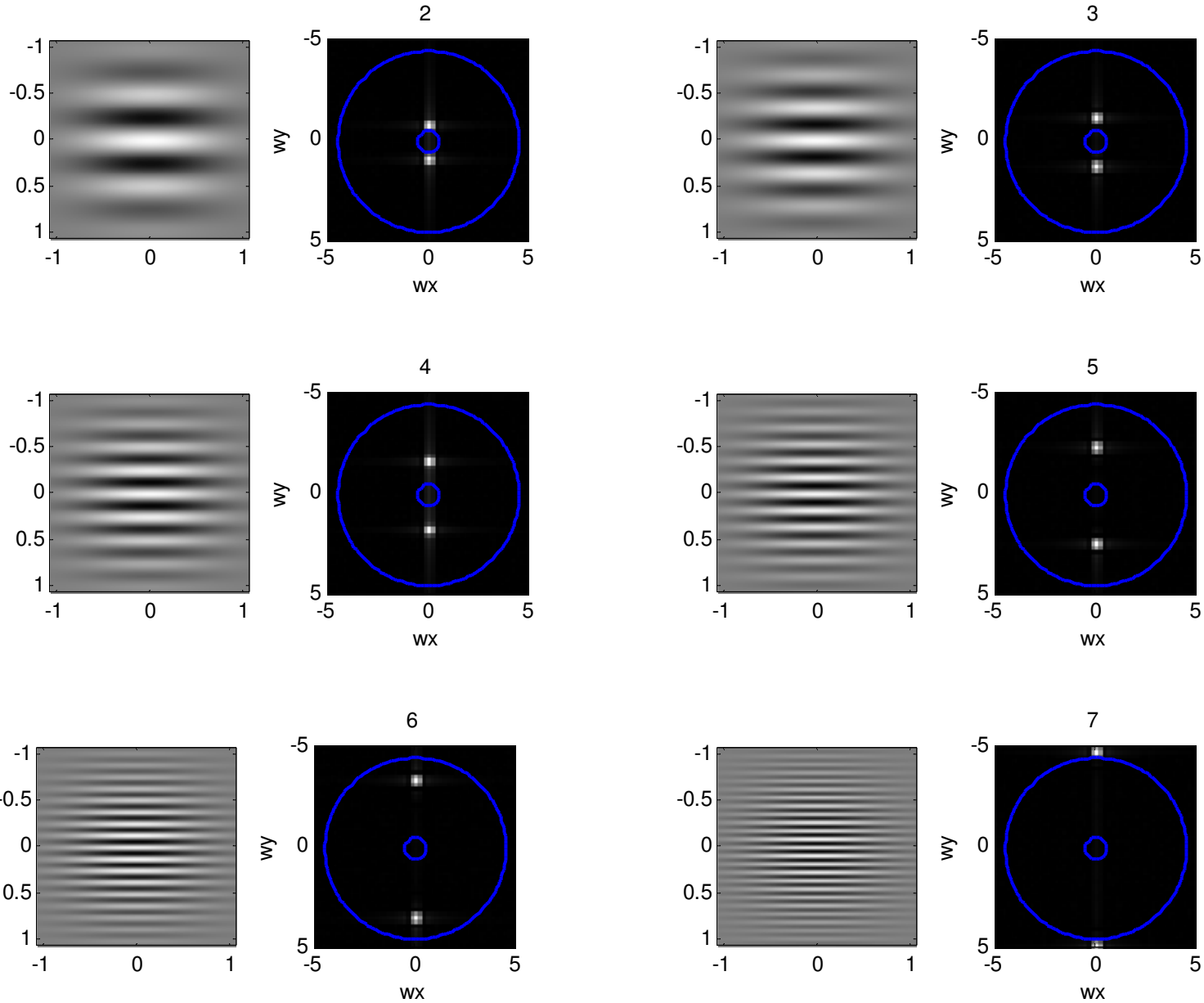


Deviations between model and thresholds, in descending order



How to think about the model in the Fourier domain

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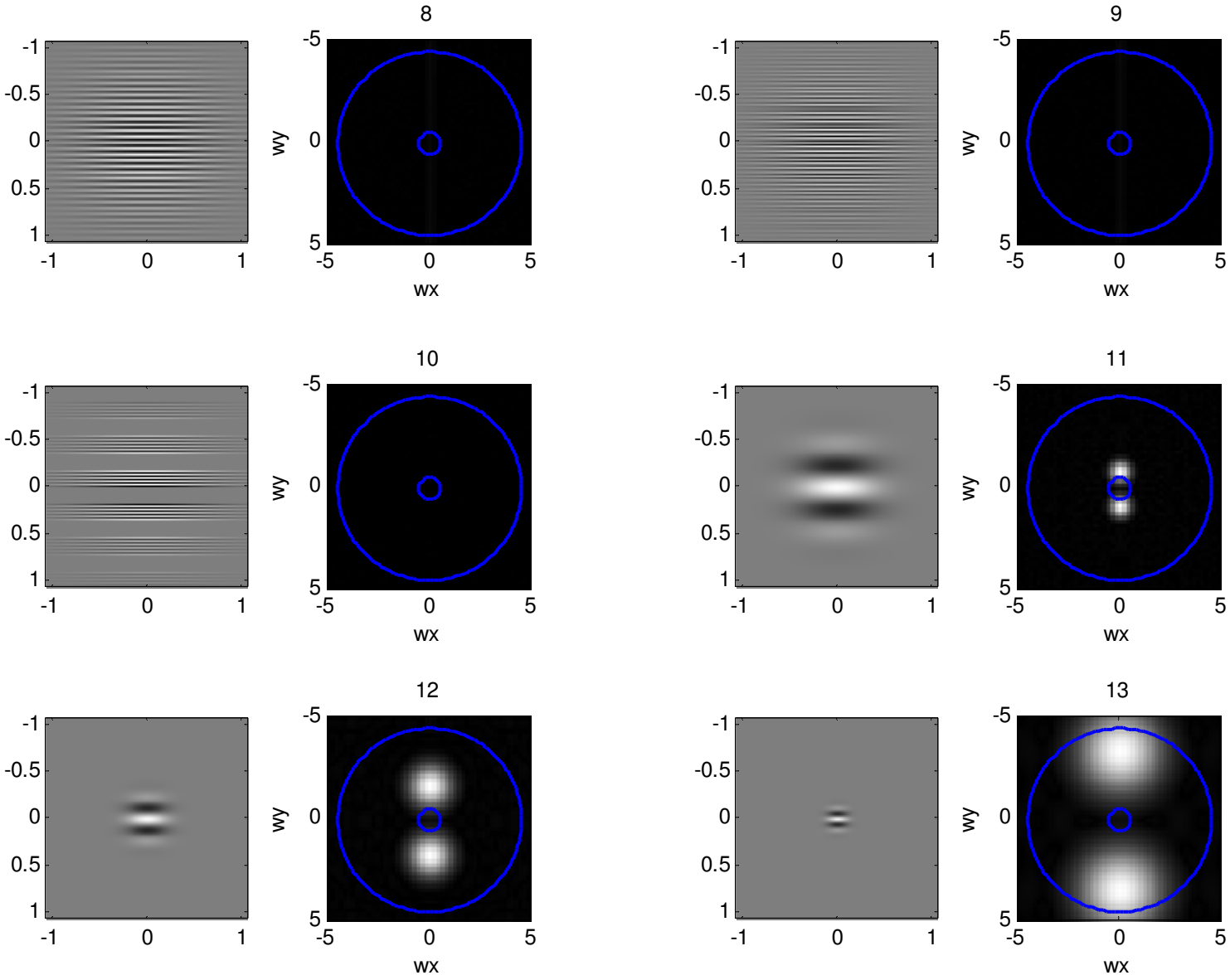
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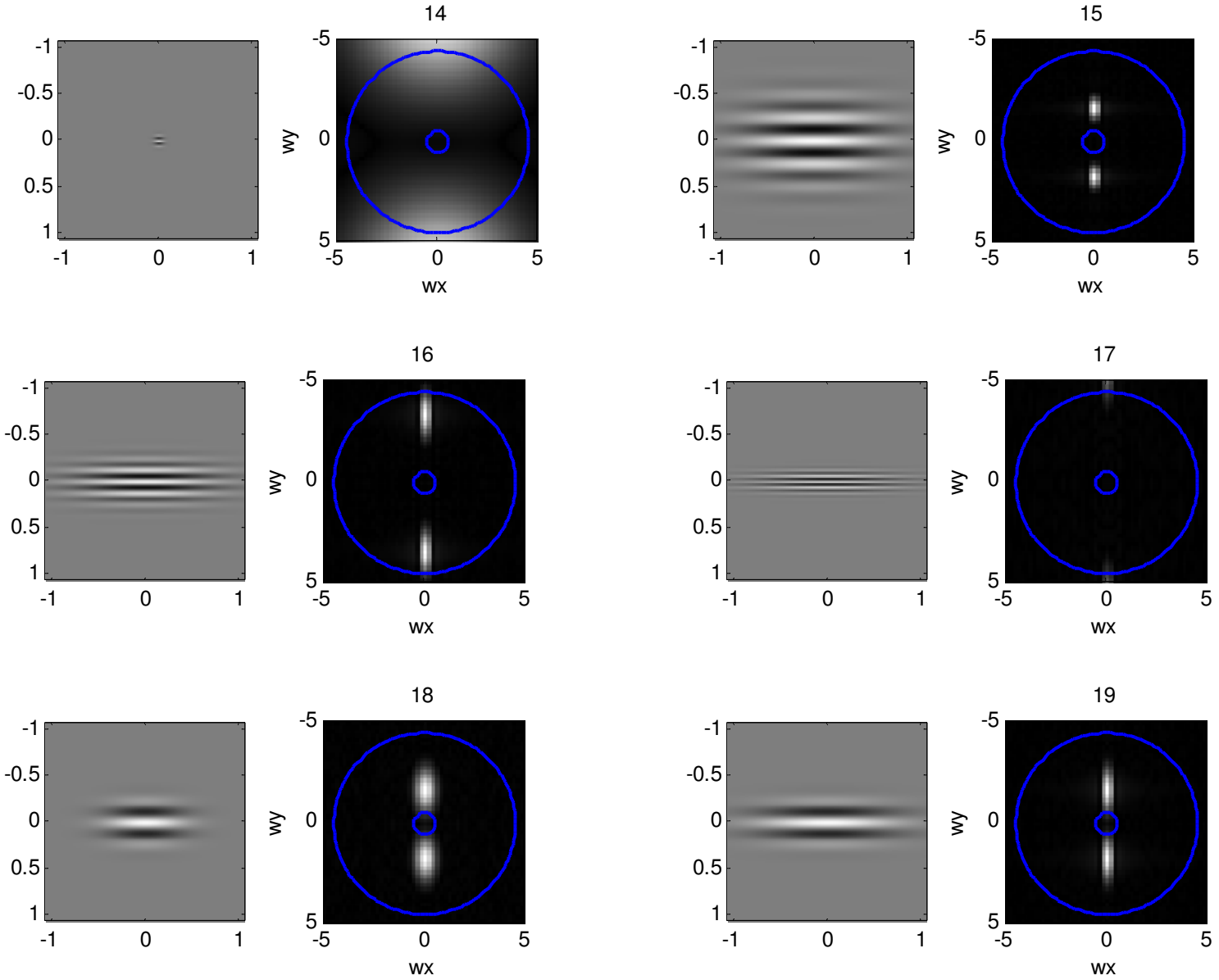
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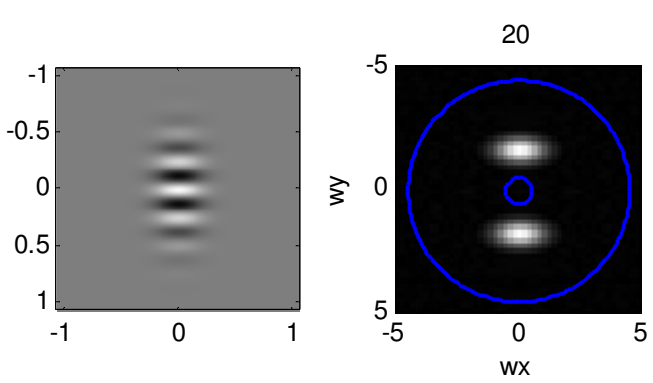
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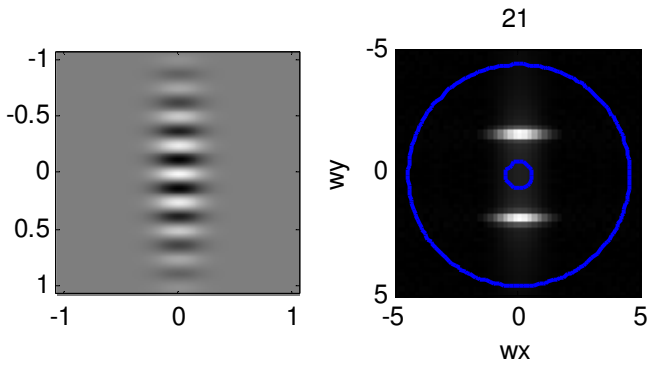
