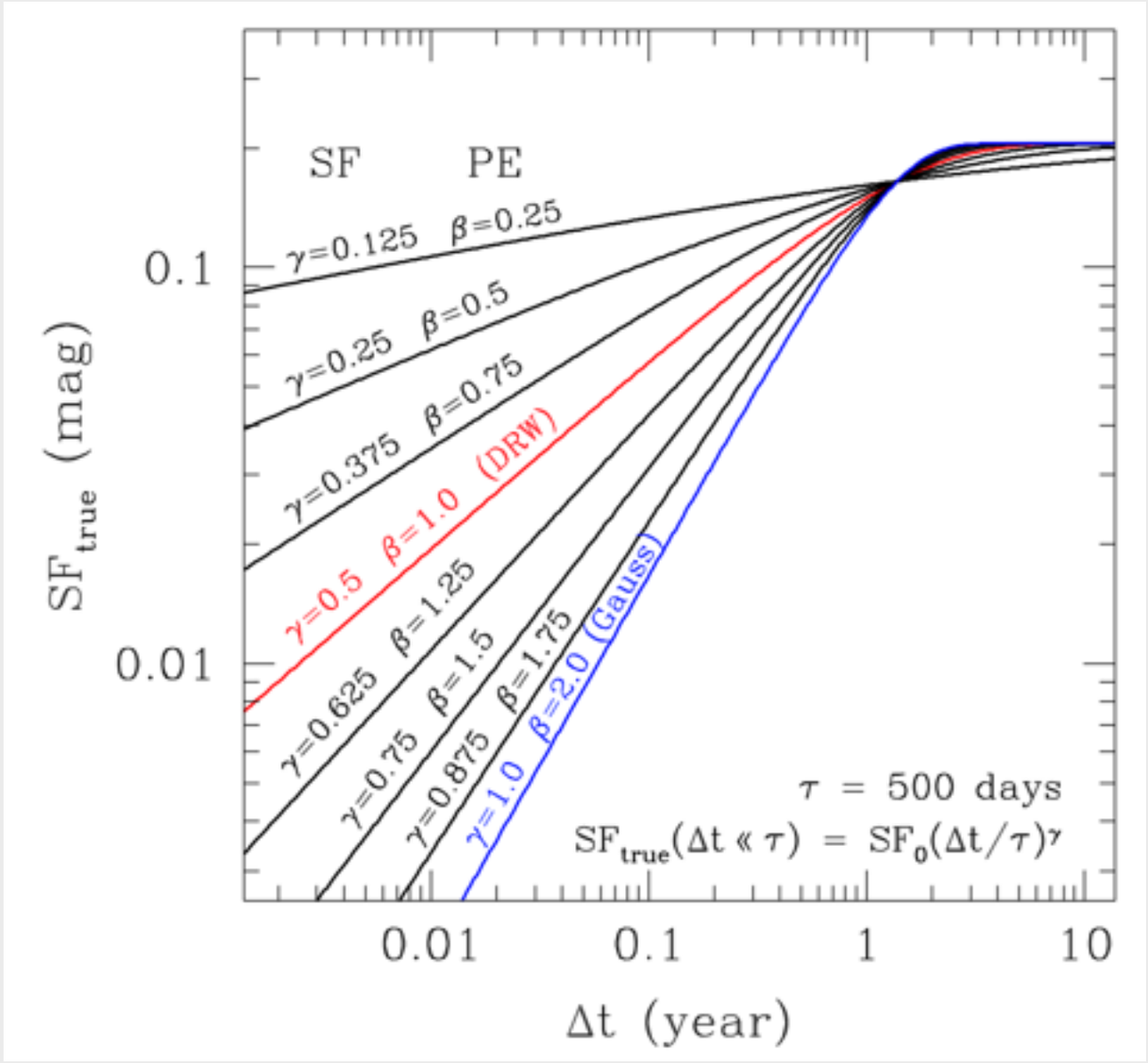
Why monitor quasars?

