

Dusty Echoes of Nearby AGN

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- ▶ From Stefan-Boltzmann:
 $L \propto R^2 T^4$
- ▶ $\tau \propto R$
- ▶ $\tau \propto \sqrt{L}$

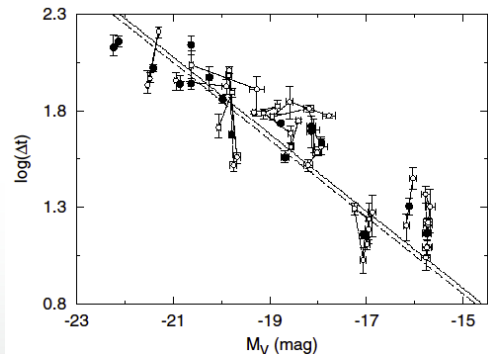


Figure: A plot showing the lag-luminosity relationship from Koshida et al. 2014

AGN as Standard Candles

- Use τ as a proxy for luminosity to create a Hubble Diagram.

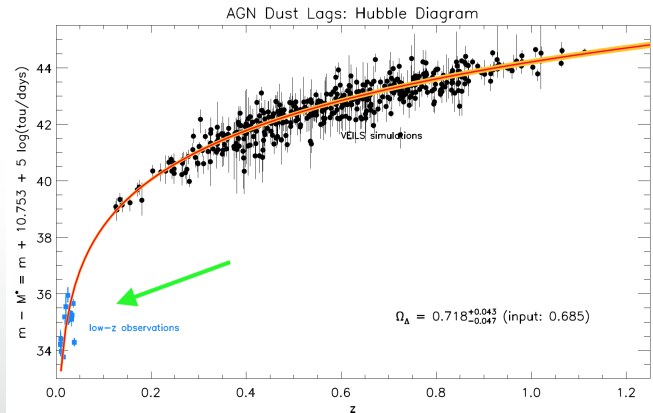
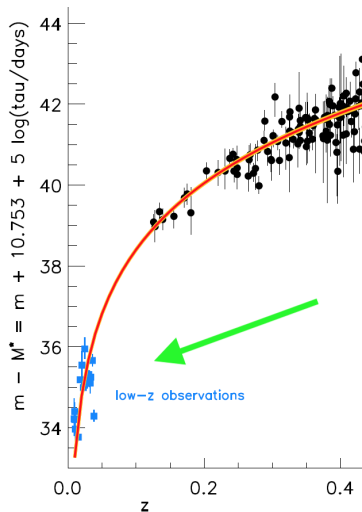


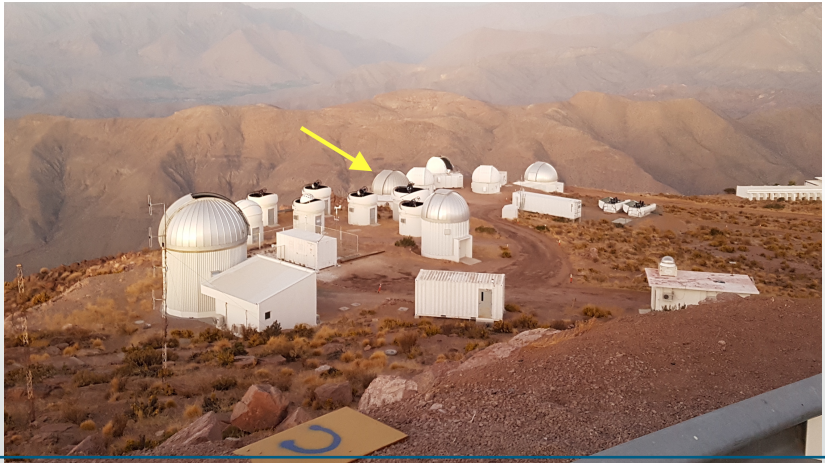
Figure: A simulated AGN Hubble Diagram. Image credit: Hönig et al. 2017.

