

# X-Ray Based Analysis of the “Changing-Look” Galaxy NGC6418

LUCAS SHADLER  
Rochester Institute of Technology  
lxs2208@rit.edu

DR. ANDREW ROBINSON  
Rochester Institute of Technology  
axrsps@rit.edu

DR. TRIANA ALMEYDA  
Rochester Institute of Technology  
tra3595@g.rit.edu

February 13, 2017

## Abstract

*NGC6418 is a Seyfert I Active Galactic Nucleus (AGN) that has exhibited qualities of a rare “changing-look” galaxy. Infrared and optical observations in the B and V optical bands have demonstrated that 3.6 and 4.5 $\mu$ m flux variations lag behind the optical continuum with large variations in intrinsic luminosity. This behavior could be consistent with dust obscuration from a clumpy torus or a dusty cloud traversing the line of sight. The nature of this obscuration can be further quantified through analysis of the X-ray spectrum, which will provide insight into the derived spectral shape, X-ray luminosity, and hydrogen column density. Recent observational data from the X-ray Multi-mirror Mission (XMM) Newton telescope will be reduced and extracted through open-source analysis software to develop further conclusions on NGC6418.*

## I. INTRODUCTION

An active galactic nucleus (AGN) is the compact center of a galaxy which typically contributes a significant portion of the galaxy’s luminosity. Under the AGN unification scheme, it is believed that AGN are actually supermassive black holes centered in the galaxy, obscured by a dusty toroidal component. Galaxies can be further classified as Seyfert I, where the spectrum is broadened by obscuration, and Seyfert II, where the spectrum lines are very narrow and prominent. Seyfert classification was further classified by Donald Osterbrock in 1981, giving rise to Seyfert 1.2, 1.5, 1.7, and 1.9.

A galaxy’s properties can change over time in a way that affects the optical spectrum. A rare group of AGN experience significant changes in their spectrum such that their Seyfert classification changes. These galaxies are named “changing-look”, and they remain

the subject of further study.

## II. NGC6418

NGC6418 is a Seyfert I galaxy that has exhibited the qualities of a rare “changing-look” AGN. Infrared and optical observations in the B and V optical bands from the Spitzer Space Telescope have demonstrated that 3.6 and 4.5 $\mu$ m flux variations lag behind the optical continuum with large variations in intrinsic luminosity. These observations took data as NGC6418 shifted from a Seyfert 1.9 to a Type 1 and back within a 3 year span. In a observation of this character the variations are typically attributed to an AGN flare, where the luminosity undergoes a temporary increase or decrease in luminosity, or a change in the obscuration in the line of sight. However, the coherence in the optical and IR variations imply that both flare

and obscuration change may be contributing to the observations through the sublimation of dust.

### III. PROPOSED WORK

Data of the X-ray spectrum after NGC6418 had transitioned back to a Seyfert Type 1.9 has been collected from XMM-Newton. Aside from the XMM-Newton pre-processing dataset, the data needs to be reduced in order to extract significant quantities characterizing the spectral shape and conditions. Several open-source software packages, including XSpec provided by NASA, allow for the reduction of the data set. We will produce analytical quantities such as the Hydrogen column density and the X-ray luminosity so that the final transition state can be compared to the conditions before and during the “changing-look” transition. This will provide insight into the mechanism of the “changing-look” behavior.