- Behavior on short (< week) and long (>10 years) timescales poorly constrained
- some evidence that simple power-law red noise models (i.e., damped random walk) fails on short timescales.
- physics? perhaps different variability modes dominate at different timescales (*thermal fluctuations, accretion instabilities, nuclear supernovae, microlensing, x-ray reprocessing, …*)

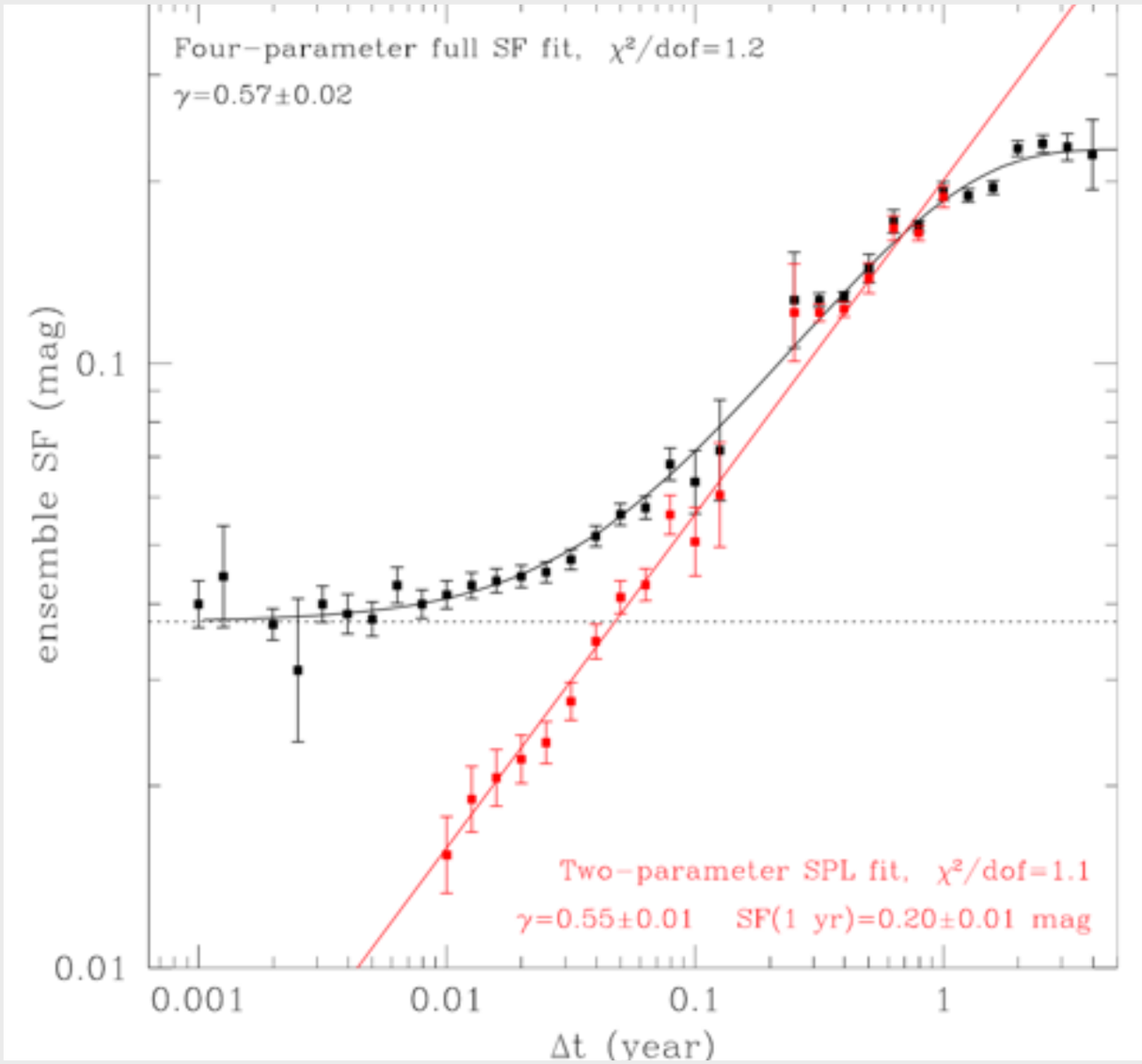


Kozlowski 2016

Why monitor quasars?

complements to LSST:

- high cadence
- calibration of color variability models with contemporaneous multicolor imaging
  - continuum lags - accretion disk structure
- efficient, industrial-scale reverberation mapping

