# Designing the Pupil Apodization for an IFS Lenslet Array

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# Outline

# Spectroscopy

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- This can be measured using a single slit spectrograph.

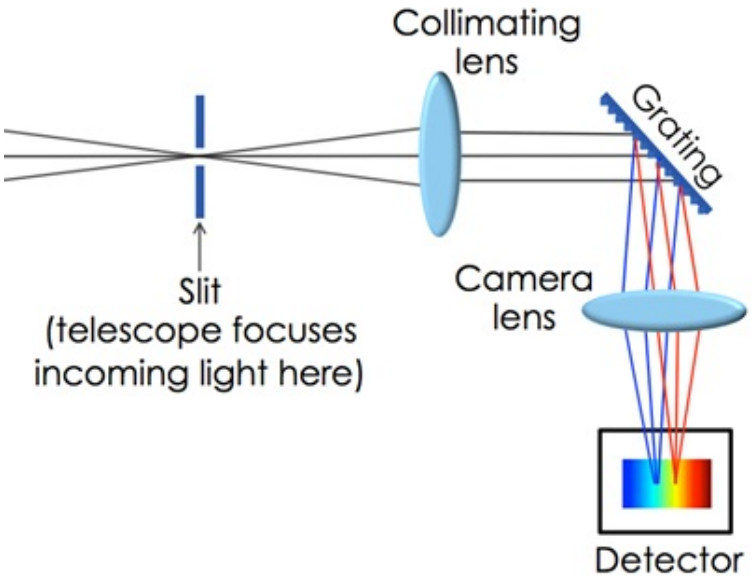


Figure: Single Slit Spectrograph

# IFS

- The slit in a single slit spectrograph can be replaced by a lenslet array to form an integral field spectrograph (IFS).