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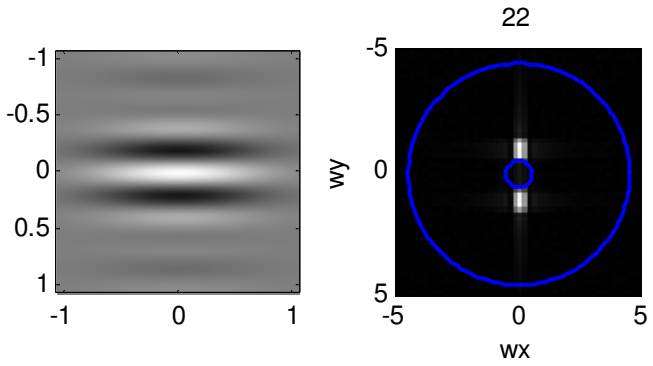
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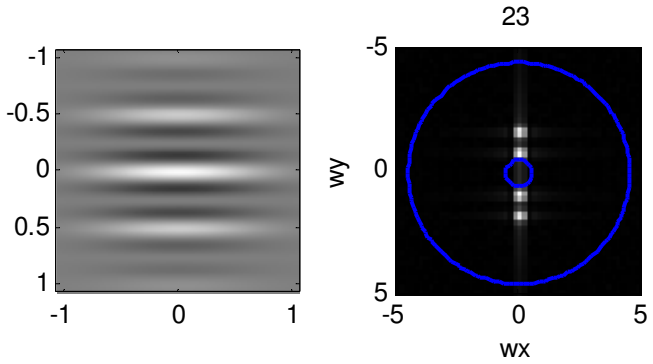
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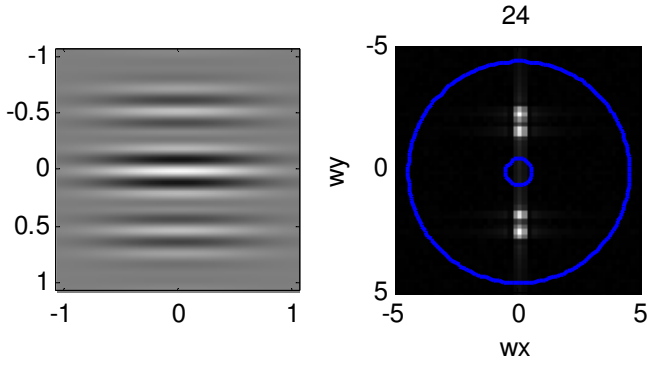
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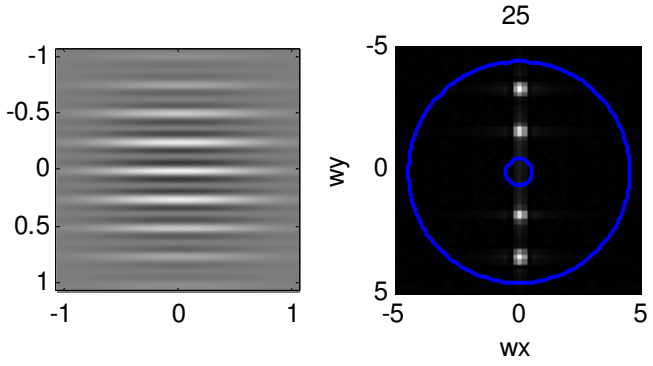
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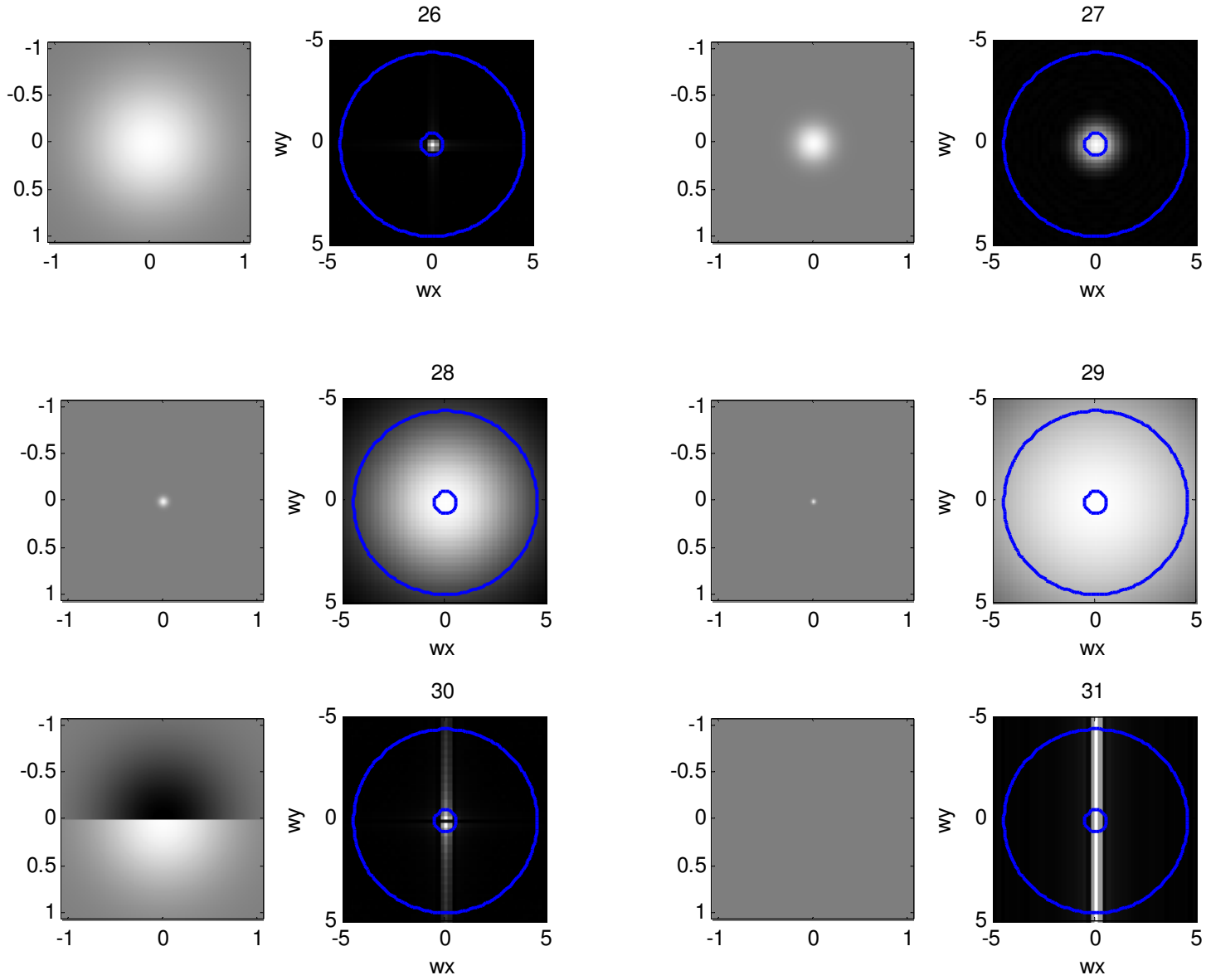
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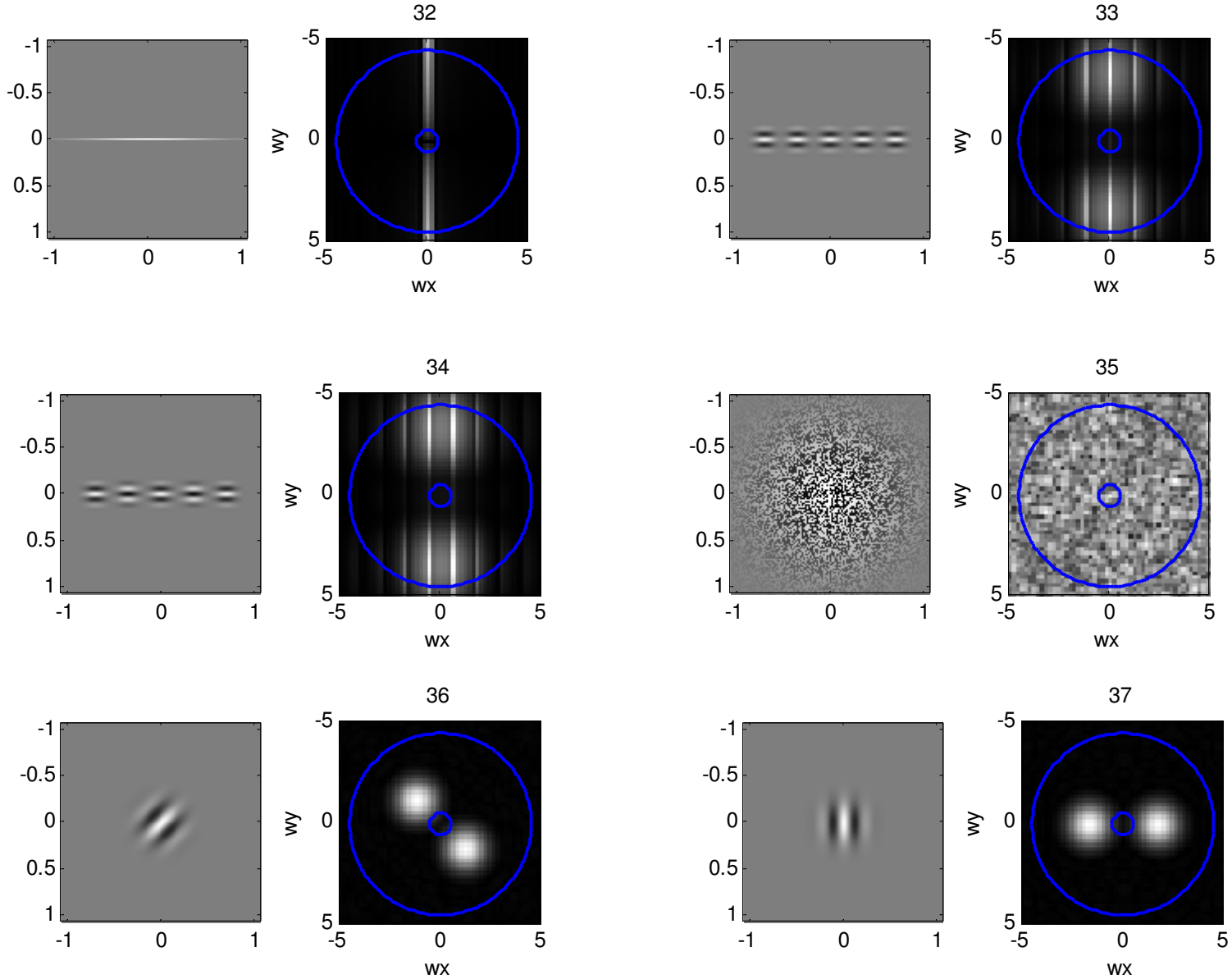