- ▶ Use τ as a proxy for luminosity to create a **Hubble Diagram**.
- ▶ Need **Low Intrinsic Scatter**



The Sample

- ▶ Low Redshift Type 1s, $z \sim 0.015$
- ▶ 15 AGN, 3 NLSy1s, 4 previously reverberation mapped
- ▶ Monitoring:
 - ▶ V ($\sim 0.5\mu\text{m}$) and K ($\sim 2\mu\text{m}$) band
 - ▶ SMARTS 1.3m telescope



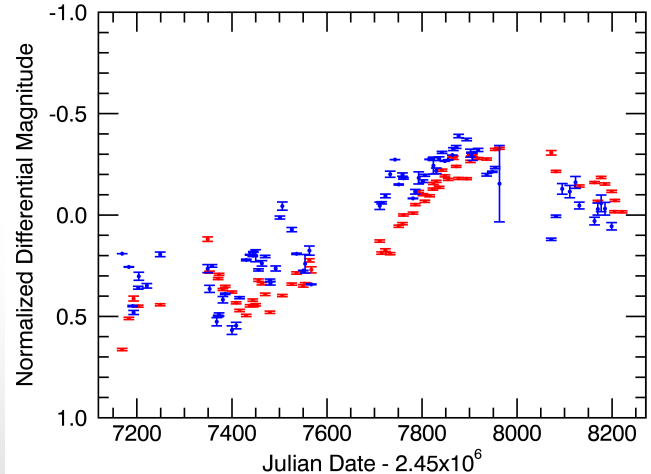


Figure: Light curve for NGC3783, V band in blue, K band in red.

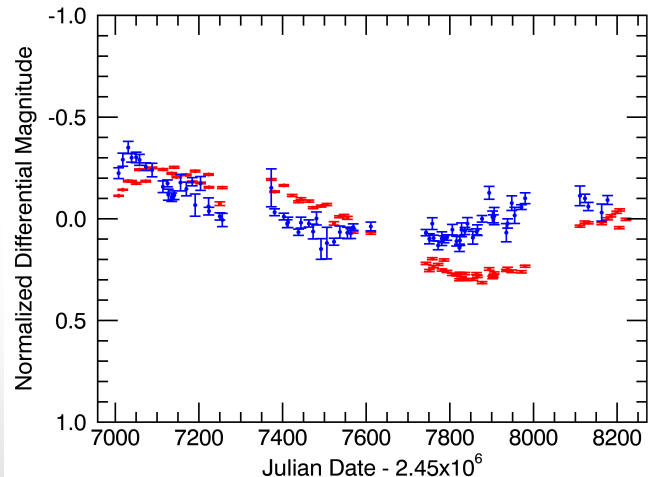


Figure: Light curve for ESO323-G77, V band in blue, K band in red.

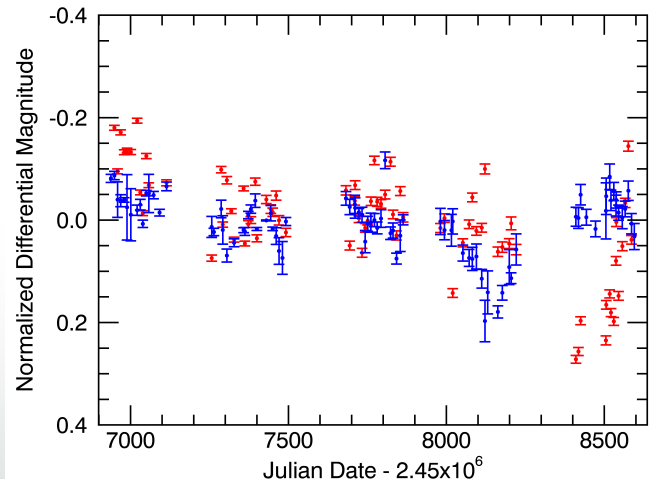


Figure: Light curve for H0557-385, V band in blue, K band in red.

