

School of Physics and Astronomy



Senior Honours Project Astrophysics

Deep Stacking of AGN Hypervariables

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February 14, 2020

Abstract

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Declaration

I declare that this project and report is my own work.

Signature:

Date: February 14, 2020

Supervisor: Professor A. Lawrence, FRSE, FRaS

12 Weeks

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1 Introduction

1.1 AGNs and the Viscous Accretion Disc

[3]

1.2 The Pan-STARRS Survey

[2]

2 The Liverpool Telescope Data

2.1 S/N Ratio and Astronomical Seeing

3 Centroiding on J094511

3.1 Initial Guess: Max-Value Centroiding

3.2 Initial Guess: WCS Centroiding

[1] [greisen'2002] [calabretta'2002]

3.3 Refinement: Two Dimensional Weighted Mean

3.4 Aperture Centroiding

3.5 Challenges in the U-band

4 Cross Sections of J094511

4.1 Linear and Radial Cross Sections

4.2 Excess Luminosity in the Wings

4.3 Point Spread Function Subtraction

5 Conclusion

References

¹D. Lang, D. Hogg, K. Mierle, M. Blanton, and S. Roweis, “Astrometry.net: blind astrometric calibration of arbitrary astronomical images”, *Astronomical Journal* **139**, 1782–1800 (2010).

²A. Bruce, A. Lawrence, C. MacLeod, M. Elvis, M. J. Ward, J. S. Collinson, S. Gezari, P. J. Marshall, M. C. Lam, R. Kotak, C. Inserra, J. Polshaw, N. Kaiser, R.-P. Kudritzki, E. A. Magnier, and C. Waters, “Spectral analysis of four ‘hypervariable’ agn: a microneedle in the haystack?”, *Monthly Notices of the Royal Astronomical Society* **467**, 1259–1280 (2017).

³A. Lawrence, “Quasar viscosity crisis”, *eng, Nat Astron* **2**, 102–103.

Appendix A: Alignment Algorithm