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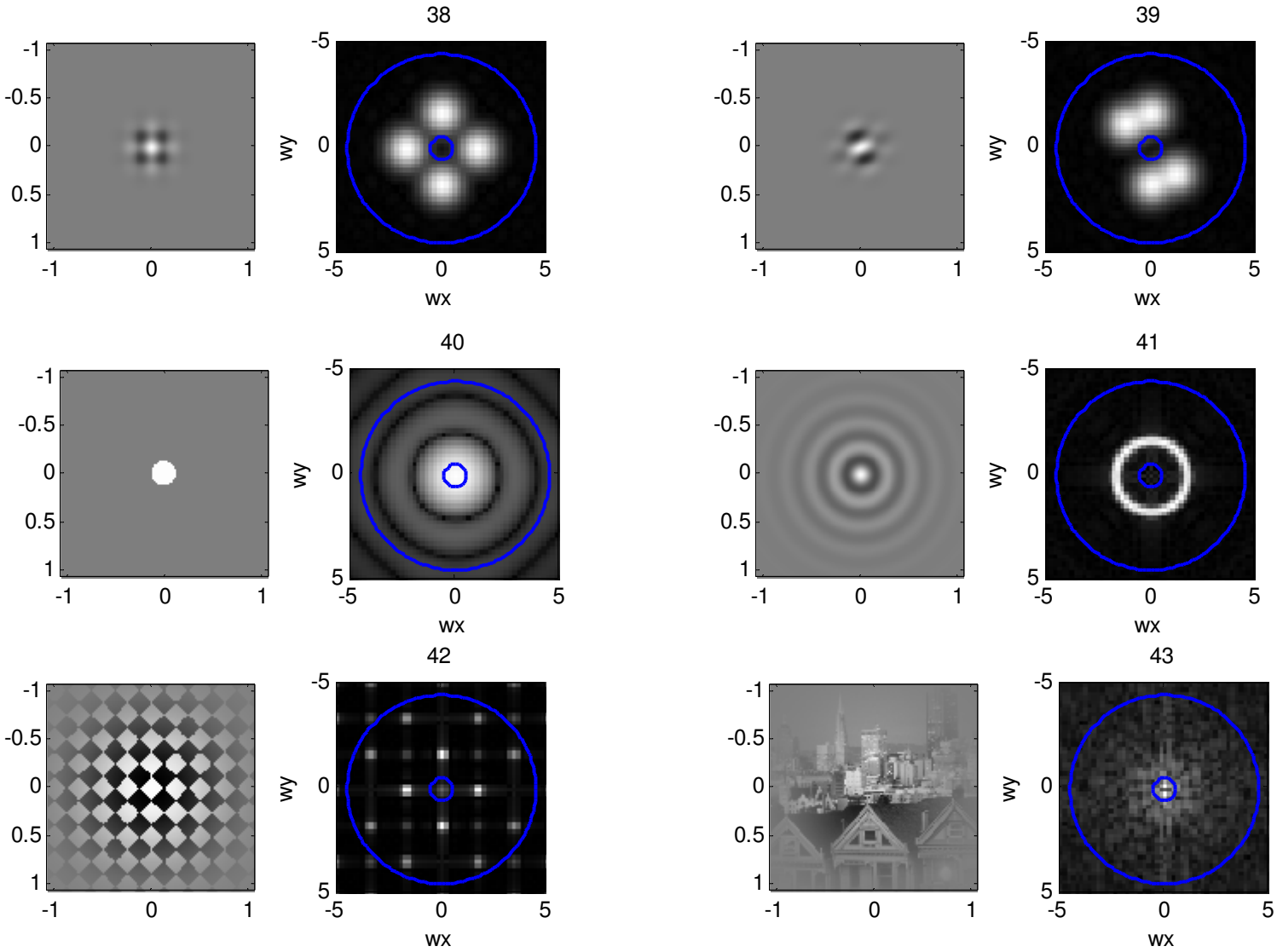
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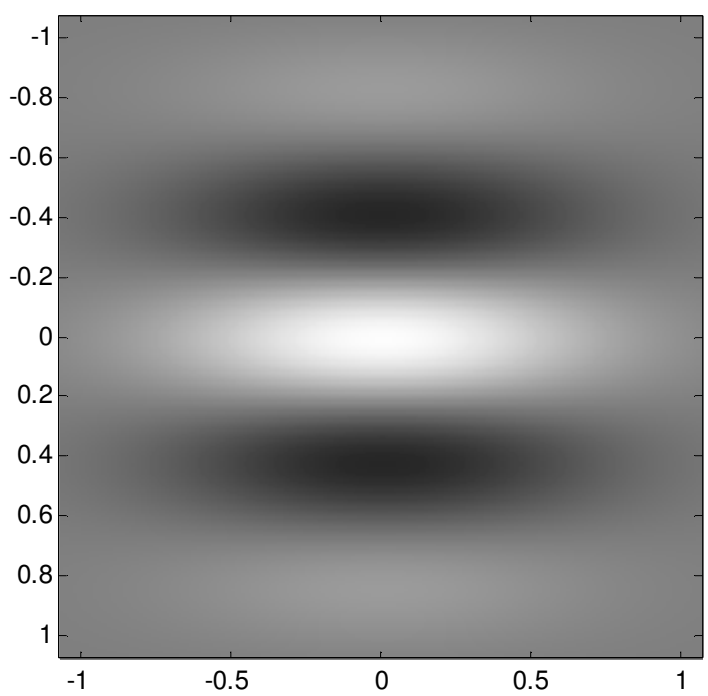
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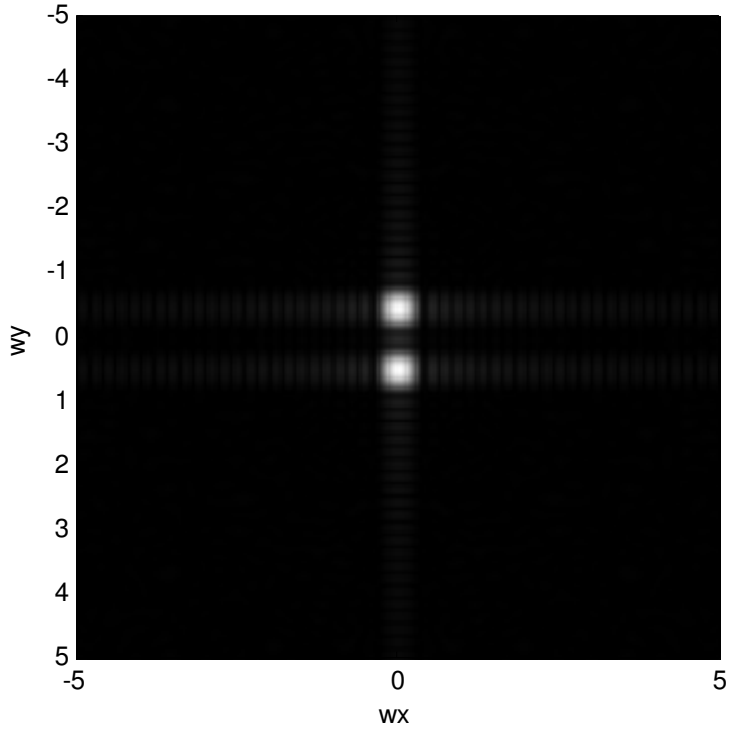
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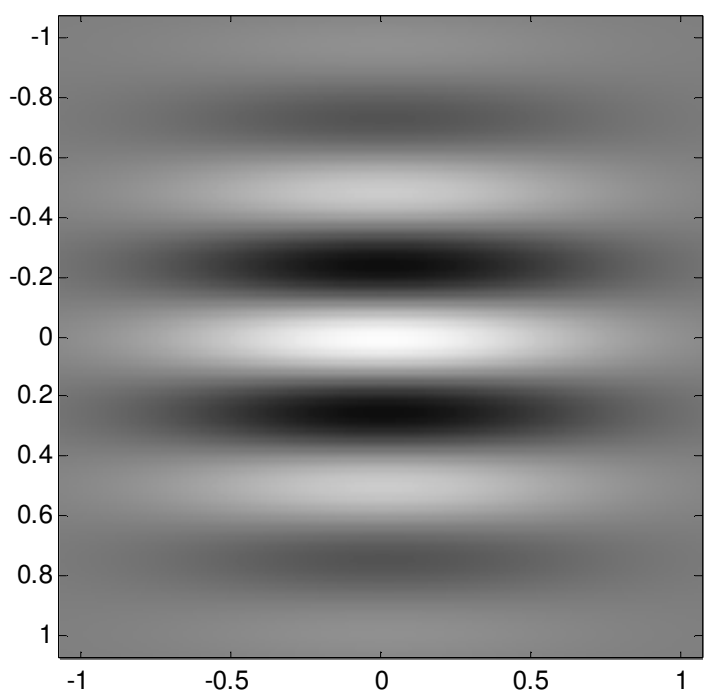
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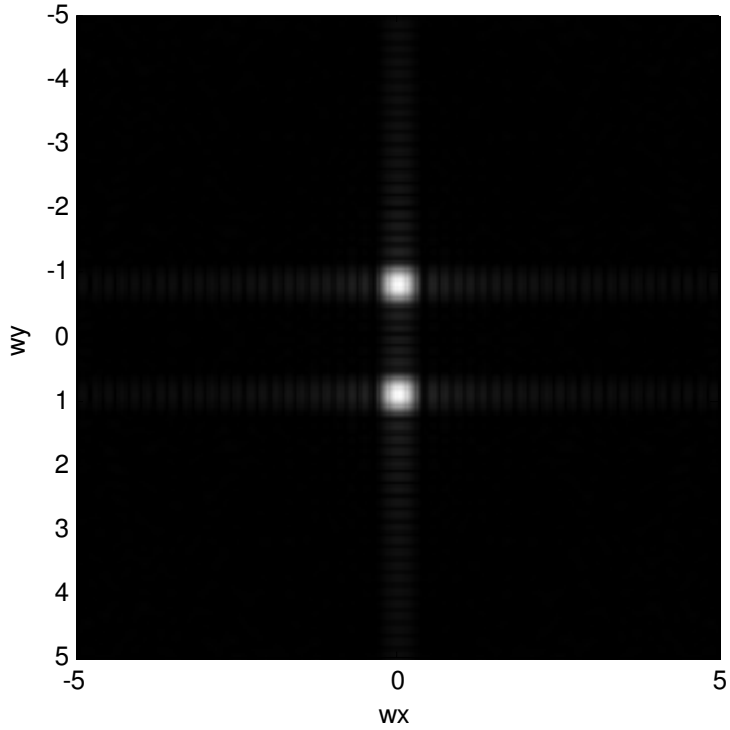
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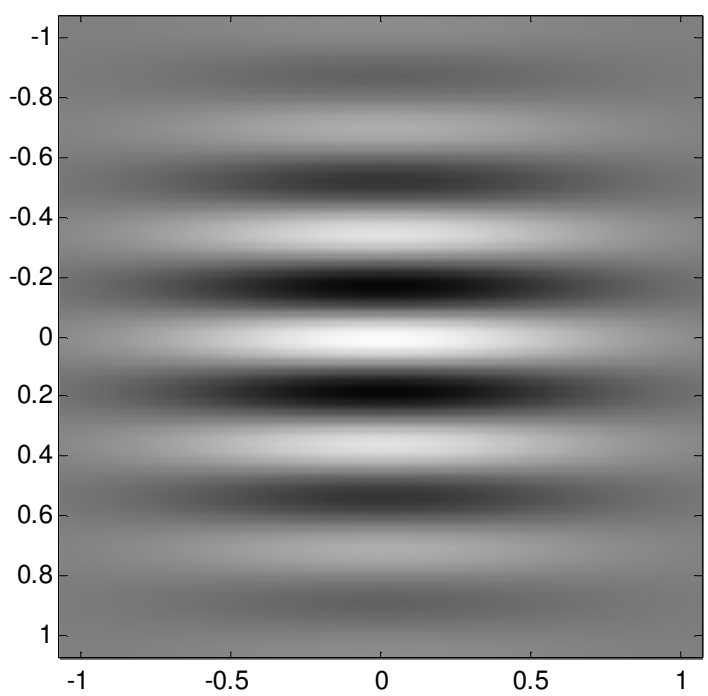
