

Department of Physics & Astronomy

Sourpouhi Bedikian

Mentor: Reshmi Mukherjee

## What is the Points Spread Response Function for a High Energy X-ray Telescope Contaminated with Dust and Epoxy Fallout?

By finding the point spread response function of scattered x-ray light from particles, the first step towards answering pressing questions in the x-ray telescope community can be completed. With insight to the PSF, deeper and more imperative questions regarding high energy telescopes can be tackled. Future deductions will give answers to the questions: What is the effect of dust on the next generation x-ray telescopes?, and 'What clean room standards must be kept to ensure the degradation by fallout remains negligible?' This is the leading motivation behind this manuscript. To find the point spread response function, theoretical research was done on scattering effects by particles with size to the order of micronic size. Principles from electro-magnetism and scattering theory were used. Currently, this paper is being used to code detailed IDL functions to determine the PSF. Early estimations of the answer lie between 1 and 15 arcseconds. While this is not a negligible amount in the High Energy Focusing Telescope(HEFT), whose average PSF before the first air born flight was about 70 arcseconds, it is not a detrimental setback. For the next generation telescopes, however, a spread of as much as 5 arc seconds could be extremely destructive to the clarity of images. As of now, second generation telescopes have the potential to slim their spreads to a few arcseconds. In fact, improvements on technology are already giving rise to high precision telescopes like Nuclear Spectroscopic Telescope Array(NuSTAR). Soon enough, if the problem of dust, epoxy fallout, and contaminants is not addressed, experimental astrophysics will need to come to a halt. Inspiration for this project, the determination of a point spread response formula, comes from these considerations. The determination of the PSF is the first, and most crucial, step in determining future theories and solutions. This issue has not been widely researched as far as I am aware, and a paper of this nature will come in handy to many future scientists.