Examining Seyfert Galaxy Classification with IRAS 1239

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Motivation

Active Galactic Nuclei, or AGNs, have drawn much attention from the astronomy community in recent years due to the many different questions surrounding them. One question has been how to properly classify them, especially as many are obscured. In this case study, we examine IRAS 12397+3333, which stood out due to its high polarization despite its soft X-ray spectrum and narrow line Seyfert 1 classification.

Abstract

IRAS 12397+3333 is a narrow line Seyfert 1 galaxy (NLS1) discovered as a bright soft X-ray Active Galactic Nucleus (AGN) during the ROSAT All-Sky survey. Although it exhibits a soft X-ray spectrum it shows a high degree of optical polarization. These findings make IRAS 1239+333 interesting because the high polarization is an indication of significant attenuation of the line of

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Methods

1. Swift

Swift is useful due to its flexible observing schedule, simultaneous observations in X-ray and UV/optical, and long term monitoring.

2. XMM-Newton

XMM also has simultanous observaions, but has much longer observations with a larger collection area, providing much better spectra and allowing for a more detailed analysis.

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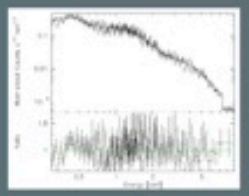
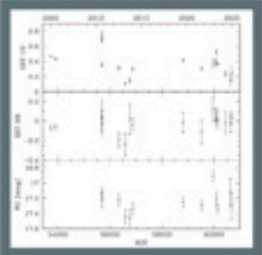
Swift Observations

We merged the XRT data from 17 kiloseconds of previous Swift observations to create X-Ray spectra and used the UVOT data to create light curves. We binned and plotted the data with 20 counts/bin, and fit it with an absorber blackbody plus power law model with a temperature of 8.91e^-2 +/- 5.85e^-3 keV and a photon index of Gamma = 1.87 +/- 3.62e^-2.



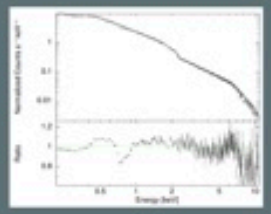
Merged spectrum fit with blackbody plus power law model



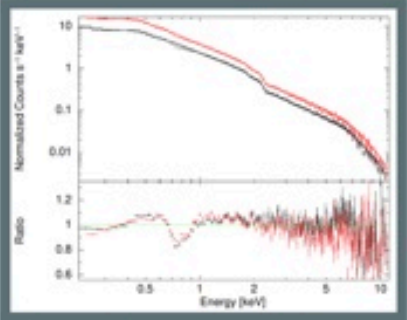
Light curve of Swift data from 2005-2024

XMM Observations

There were 3 XMM observations of IRAS F12397 +3333 from 2005 and 2019. The spectra created from this data clearly did not fit a normal power law. Of the models we tested, the data from the first 2005 observation had the lowest chi-square value when fit with an ionized absorber and a partial covering absorber model. The continuum spectrum is a blackbody from the accretion disk, and a power law from the corona.



2005 spectrum fit with blackbody plus power law model with temperature of 8.89e^-2 +/- 6.27e^-4 keV and a photon index of Gamma = 2.02 +/- 5.62e^-3



Comparison of 2005 spectrum (black) and 2019 spectrum (red)

Conclusions

Conclusions

- The XMM data provides a more detailed picture than the Swift data
- There appears to be an absorber present within line of sight
- Both Swift and XMM data reveal flux variability

Future Work

Despite the results, the parameters for our XMM fit seem rather extreme. We plan to continue working with the data and attempting several other models, such as a reflection model, to see if we can lower the chi-square any further. We also plan to submit a proposal for another Swift observation to gather more data, which will help us extend our light curve and examine how the spectral energy distribution of the AGN evolves over time.

Acknowledgements and References

Acknowledgements

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References

1. Goodrich, R. W., 1989. "Spectropolarimetry of 'narrow-line' Seyfert 1 Galaxies."

2. Grupe, D. et al. 1998. "Scattering and absorption in soft X-ray selected AGN: an optical polarization survey."

3. Grupe, D. et al. 2001. "X-ray variability in a complete sample of Soft X-ray selected AGN."

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