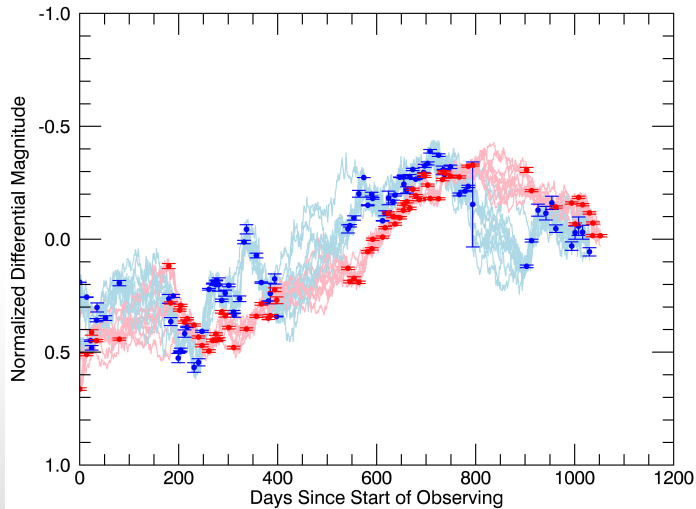


Figure: Light curve for NGC3783, V band in blue, K band in red.

Light Curves

Interpolations

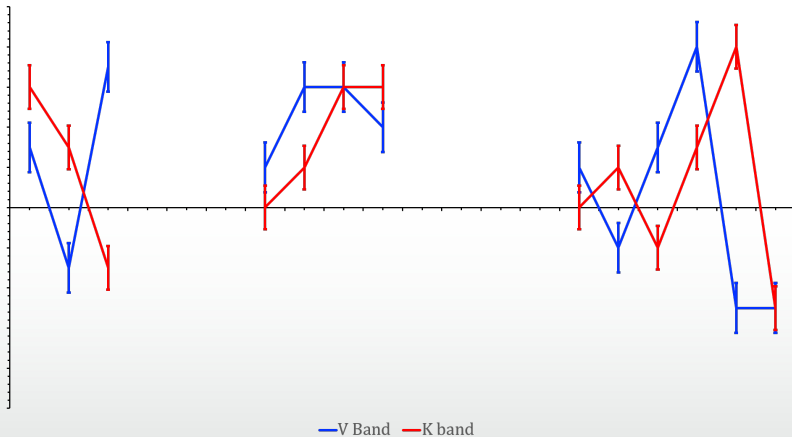


Figure: Matching Method

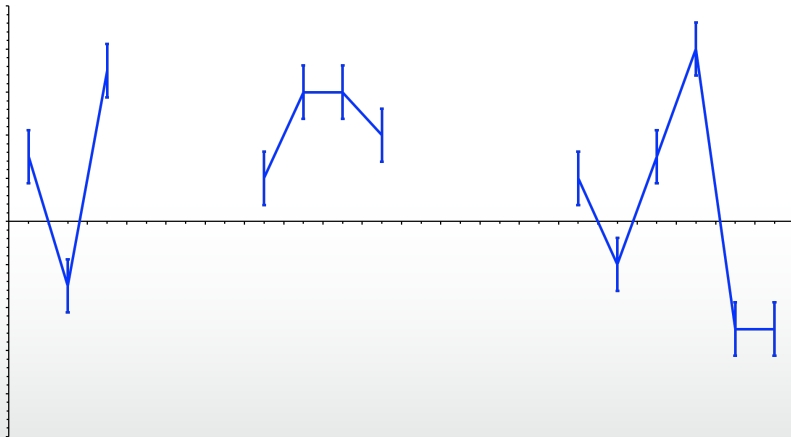


Figure: Matching Method

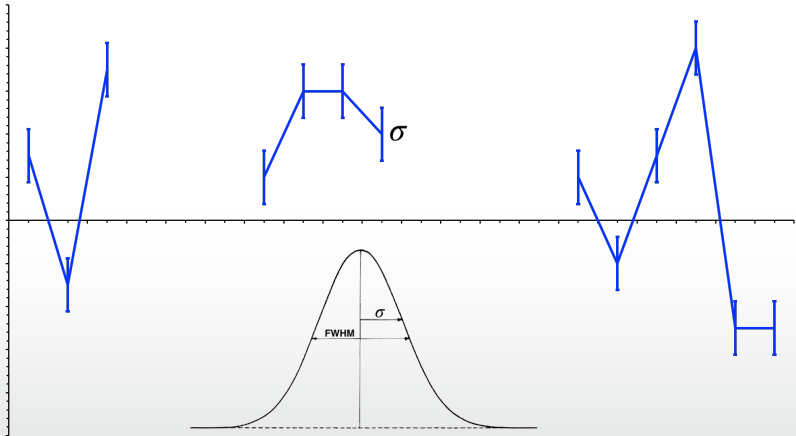