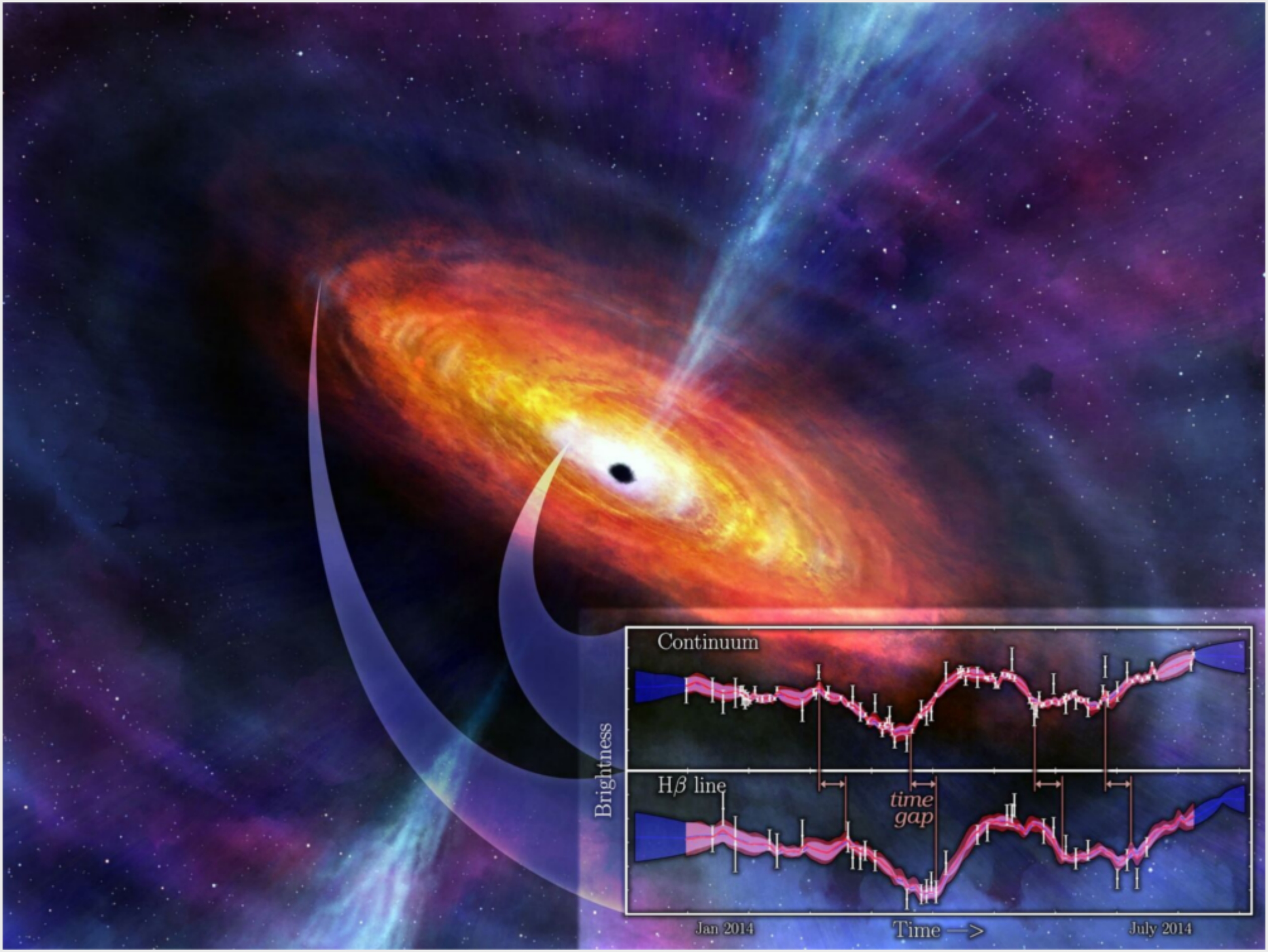


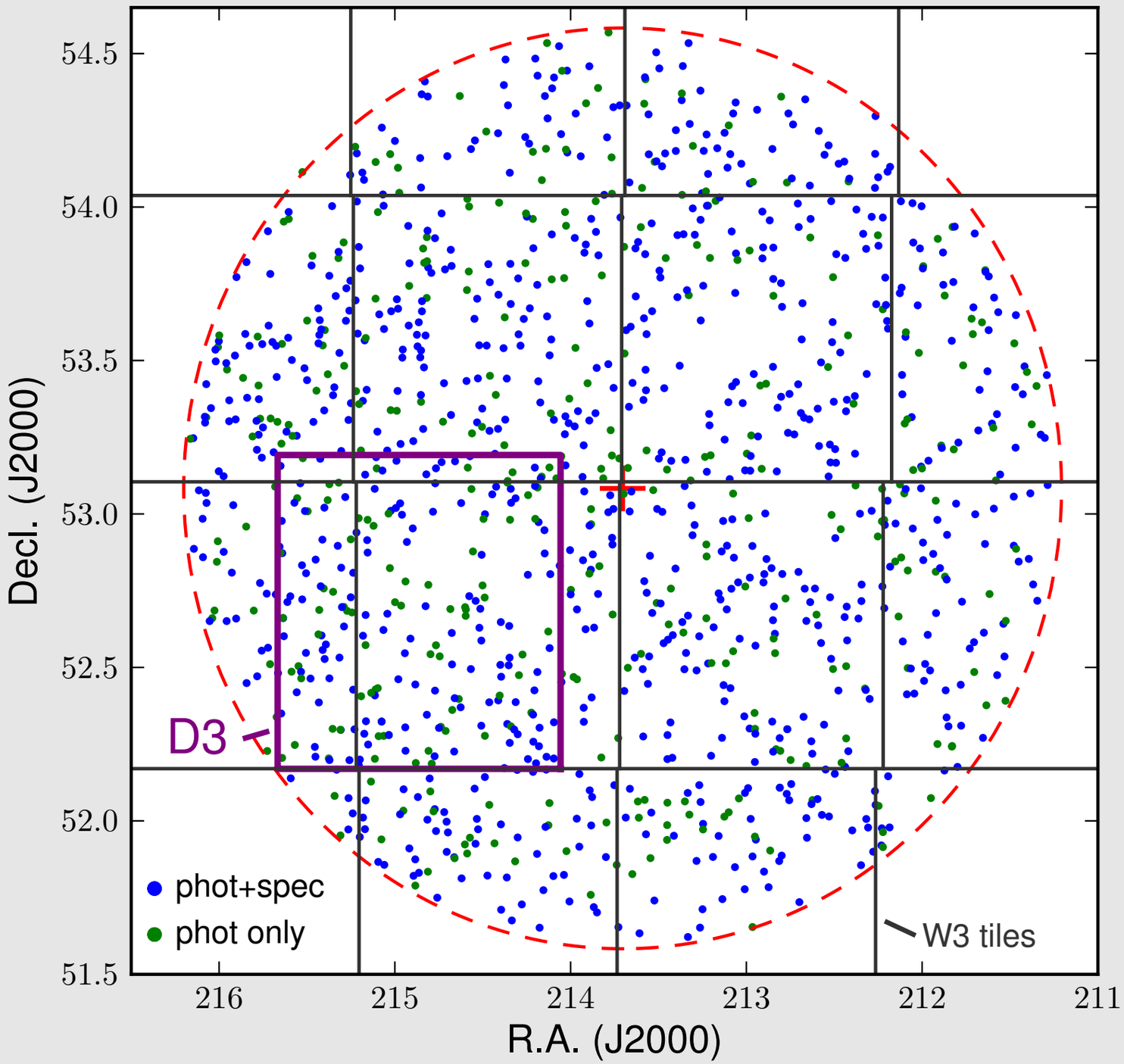
Kozlowski 2016

An artist's impression of a very distant quasar powered by a black hole with a mass 2 billion times that of the sun (Credit: ESO/M. Kornmesser)

Students Help Little Telescope Do Big Things

A four-year effort involving UA students helped a team of astronomers measure the masses of a large sample of supermassive black holes in the farthest reaches of the universe. As part of a robotic telescope network in southern Arizona, instruments such as the Bok Telescope could play a crucial role in future "grand challenge" science endeavors.


