Phys-ga2000: Point Spread Function of a Telescope

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(Dated: November 22, 2023)

UNCHAGED FROM FIRST DRAFT When light enters a telescope, in the ideal on-axis case, it will all be focused to a single point. But, due to the wave properties of light, instead of going to a point it will form a finite image at the focus. How and where the light will be focused depends on what is known as the point spread function of the telescope. The point spread function depends on different properties of the telescope such as the shape of and imperfections in the telescope. By convoluting the point spread function with an example incoming light source we can produce an example image that would be produced by the telescope. In this paper we go over how to calculate and different use cases for the point spread function in different situations.

I. INTRODUCTION

The image formed is the squared amplitude of the complex pupil function: $P(x,y) = P_r(x,y)e^{\frac{-i2\pi W}{\lambda}}$

A. Prep work

(J1 calculation)
(analytic solution to cassegrain design)

II. CALCULATING IDEAL PSFS

(comparison of circular aperture analytic solution vs fourier transform computational result)

(description of cassegrain telescope and hubble telescope, comparison of computational struts and comparison to hubble images)

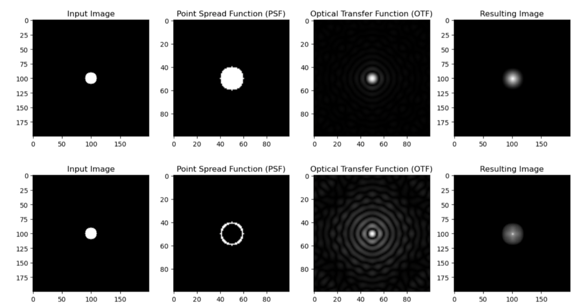

FIG. 1. Circular aperture vs. Cassegrain telescopes

III. CALCULATING PSFS IN IMPERFECT SYSTEMS

(Gaussian random field discussion and calculation)
(Atmospheric Gaussian random field aka low power spectrum removal)
(Many combinations of gaussian random field psfs to show long exposure results)

IV. DISCRETE VS FAST FOURIER TRANSFORM RESULT

(FFt requires large grid with many zeros, using a discrete fourier transform you do not have to pad a large grid with many zeros. how do these results differ?)

V. DISCUSSION