Figure: Matching Method

Light Curves

Interpolations

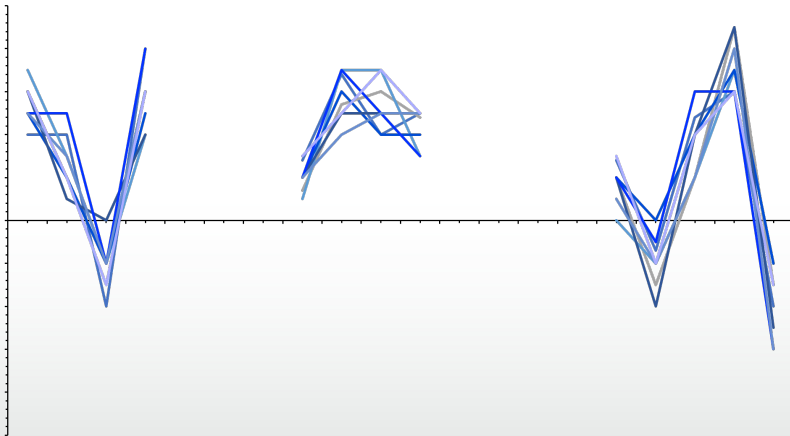


Figure: Matching Method

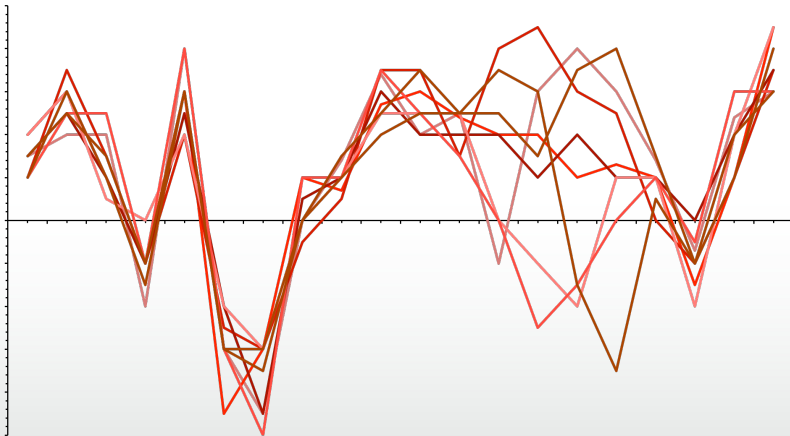


Figure: Matching Method

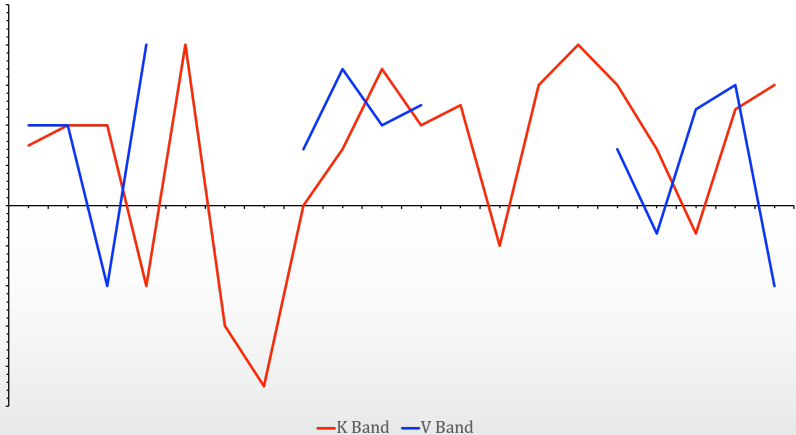


Figure: Matching Method

Light Curves

Interpolations