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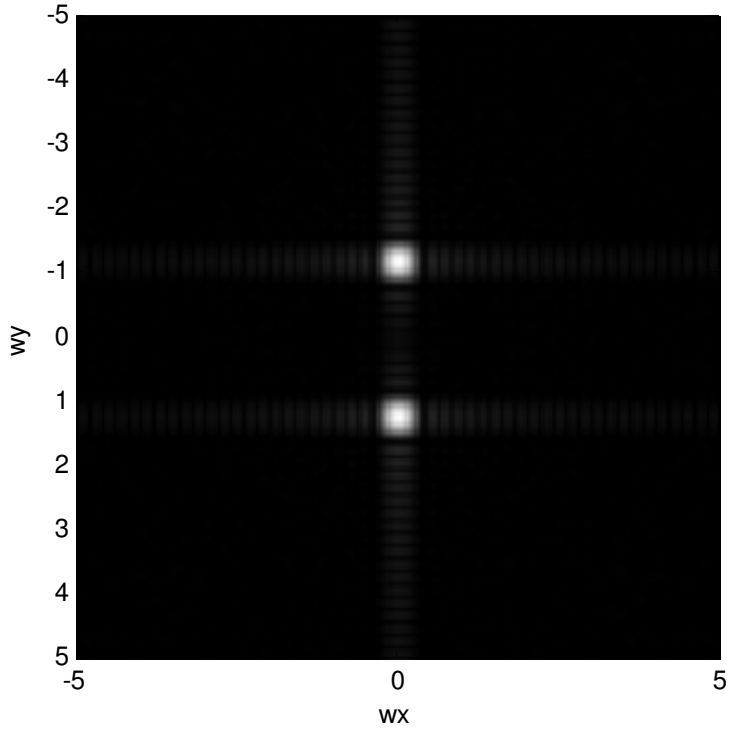
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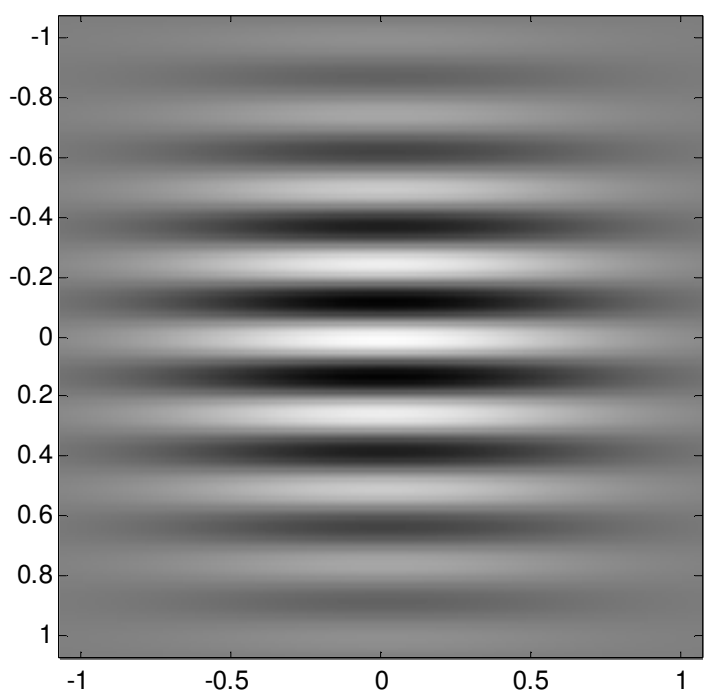
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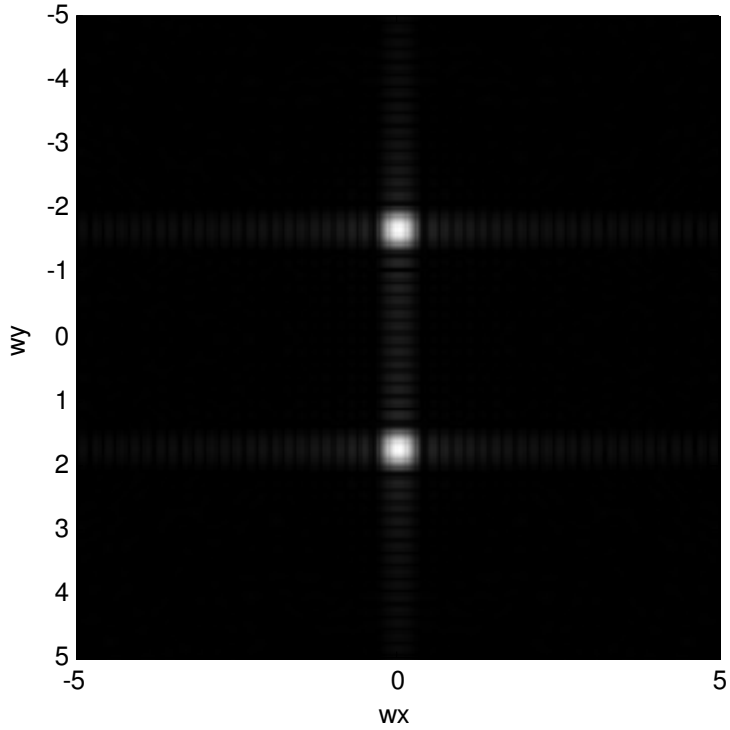
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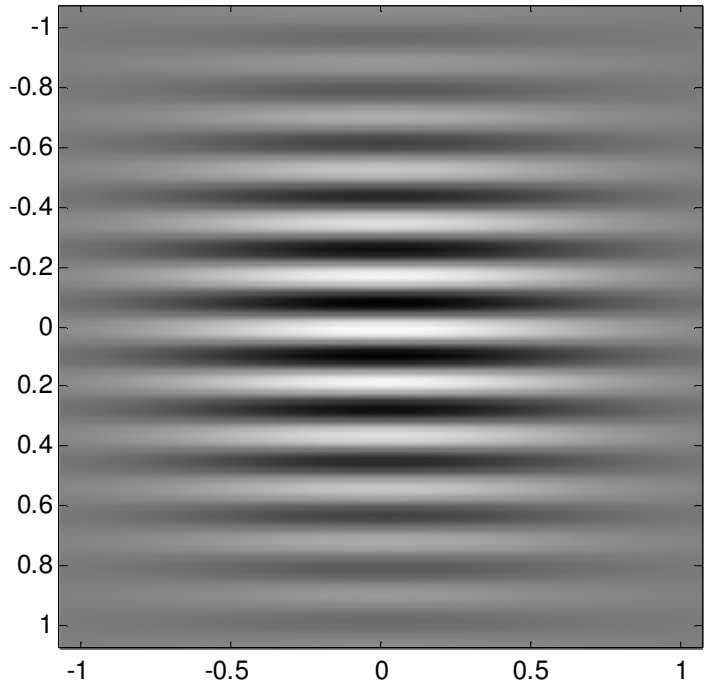
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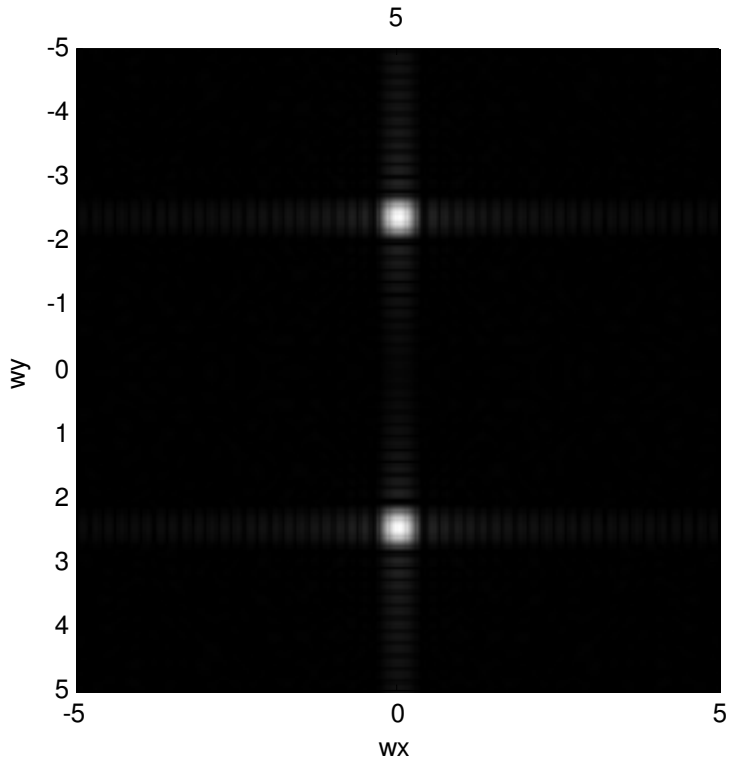
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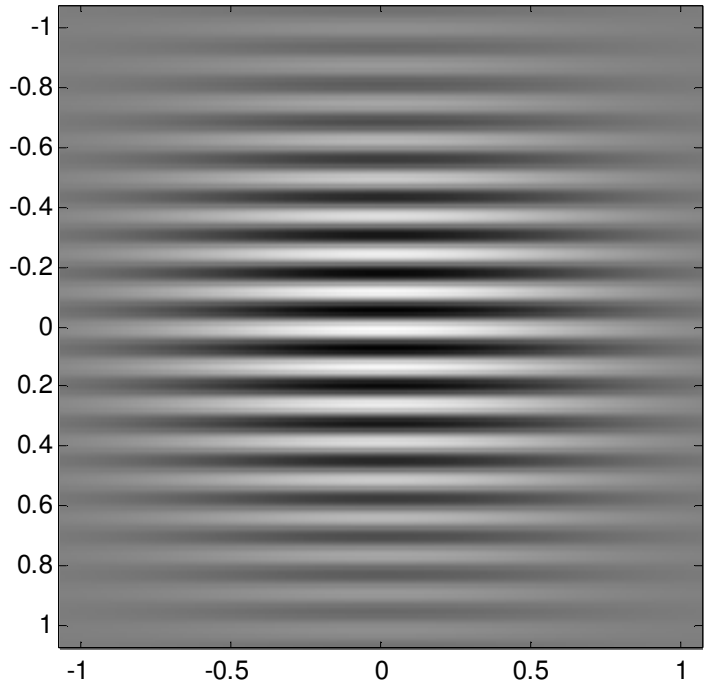
