

University of Nottingham

Long-term NIR Variability in the UKIDSS Ultra-Deep Survey

A new probe of AGN activity at high redshift

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OUTLINE

- Introduction
- Identifying variable sources
- Comparing to X-ray AGN
- A new population of AGN?
- Summary

WHY THE NIR?

- Due to the long timescales, NIR variability is largely unexplored at high redshifts.
- But NIR is particularly interesting as it probes rest-frame red optical light at high redshift.

Introduction

Identification

Comparison

Summary

UDS

- Deepest NIR survey over 1 deg²
- Deep Chandra data in the centre of the field
- Shallow XMM data across the whole field
- Data taken over almost 10 years



UKIDSS UDS

THE DATA



- Images created from stacking one semester of observations.
- 2" aperture photometry from SExtractor in dual mode.
- 06B is discounted as there is not enough data.
- Gives a total of 7 epochs.

PSF MATCHING



- In order to study the variability, we need to remove any other sources of variation in the data.
- The main source is differences in PSF across the images.

PSF MATCHING



PHOTOMETRIC UNCERTAINTIES



PHOTOMETRIC UNCERTAINTIES



THE METHOD





THE SAMPLE



Whole sample:

- 393 variable sources.
- 167 X-ray detected.
- = 42% X-ray detected

THE SAMPLE



XMM Imaging of the whole field reaches $F_{lim} \sim 10^{-15} \ erg \ cm^{-2}s^{-1}$

1.5Ms Chandra imaging is deeper and unambiguous: $F_{lim} \sim 10^{-16} \ erg \ cm^{-2}s^{-1}$.

THE SAMPLE









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LLAGN?

Summary

THIS METHOD IDENTIFIES A POPULATION OF AGN IN LOW MASS, LOW LUMINOSITY GALAXY HOSTS

BUT HOW CAN WE BE SURE THAT THEY ARE REAL?



We have a few spectra of variable non-X-ray sources, including this BAL quasar at z~3.

THREE MAIN QUESTIONS

- Is the variability just noise?
 - Self-calibrated uncertainties should account for the increased noise at low fluxes, as well as any remaining variations between epochs and detectors
- Is this population expected?
 - AGN with lower luminosities have been shown to have larger amplitude variations.
- Could the sources be another type of variability, such as supernova?

LLAGN?

Summary

COULD THE SOURCES BE SUPERNOVA?







SUMMARY

- We can identify variable AGN using only their light curves in the NIR.
- Using this selection finds a population of LLAGN that would be missed by other selection techniques, including deep Chandra imaging.
- Future analysis on variability amplitudes, and correlations between the JHK light curves will hopefully provide more insights on the causes of the variability.







3.6 - 4.5

Identification

Comparison

LLAGN?



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Introduction

Identification



VARIABILITY AMPLITUDES