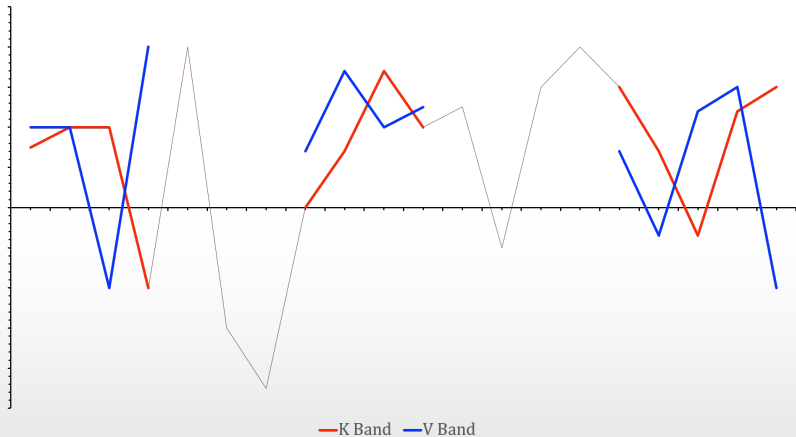


Figure: Matching Method at $\tau = 0$ days

Light Curves

Interpolations

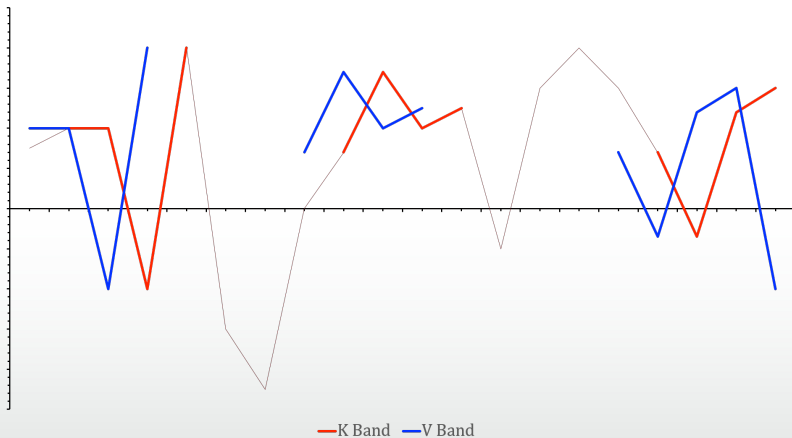


Figure: Matching Method at $\tau = 1$ day

Light Curves

Interpolations

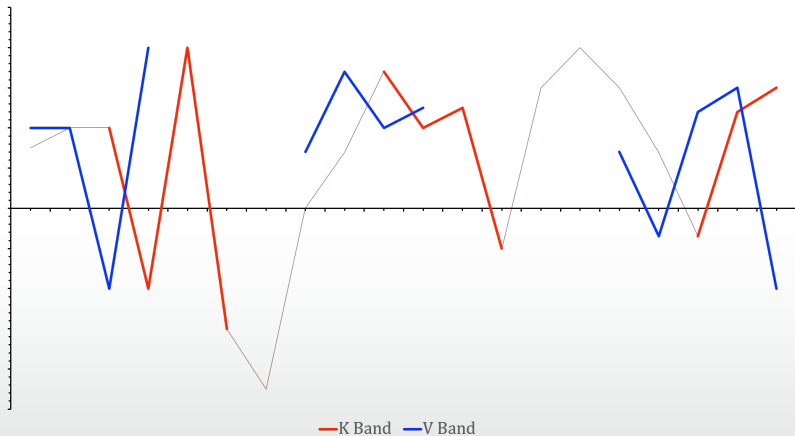
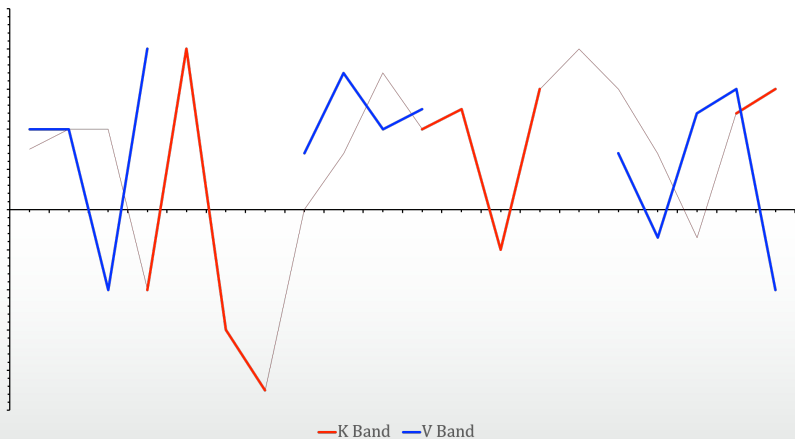