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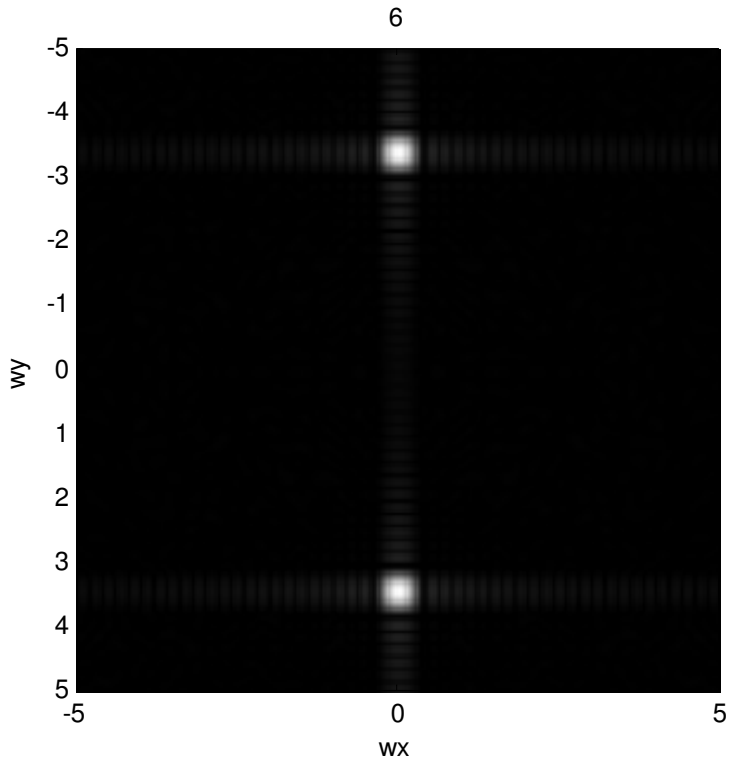
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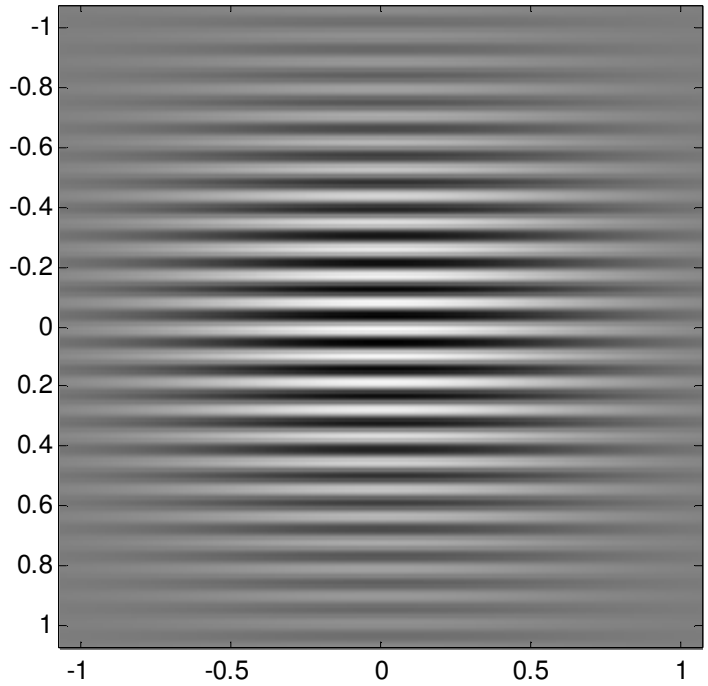
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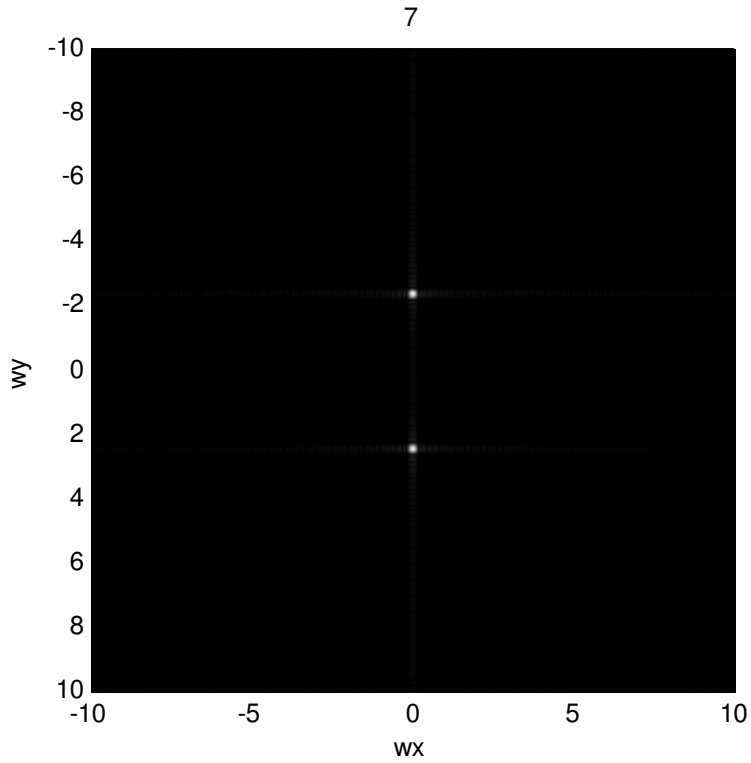
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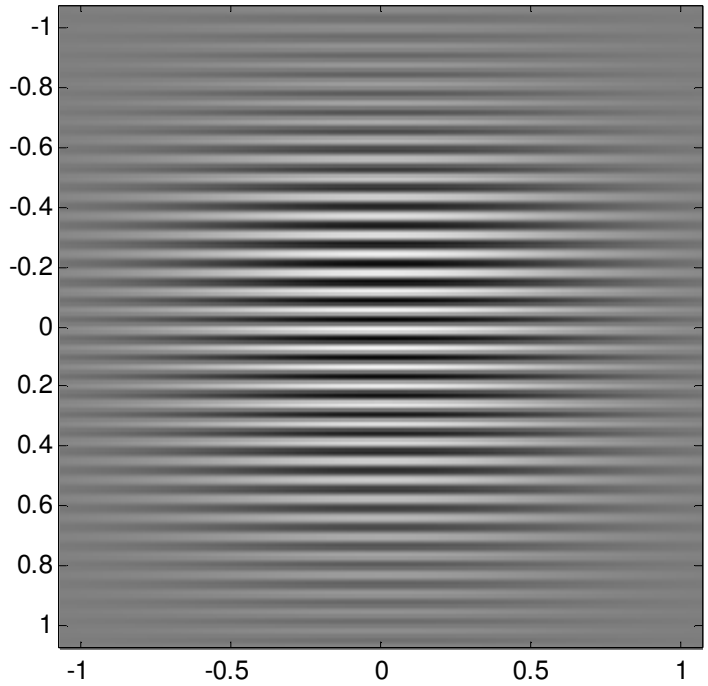
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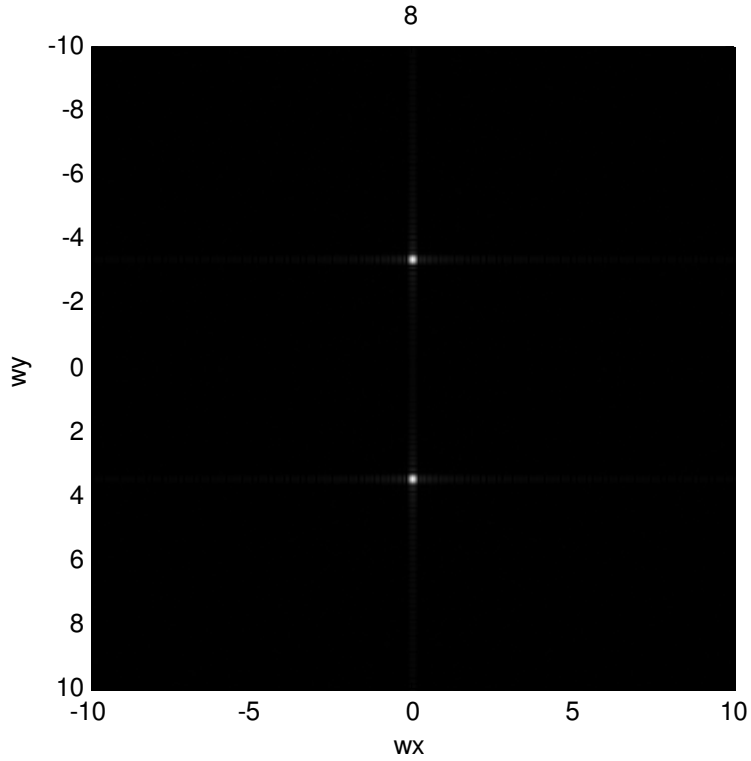
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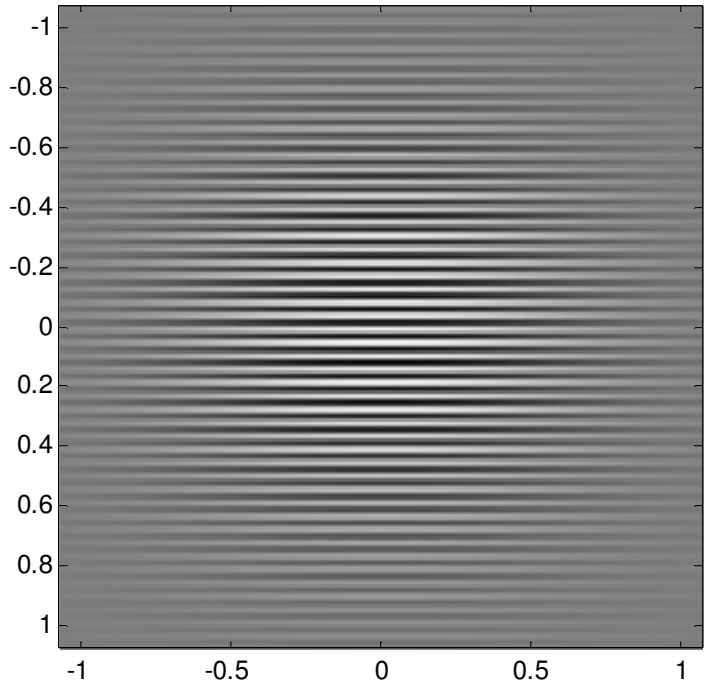