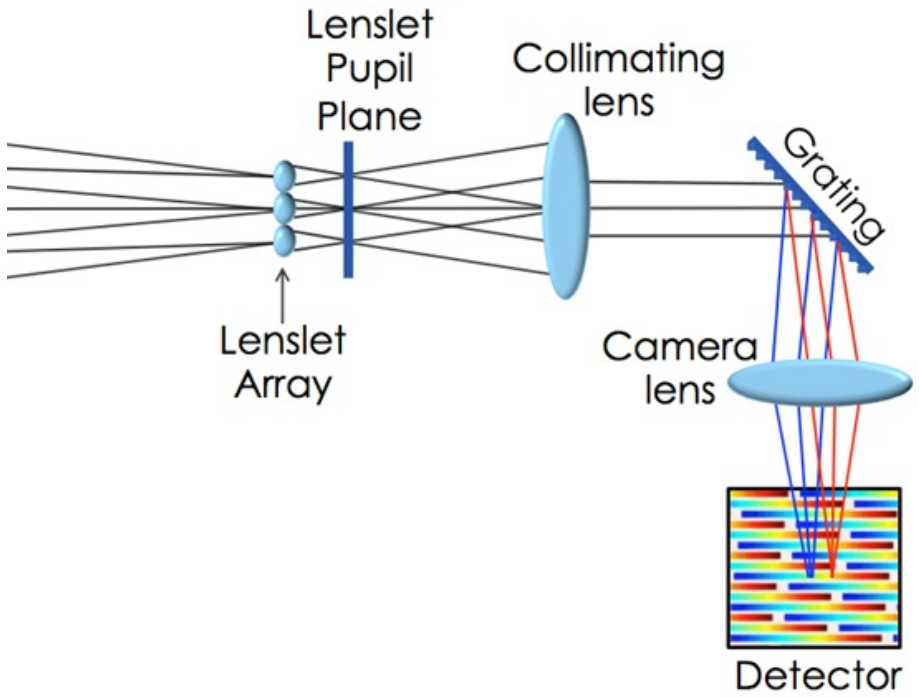


Figure: Integral Field Spectrograph

# Why?

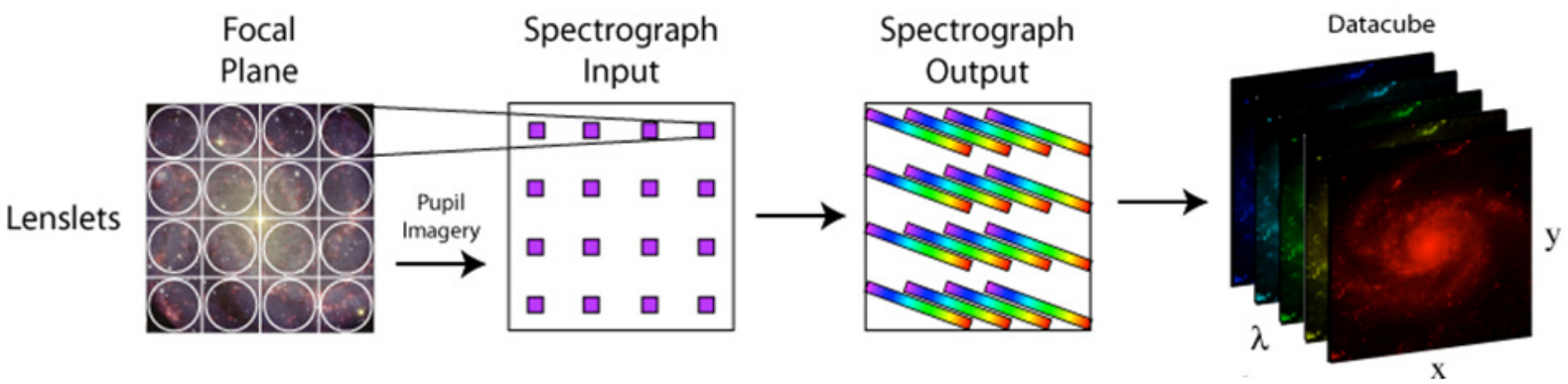


Figure: Imaging Galaxies

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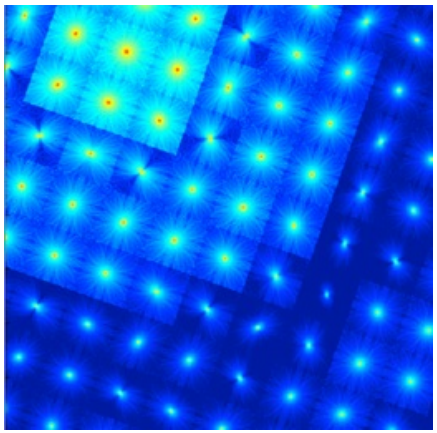
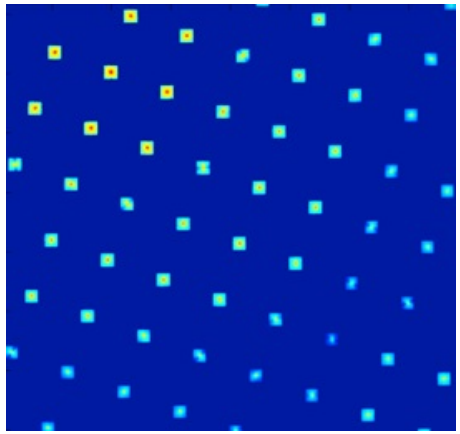


Without Aperture Mask



With Aperture Mask

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# The Lenslet Array

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  The Point Spread Function describes how a point source of light is resolved in the image plane.

- One approach to preventing the light from one lenslet from spilling into another is to apodize (tint) the array.
- A proper apodization of the lenslet array would cause the PSF of each lenslet to taper off to negligible amounts at its edges.

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Design an apodization that

- prevents unwanted cross talk between the lenslets,
- does not reduce the throughput too drastically,
- and is "smooth enough" to allow for physical realization.

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- We want to maximize the amount of light that passes through each lenslet.
- We also want to minimize the extent to which the PSF of each lenslet interferes with that of its neighbors.

# Some Specifics

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- Thus, we will be forced to solve 2 dimensional Fourier Transforms in the process of optimizing our model.
- This is a rather computationally intensive process and quite time consuming.
- However, square lenslets and pinhole apertures allow us to use symmetry to reduce the complexity of our problem to a single dimension.

