

# First Constraints On The Local Heavily Obscured AGN Fraction With NuSTAR

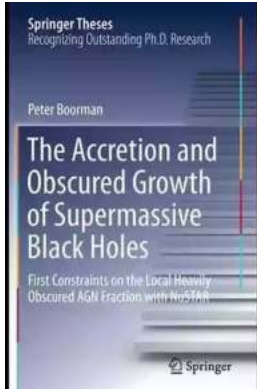


The study of Active Galactic Nuclei (AGNs) has been a fascinating field of research for astronomers around the world. AGNs are extremely luminous objects at the centers of galaxies, powered by supermassive black holes accreting surrounding material. They emit vast amounts of energy across the electromagnetic spectrum, making them visible from great distances. However, a significant fraction of AGNs are heavily obscured, making them challenging to study using traditional observational techniques.

## **The Importance of Studying Heavily Obscured AGNs**

Heavily obscured AGNs play a crucial role in shaping the universe we observe today. Not only do they provide essential feedback mechanisms in galaxy formation and evolution, but they also contribute significantly to the cosmic X-ray

background radiation. Understanding the properties, demographics, and nature of these objects is crucial for a comprehensive understanding of the overall AGN population and their impact on their host galaxies.



## The Accretion and Obscured Growth of Supermassive Black Holes: First Constraints on the Local Heavily Obscured AGN Fraction with NuSTAR (Springer Theses)

by Kevin Sivils(1st ed. 2021 Edition, Kindle Edition)

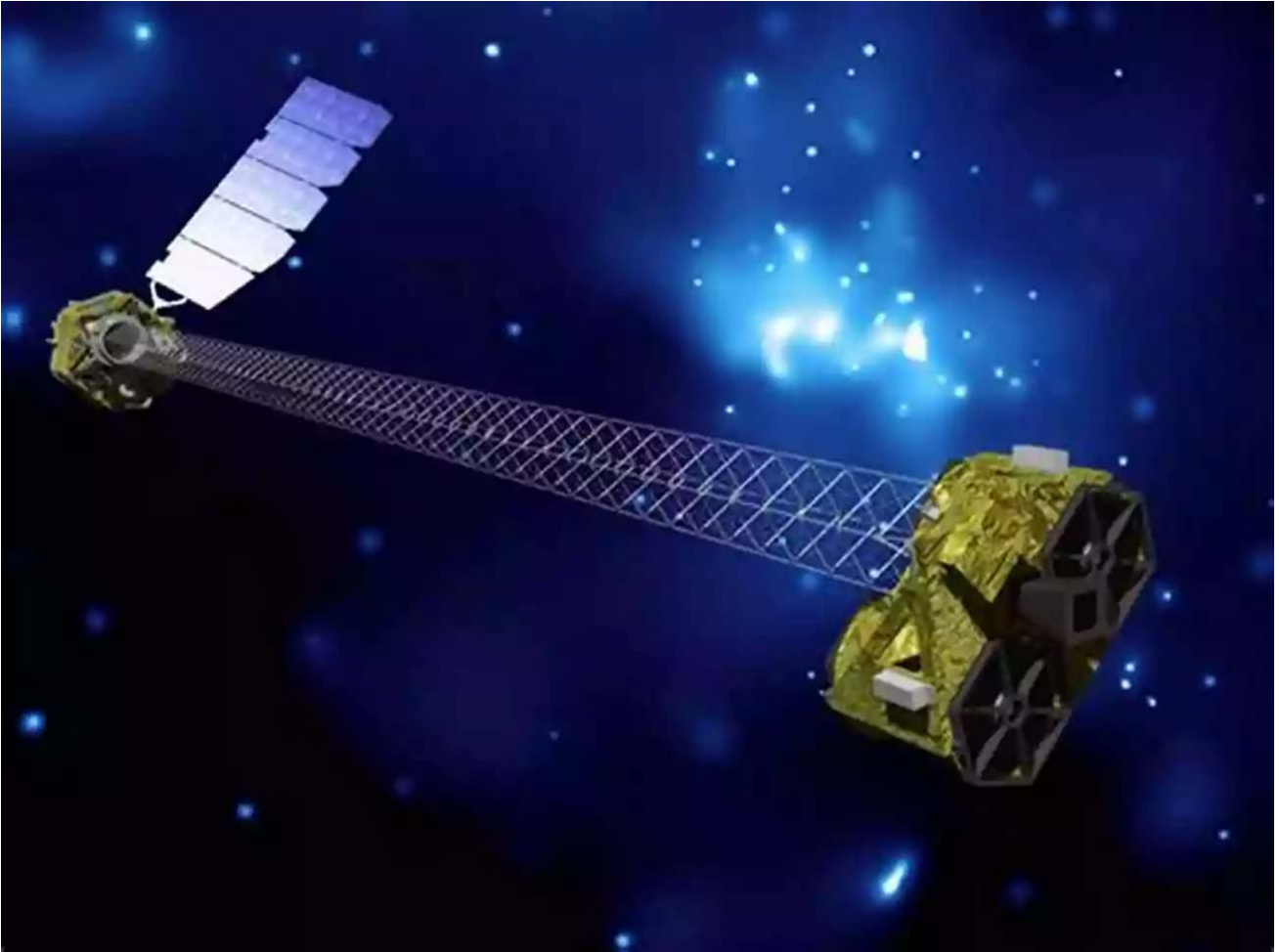
★★★★☆ 4.4 out of 5

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### to NuSTAR

NASA's Nuclear Spectroscopic Telescope Array (NuSTAR) is a space-based X-ray observatory launched in 2012 specifically designed for studying the high-energy X-ray universe. NuSTAR has provided astronomers with unique capabilities to probe the heavily obscured regions of AGNs by harnessing the power of focusing X-ray optics and high-energy sensitivity.



