A Quasar caught in the act of turning off

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We present the $z = 0.378$ quasar SDSS J110057.70-005304.5 as a quasar that is transitioning from a blue continuum sloped object to become a "Changing-Look" quasar – with the prominence of the Hβ and Hγ broad-emission lines being dramatically reduced. What makes J110057 particularly interesting, however, is (by selection) its associated short-term IR variability, and dramatic reddening in the optical continuum during the transition to its non-broad line state. (TBD!!) We explore simple models of quasar obscuration, and given the short observed timescales ($\approx$7 years in the rest-frame) find it very hard to explain this behavior.

Shortly after their initial identification (**??**), quasars were seen to vary photometrically. This placed strict limits on the size of the central engine power source and gave credence to the idea that a supermassive black hole powers AGN.

From e.g., Lawerence (2016, ASPC):: If the accretion disc is in a stable steady state, we expect it to evolve gradually on the inward drift timescale set by viscosity, which is of the order 10,000 years (see e.g. Netzer (2013)). However, instabilities of various kinds could give much faster changes. The 'light crossing' timescale $t_{\rm lt} = R/c$, is the shortest timescale set by radiation heating or reflection. This is of the order hours, days, and years for disc, BLR, and torus respectively. The 'dynamical timescale', $t_{\rm dyn} = R^3/GM$, is the shortest timescale on which we are likely to see significant physical changes in a region, and is of the order of days, years, and thousands of years for disc, BLR, and torus respectively. (The 'free-fall' timescale is roughly the same and orbital timescale is 2π times longer.) More realistically, perturbations may transmit across a region on the sound crossing timescale $t_{\rm snd} = R/v_{\rm snd}$. This is somewhat model dependent but is of the order of years for the accretion disc. This is the global time to cross the whole region; local hot spots could grow on the timescale it takes sound to cross the vertical height of the disc, which can be 1âĂŞ3 orders of magnitude faster. The "thermal" timescale $t_{\rm therm}$ which is roughly the time it takes for for energy to dissipate within the disc, i.e. the response timescale to a spike of energy input. It is of the order of days for the inner disc and years for the optical disc. The analogous "response" timescale for the BLR and for the obscuring region is actually the light-crossing time - the local response time to a change in photo-ionisation or heating is very short, but is smeared out by the range of light travel delays.

Although the observed variability of quasars has been known since shortly after their discovery, only recently, with the advent of extensive imaging surveys and the associated, repeat spectroscopy, has given actual evidence for

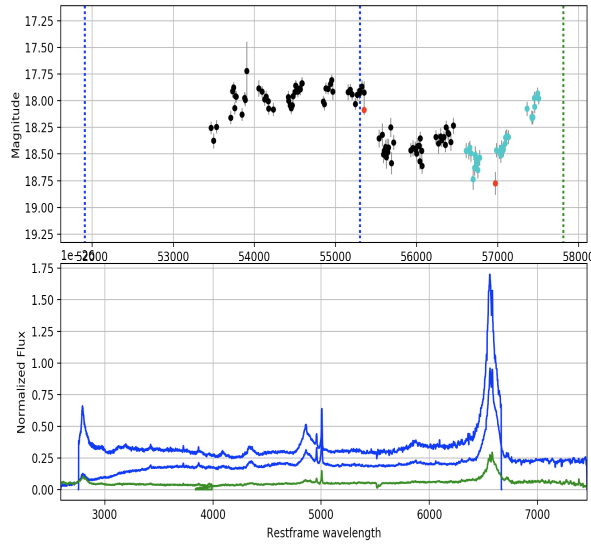

Figure 1 Three spectra of J110057.

these key physical mechanisms.

In this article we present the $z = 0.378$ quasar SDSS J110057.70-005304.5 that we have observed transitioning from a blue continuum sloped object to become a regular galaxy. However, along with the changes in the BELs, we see a major change to the disk interior to $150R_g$.

1 Results

Figure 1 gives the optical light curve of J110057. Figure 2 shows the three optical spectra of J110057. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aliquam porta sodales est, vel cursus risus porta non. Vivamus vel pretium velit. Sed fringilla suscipit felis, nec iaculis lacus convallis ac. Fusce pellentesque condimentum dolor, quis vehicula tortor hendrerit sed. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Etiam interdum tristique diam eu blandit. Donec in lacinia libero.

2 Discussion

Using Ford et al and Sirko & Goodman 2003, Figure **??** shows a model for a $M_{\rm BH} = 3 \times 10^8 M_\odot$, radiative efficiency of $\varepsilon = 0.1$, accretion rate in units of Eddington accretion, $\dot{M} = 0.032$, inner and outer disk radii in units of r_g of SMBH of radius$_{\rm in}$=6.0, radius$_{\rm out}$=1.0$\times$10^4.

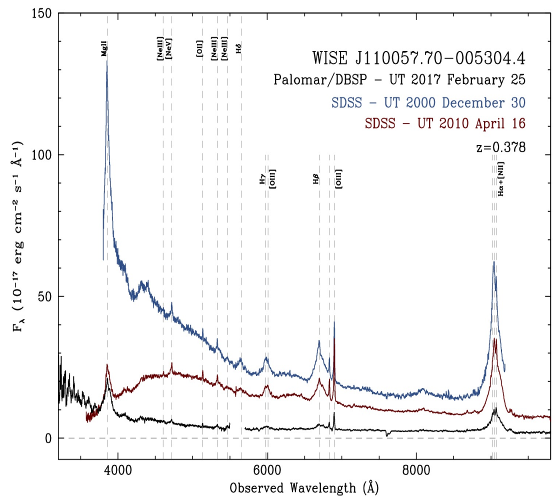

Figure 2 Three spectra of J110057.

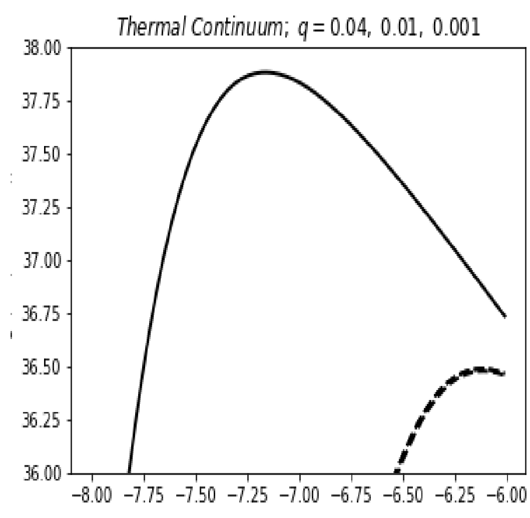

Figure 3 Model spectra of J110057.

3 Method