Continuum
Hβ line
time gap
Brightness
Jan 2014
Time —>
July 2014



SDSS-RM Fact Sheet

7 deg^2 (one SDSS plate)

N_{QSO} = 1200 (photo, $i < 22$)
= 849 (spec, $i < 21.7$)

2014A monitoring:
- 30 epochs spectroscopy
- 60 epochs Bok imaging
- 30 epochs CFHT imaging

Previous data:
- SDSS-I (2003)
- CFHTLS-Wide (W3, 2007)
- CFHTLS-Deep (D3, 2003-)
- Pan-STARRS1 (MD07, 2011-13)

SDSS-IV extension (2015-16):
- 12 epochs spectroscopy
- 30 epochs Bok
- 24 epochs CFHT

Figure 2

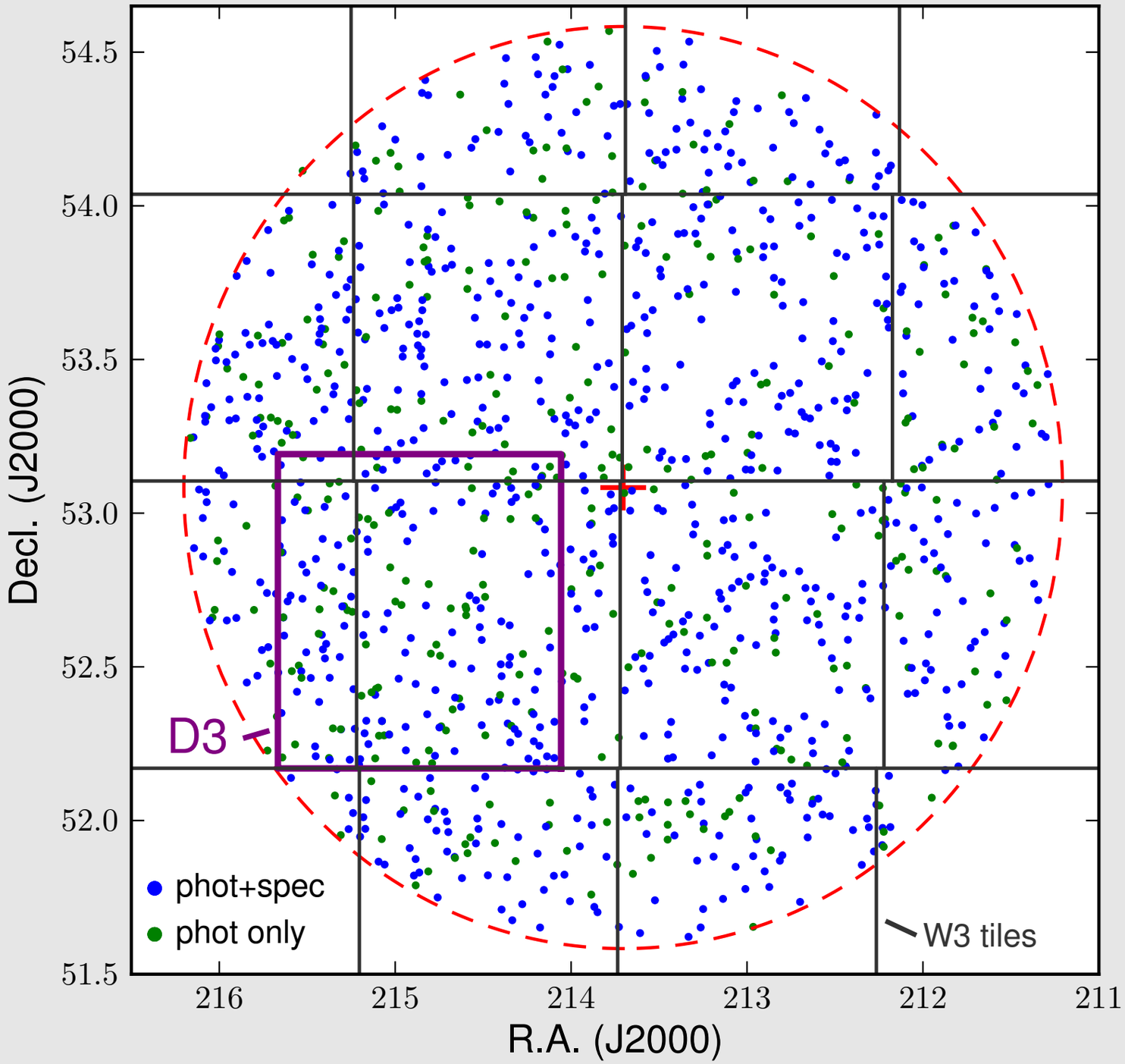


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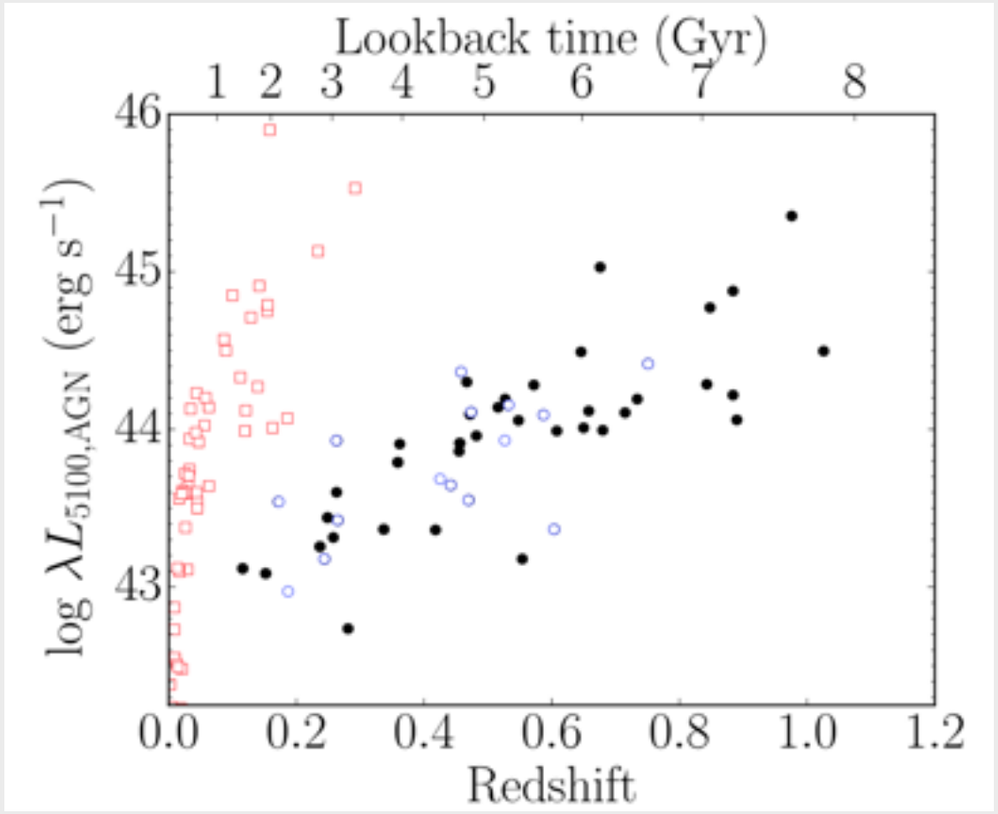
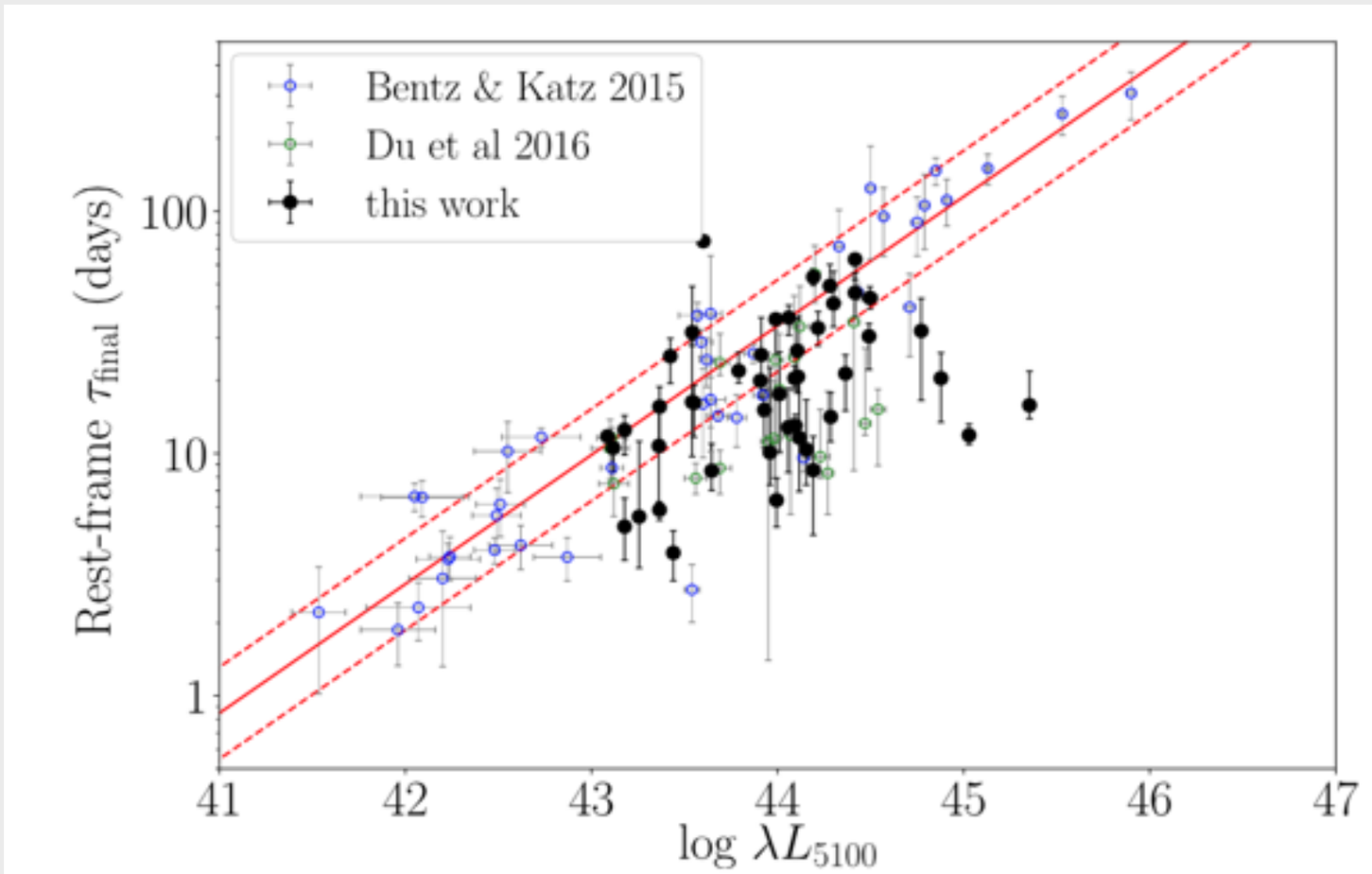
Figure 2