# Apodization Function

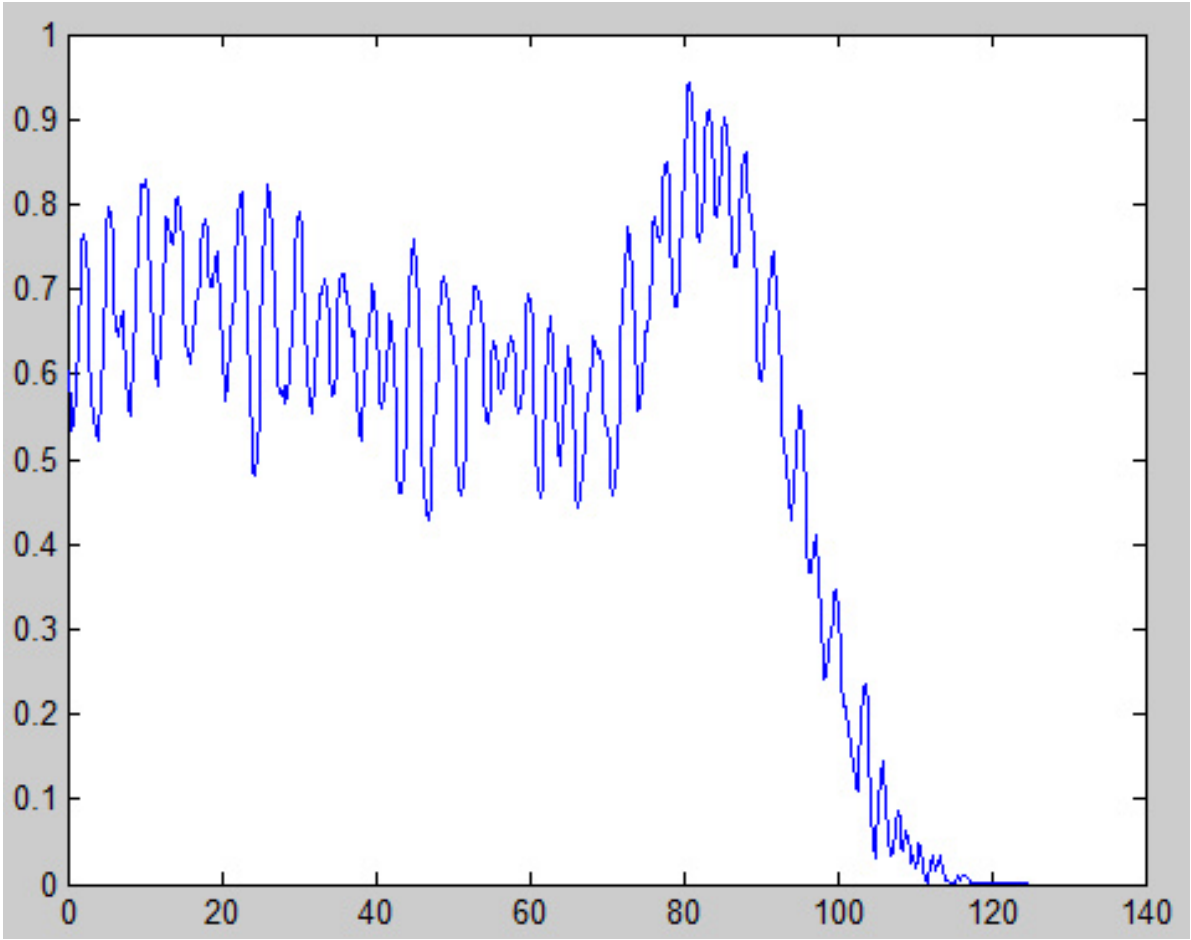


Figure: First Try

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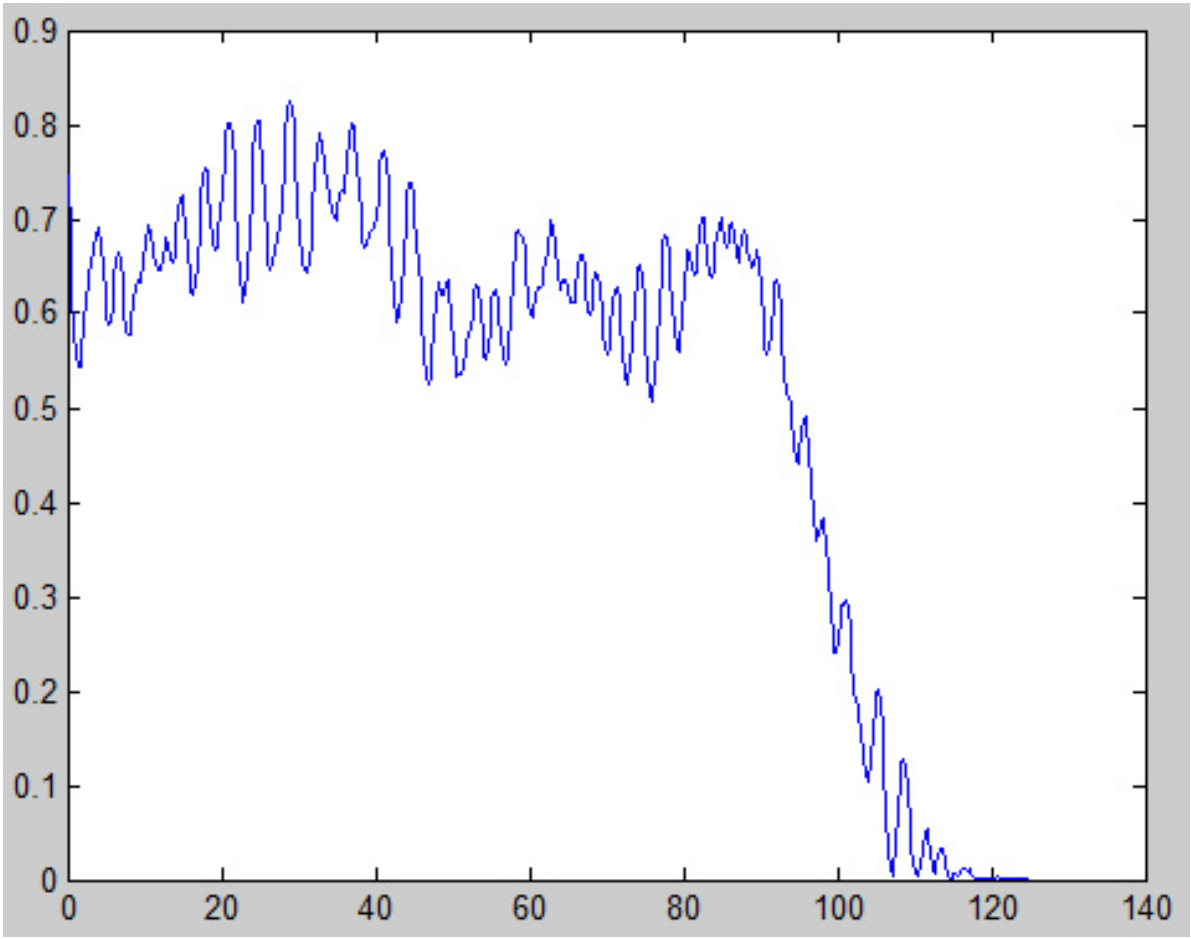