Figure: Matching Method at $\tau = 2$ days

Light Curves

Interpolations

Figure: Matching Method at $\tau = 3$ days

Results

NGC3783

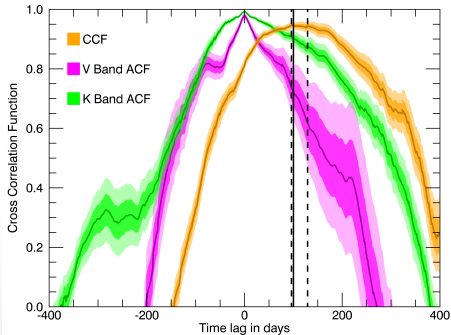


Figure: Cross correlation function for NGC3783. The vertical lines on each plot show the result and the 1σ confidence boundaries.

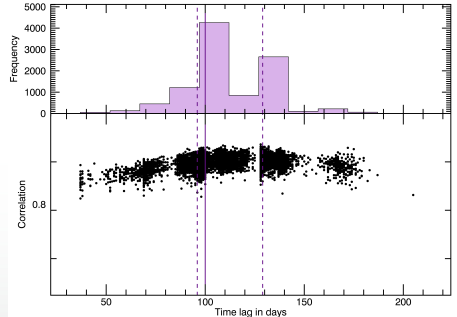


Figure: Histogram showing the frequency distribution for the peaks CCFs NGC3783, $\tau = 100^{+29}_{-4}$ days.

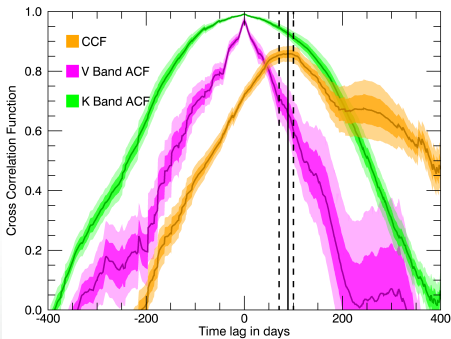


Figure: Cross correlation function for ESO323-G77. The vertical lines on each plot show the result and the 1σ confidence boundaries.

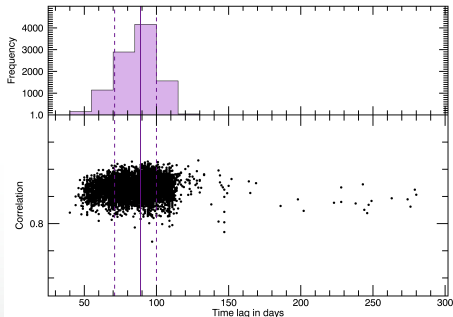


Figure: Histogram showing the frequency distribution for the peaks CCFs ESO323-G77, $\tau = 89^{+11}_{-18}$ days.

Results

H0557-385

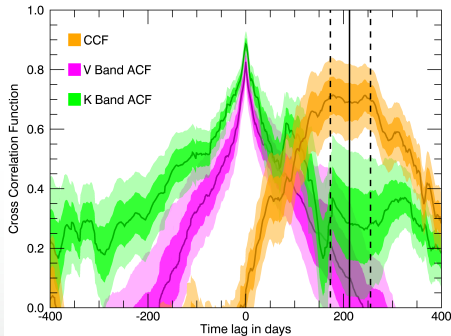


Figure: Cross correlation function for H0557-385. The vertical lines on each plot show the result and the 1σ confidence boundaries.