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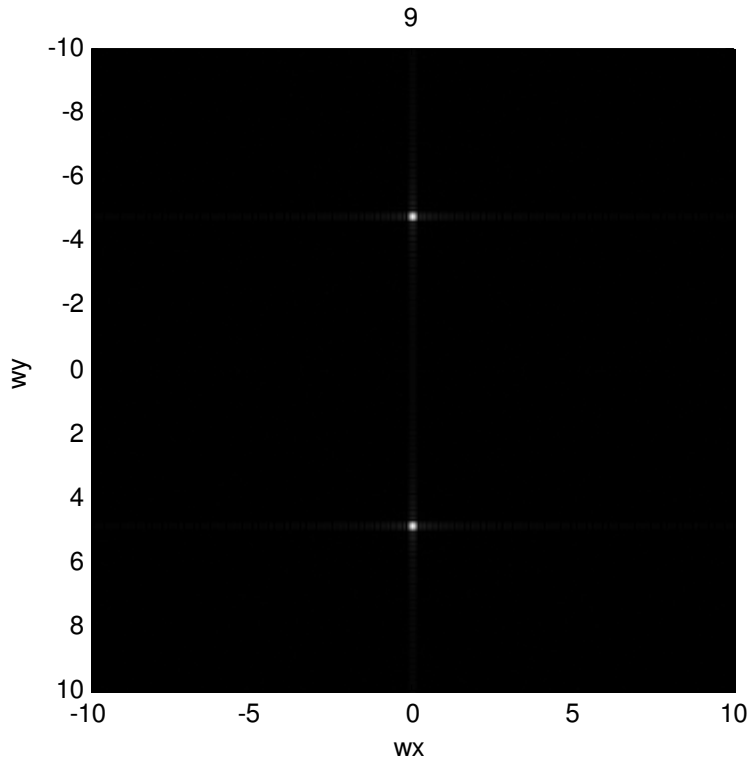
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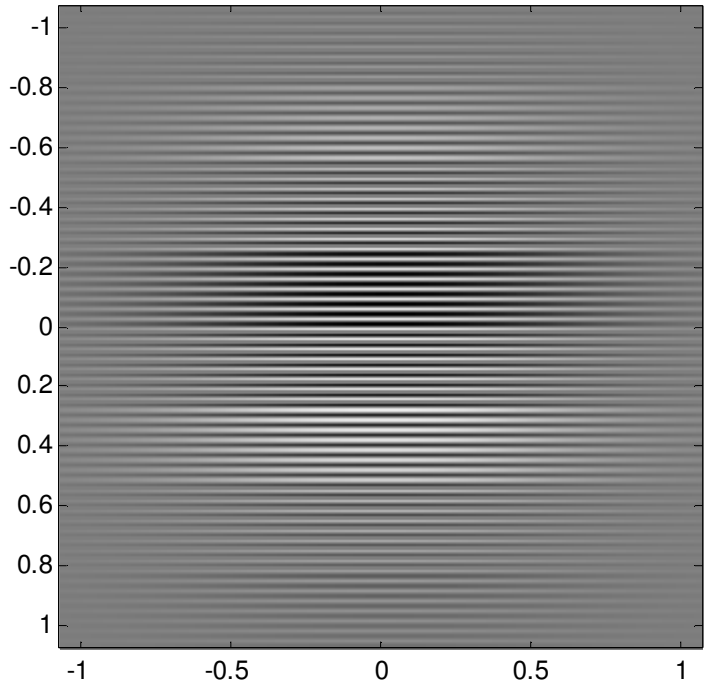
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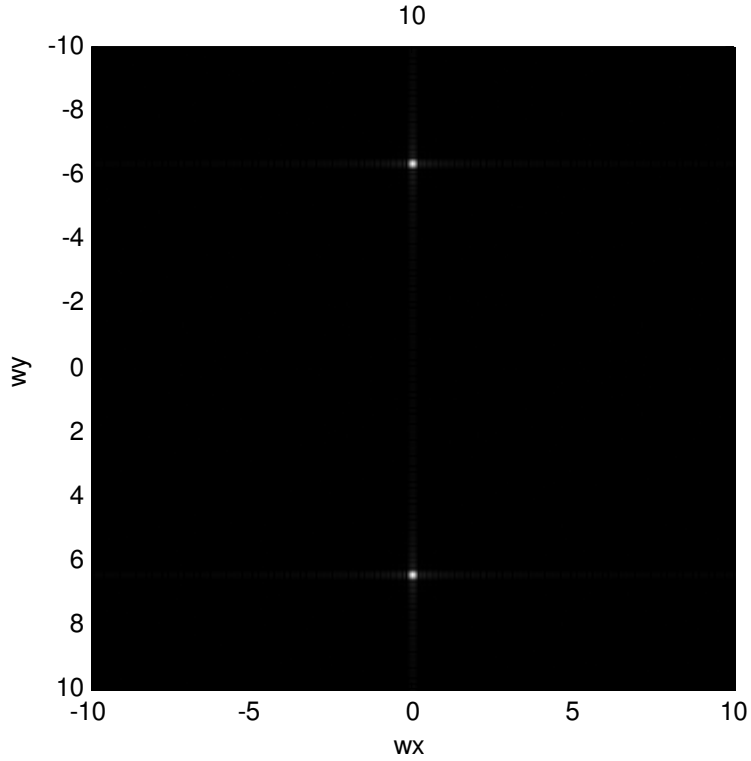
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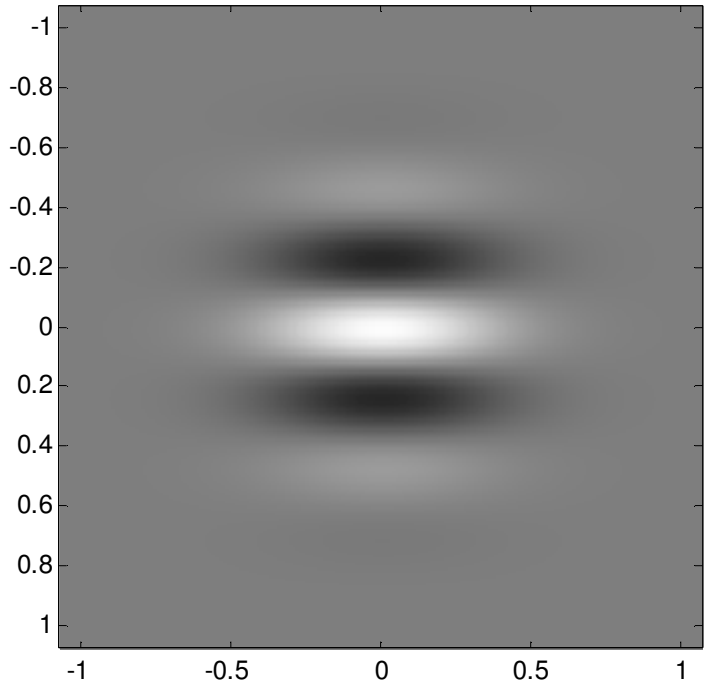
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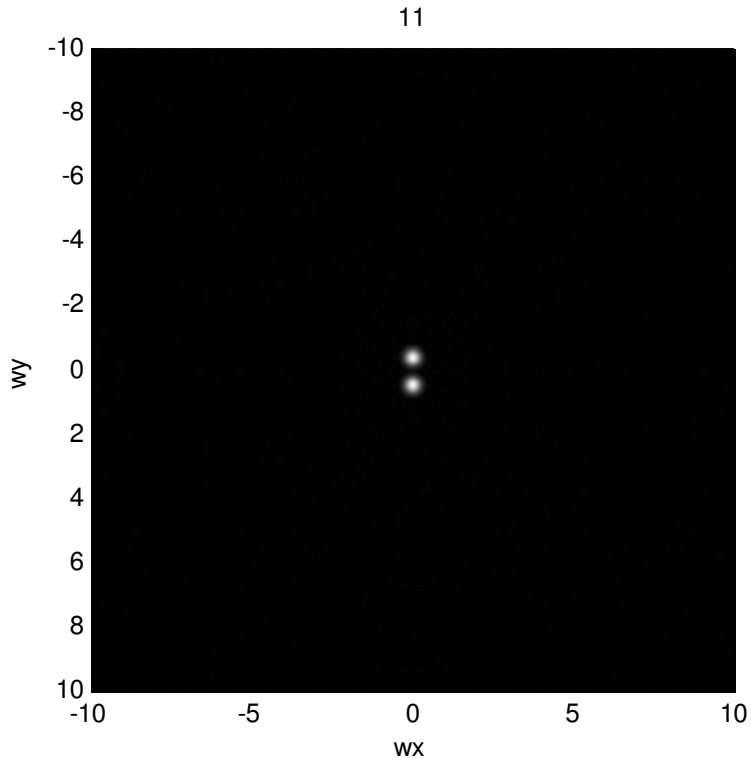
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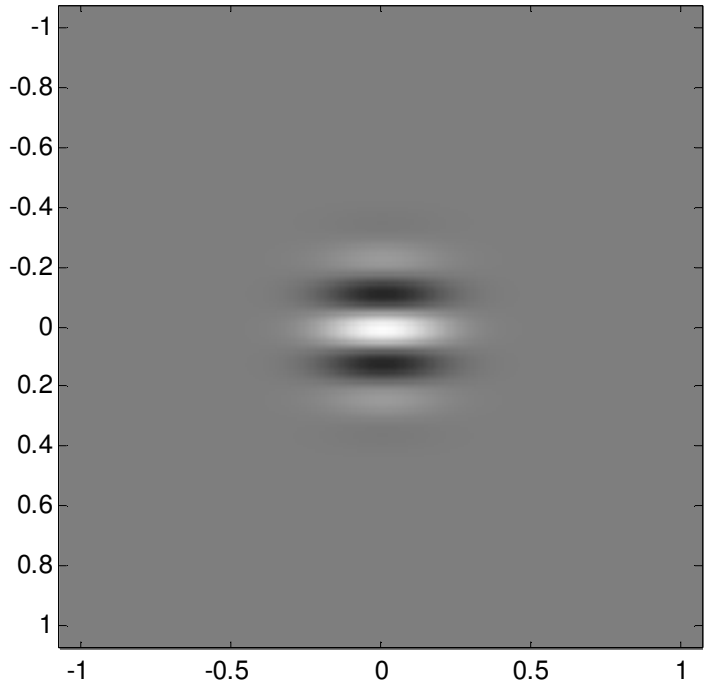