Figure: Adding a Smoothness Constraint

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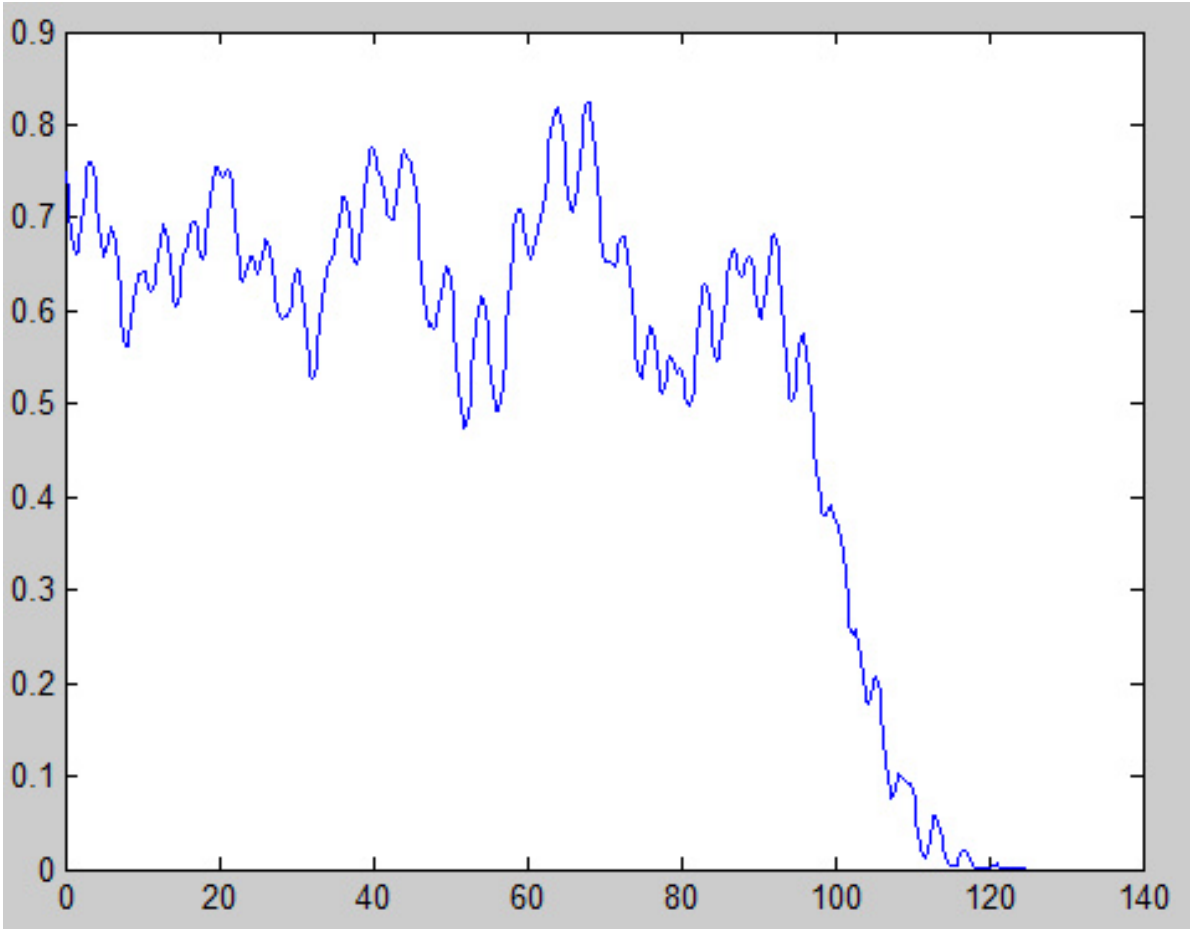