## **First Constraints on the Local Heavily Obscured AGN Fraction**

Recent research utilizing data from NuSTAR has unveiled the first constraints on the heavily obscured AGN fraction in the local universe. By observing a carefully selected sample of galaxies, researchers have been able to estimate the fraction of AGNs that were significantly obscured by dust and gas. These preliminary results are providing valuable insights into the prevalence and properties of these obscured objects, shedding light on their significance in the cosmic context.

### **Methodology and Key Findings**

The study employed a multi-wavelength approach, utilizing data from NuSTAR, along with complementary observations from other X-ray and infrared telescopes.

By cross-referencing different wavelengths, researchers were able to construct a more complete picture of the heavily obscured AGN population and determine their intrinsic characteristics.

The results showed that approximately 30% of AGNs in the local universe are heavily obscured, suggesting a significant population of these objects that were previously difficult to identify using traditional methods. Furthermore, the study revealed that the heavily obscured AGN fraction is more substantial in galaxy mergers and interactions, highlighting the role of these events in triggering AGN activity and obscuration.

### **Implications for AGN Unification Models**

These groundbreaking findings have significant implications for AGN unification models, which aim to explain the observed diversity in AGN properties based on a unified physical framework. The discovery of a substantial population of heavily obscured AGNs challenges the traditional unification models, suggesting that the obscuration mechanism may be more complex than previously thought.

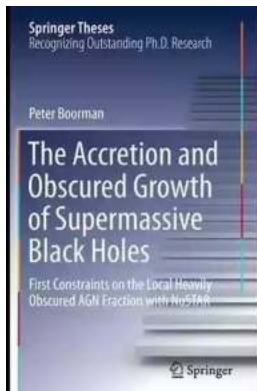
### **Future Prospects with NuSTAR**

The success of NuSTAR in constraining the heavily obscured AGN fraction in the local universe encourages further investigations using more extensive datasets and refined analysis techniques. Future surveys with NuSTAR and upcoming X-ray observatories will contribute to a more comprehensive understanding of the nature and demographics of obscured AGNs, helping astronomers unravel the mysteries of their formation and evolution.

The first constraints on the local heavily obscured AGN fraction obtained with NuSTAR have opened up exciting new avenues of research in the field of AGN studies. By providing valuable insights into the demographics and properties of

these hidden objects, this research paves the way for a deeper understanding of the overall AGN population and their impact on galaxy evolution. With the advancements in observational techniques and upcoming X-ray missions, the study of heavily obscured AGNs is set to witness remarkable progress in the coming years.

Image sources: NASA



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This thesis describes the application of state-of-the-art high-energy X-ray studies to the astronomical quest for understanding obscured active galactic nuclei (AGN). These AGN are supermassive black holes growing by accretion of matter located in the nuclei of galaxies. The material that feeds these black holes also obscures them from view, rendering them challenging to study. It is possible to study them by effectively 'X-raying' galactic nuclei to peer through these

obscuring veils. Beginning with the proof-of-concept application of novel X-ray Monte Carlo codes to the Nuclear Spectroscopic Telescope ARray (NuSTAR) spectrum of a known heavily obscured AGN, the thesis establishes the relevant parameters that characterise the AGN spectrum and central black hole growth rate. Next the largest sample of known heavily obscured AGN is compiled, finding the strength of a prominent iron spectral feature to weaken with AGN power. This is puzzling, and suggests that there may be more hidden AGN than previously thought. Finally by combining an all-sky infrared selection with NuSTAR follow-up, new heavily obscured AGN are identified. Obscuration emits infrared radiation, meaning that the infrared-selected AGN catalogue should be representative of the underlying AGN population. The absence of such representative catalogues has continually plagued cosmological studies, and the resultant obscured AGN fraction will be strongly constraining for AGN models.



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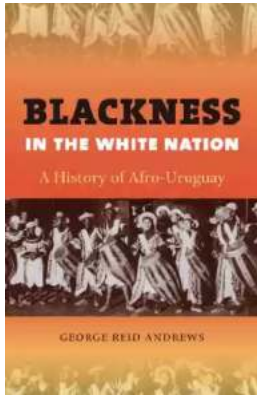
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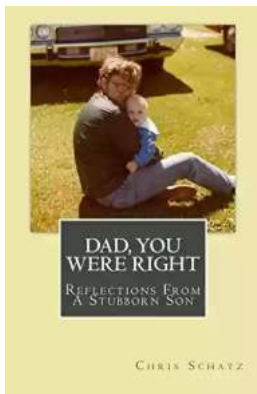
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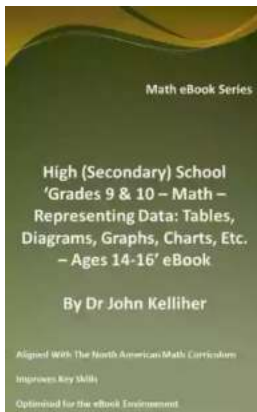
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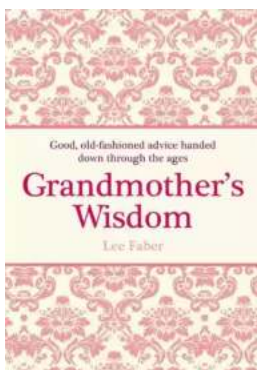
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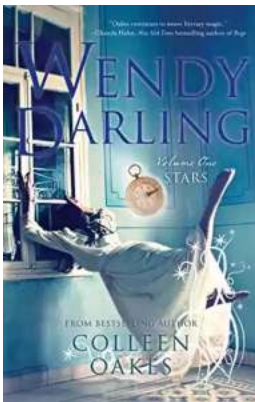
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