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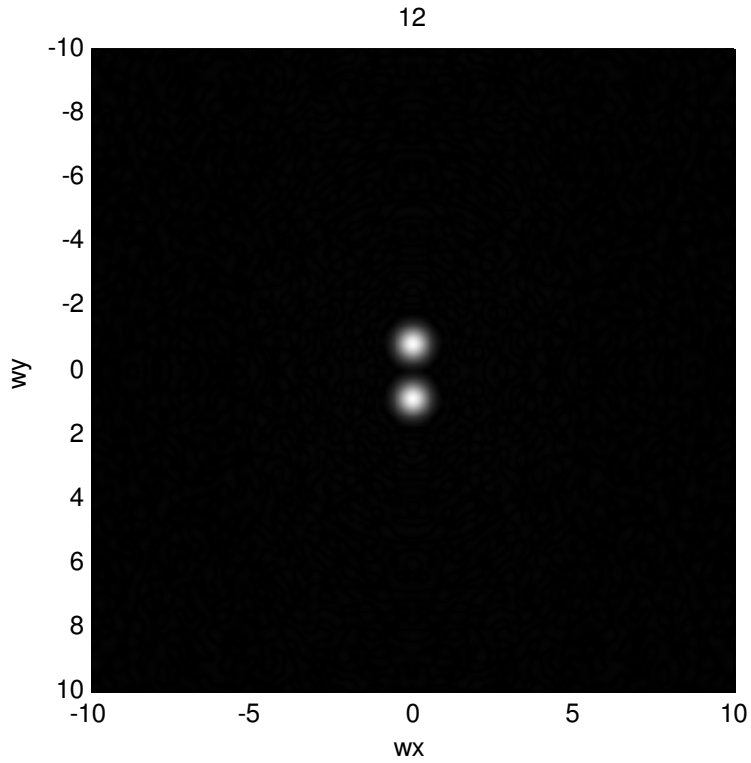
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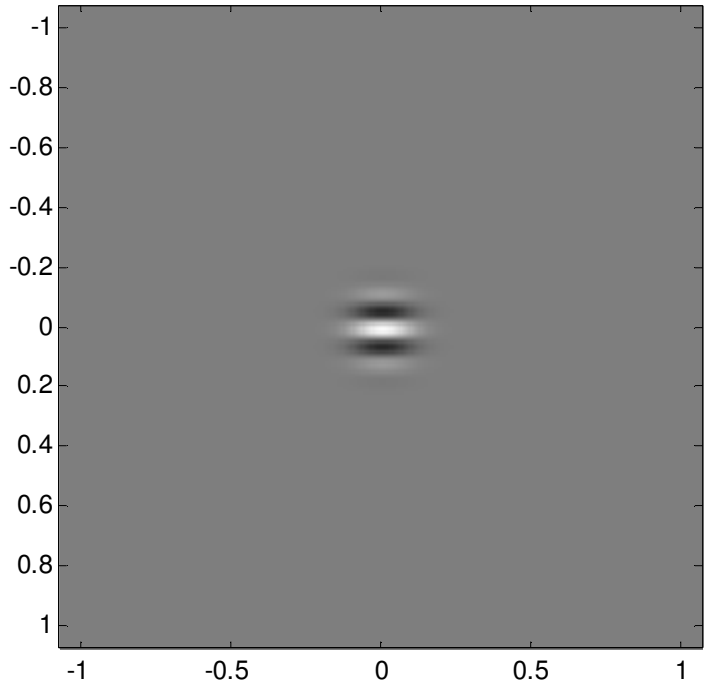
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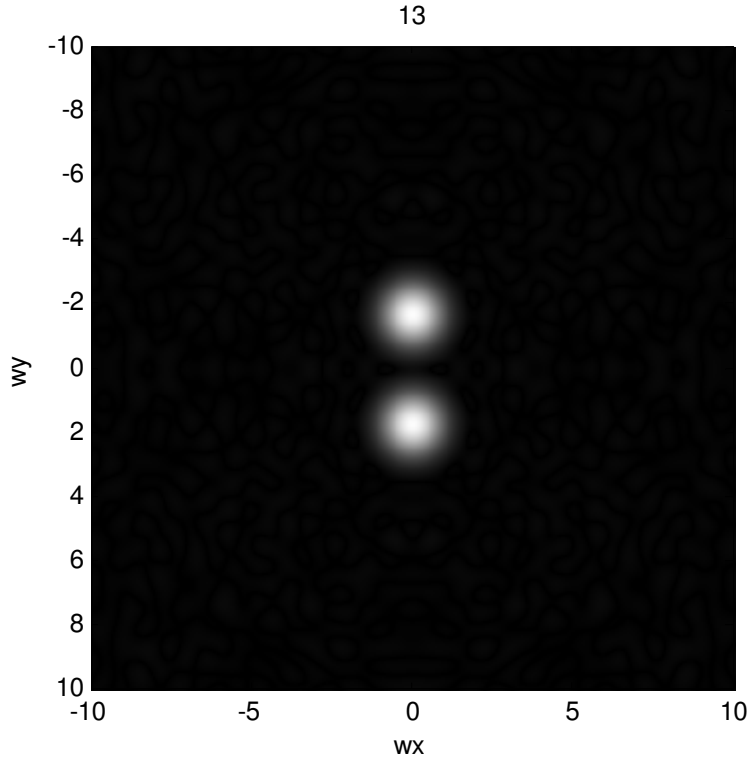
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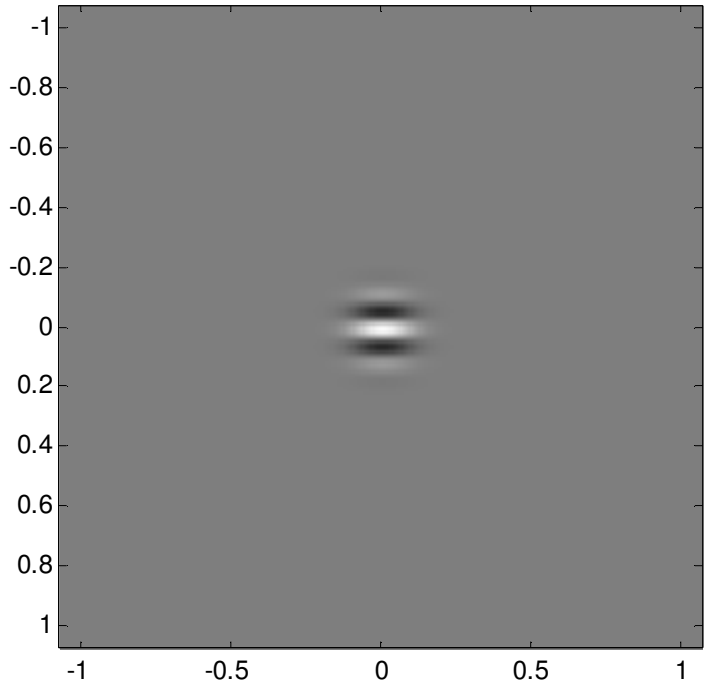
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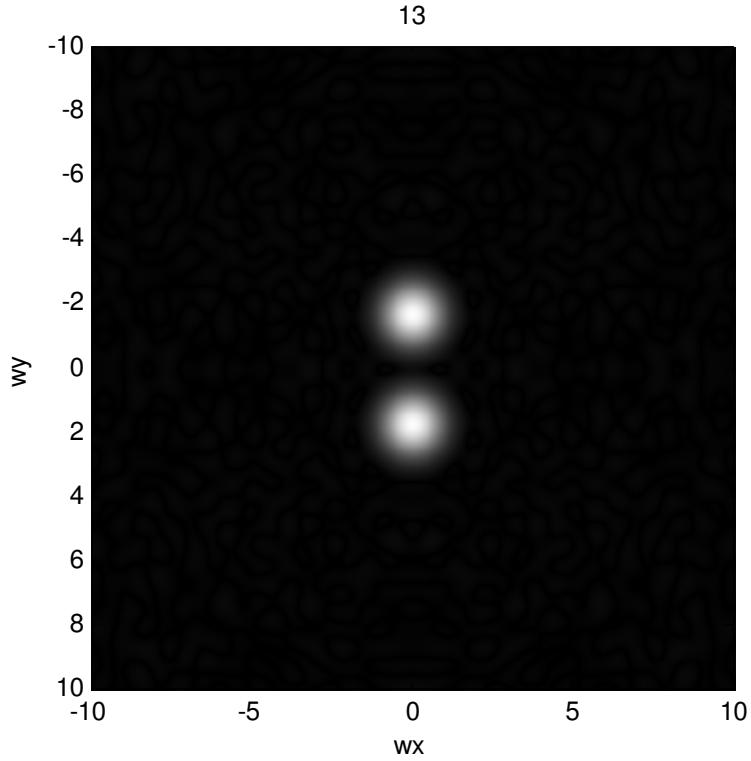
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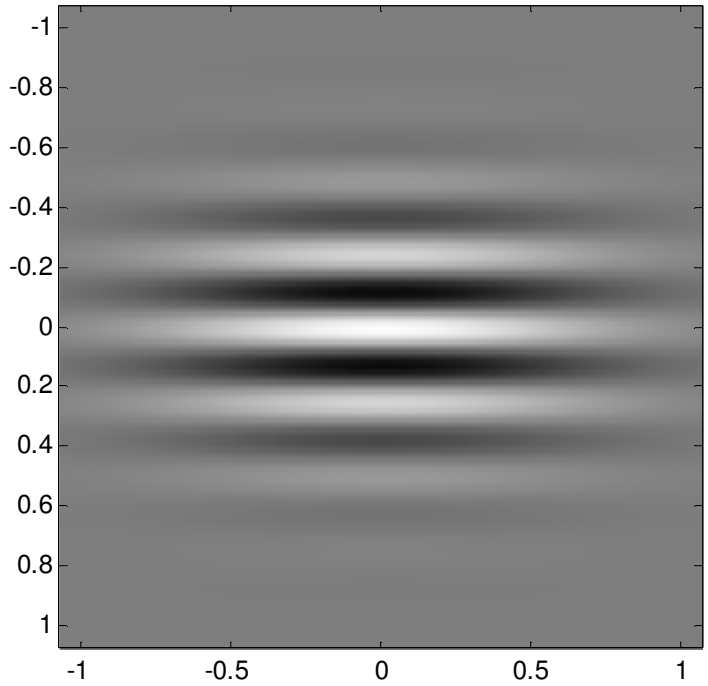