Figure: A Smoother Apodization

# Apodization Model

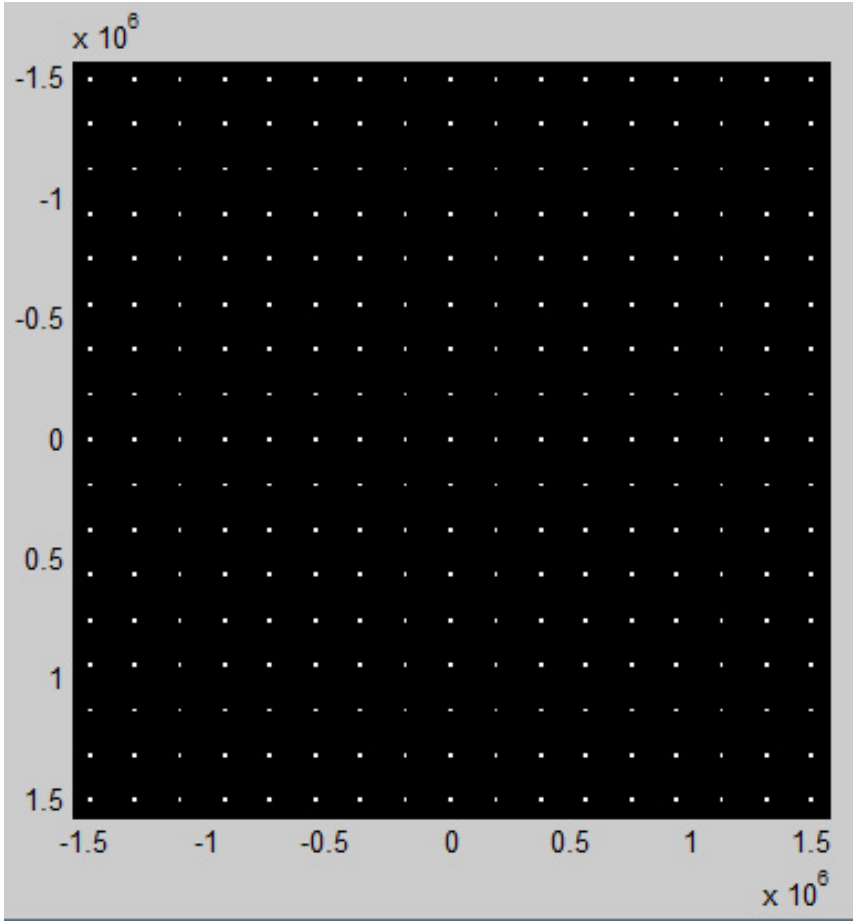


Figure: Pinpoints of Light

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