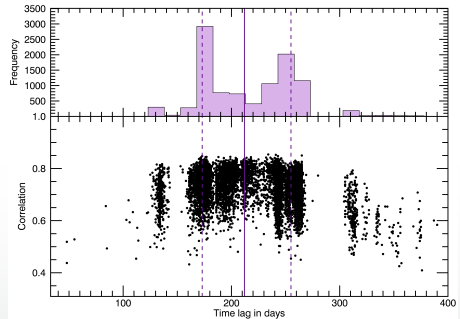


Figure: Histogram showing the frequency distribution for the peaks CCFs H0557-385,
 $\tau = 212_{-39}^{+43}$ days.

Discussion

Lag Luminosity Relationship

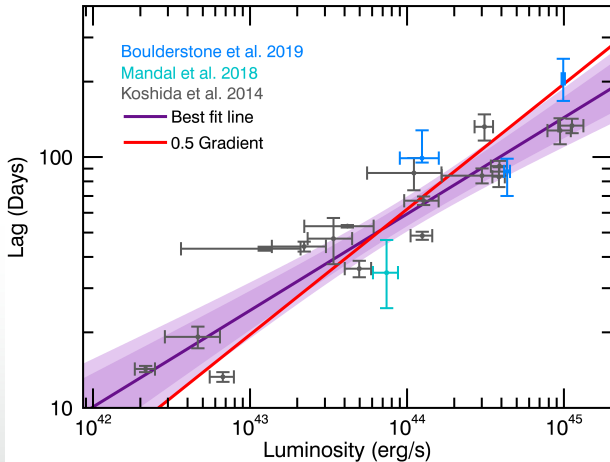


Figure: Our results with those from Koshida et al. 2014. The red line dashed line has a gradient of 0.5.

Discussion

Lag Luminosity Relationship

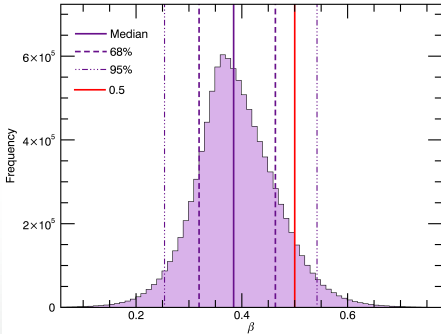


Figure: Our results for the gradient of the slope, $\beta = 0.38^{+0.079}_{-0.065}$ from Bayesian Analysis.

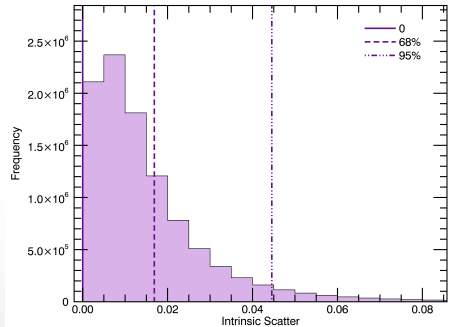


Figure: Our results for the intrinsic scatter $= 0.011^{+0.015}_{-0.0073}$, consistent with 0 scatter in a 95% confidence interval.

- ▶ Result for NGC3783 of $\tau = 100_{-4}^{+29}$ days, $R_{\text{sub}} \sim 0.083$ pc
- ▶ Result for ESO323-G77 of $\tau = 89_{-18}^{+11}$ days, $R_{\text{sub}} \sim 0.075$ pc
- ▶ Result for H0557-385 of $\tau = 212_{-39}^{+43}$ days, $R_{\text{sub}} \sim 0.18$ pc

- ▶ β consistent with 0.5 within 2σ : $0.38_{-0.065}^{+0.079}$
- ▶ Low intrinsic scatter: $0.011_{-0.0073}^{+0.015}$

- ▶ Repeat with other AGN in our sample



Continue laying groundwork for VEILS.