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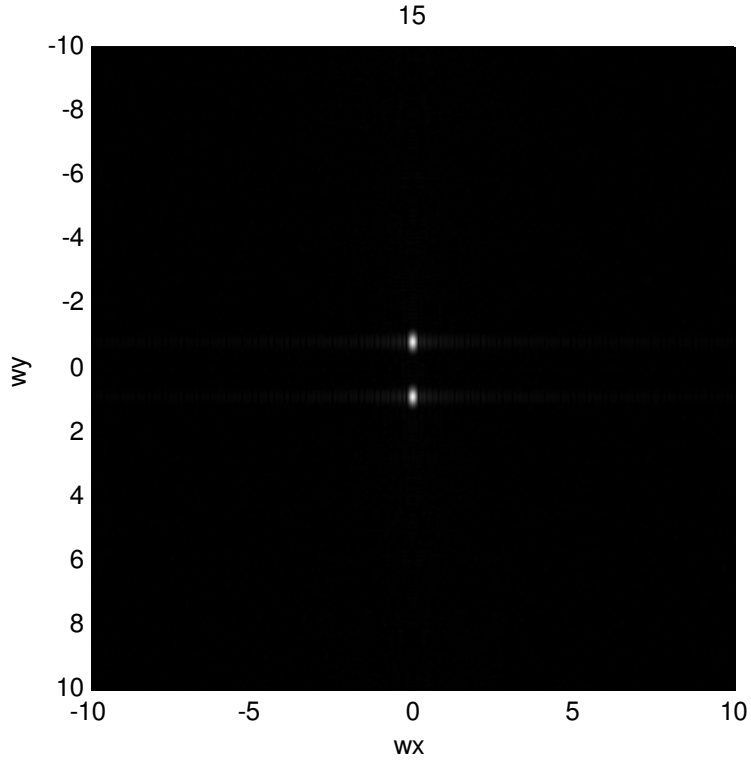
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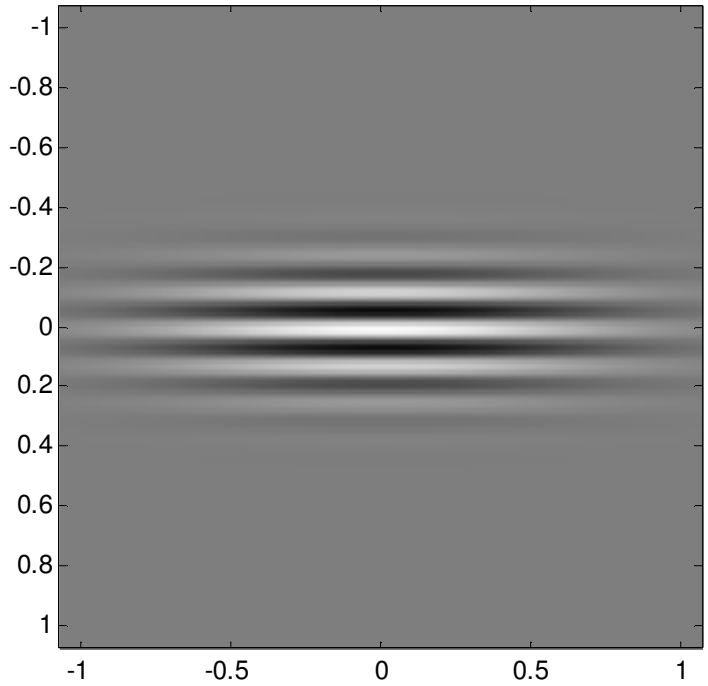
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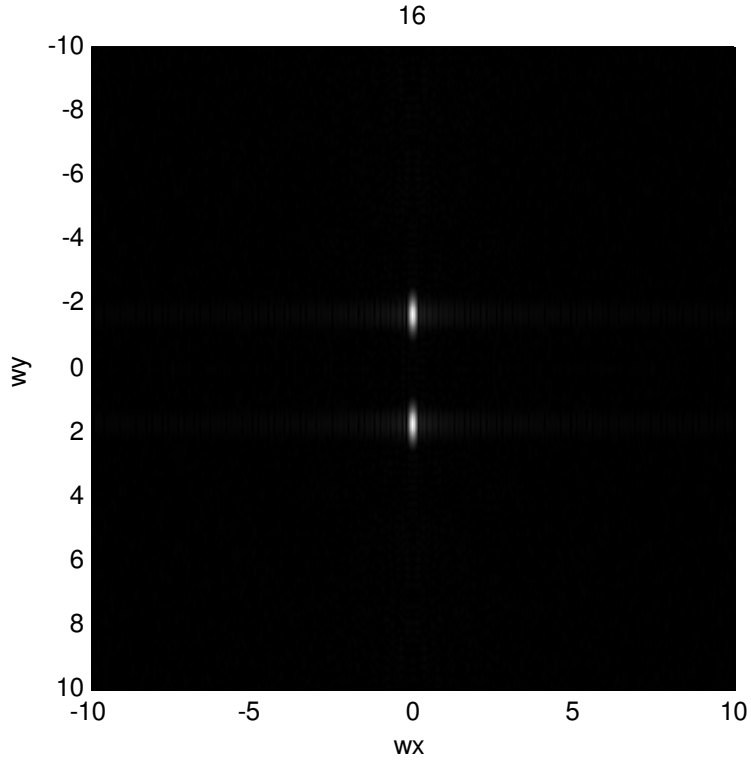
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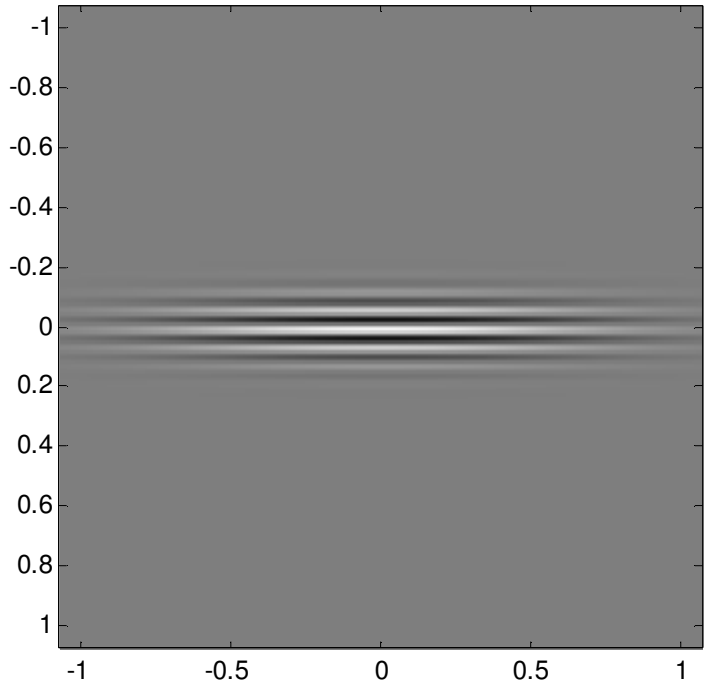
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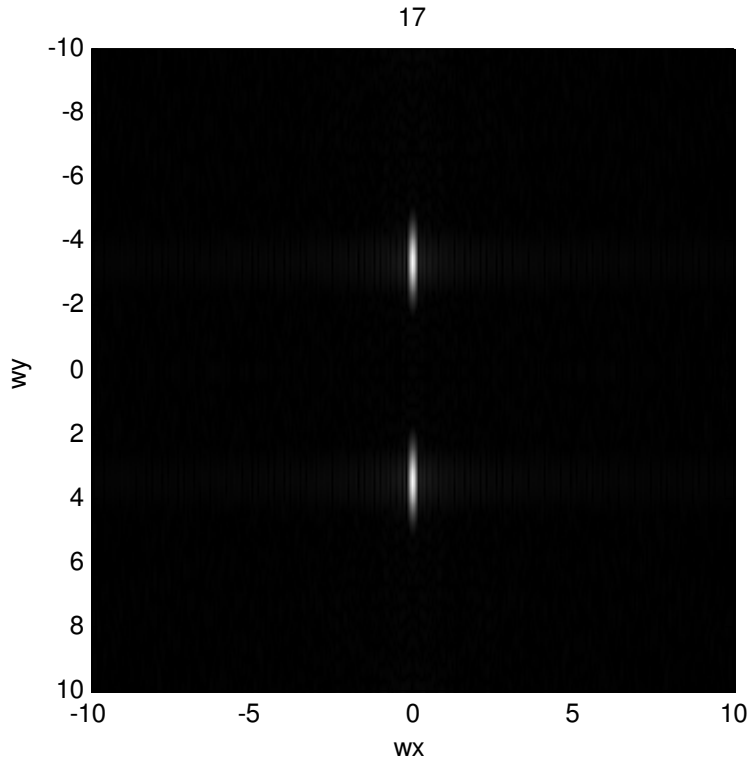
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