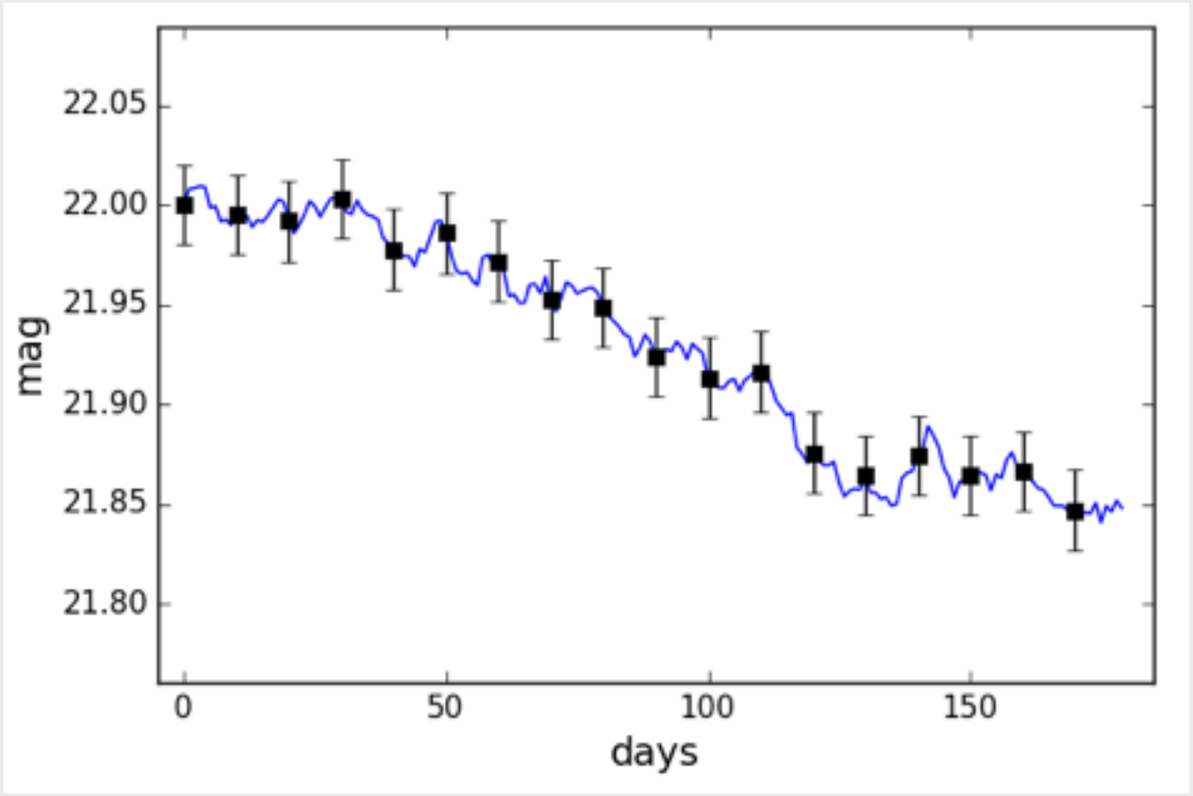
SDSS-RM 2014 results





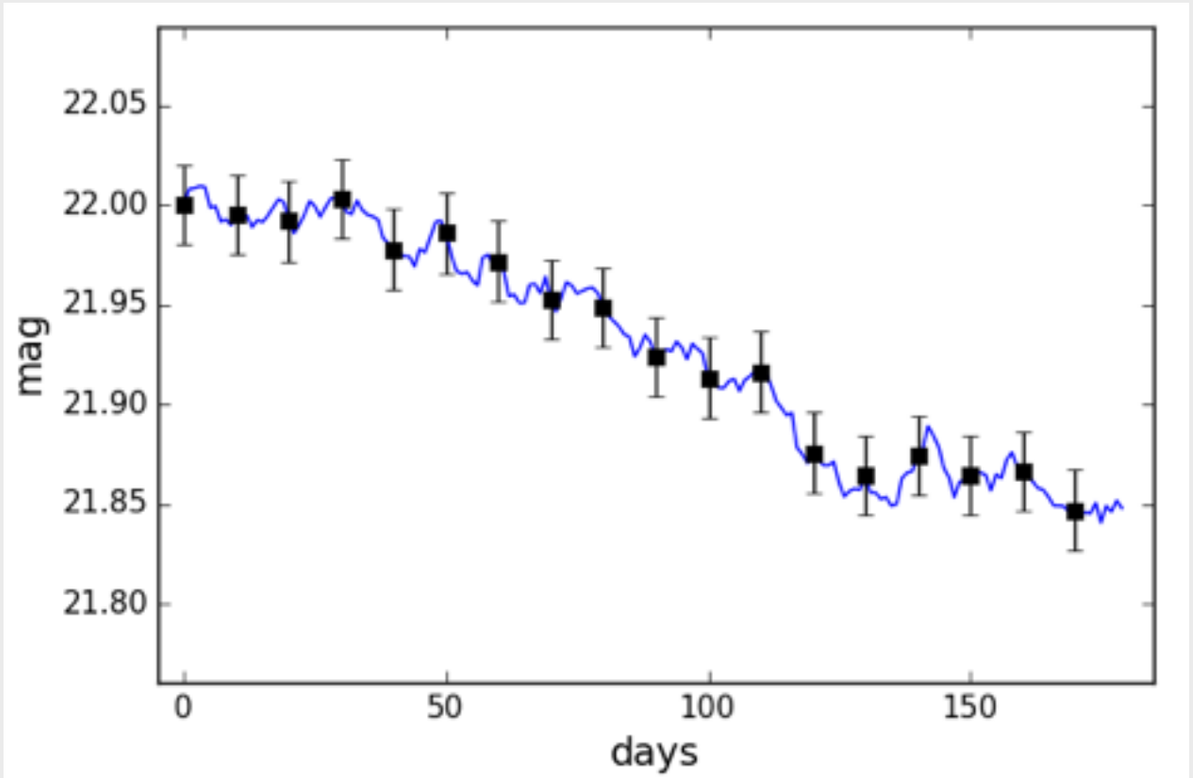
Grier et al. 2017

The future with LSST: Opportunistic RM



BAD lightcurve!

The future with LSST: Opportunistic RM



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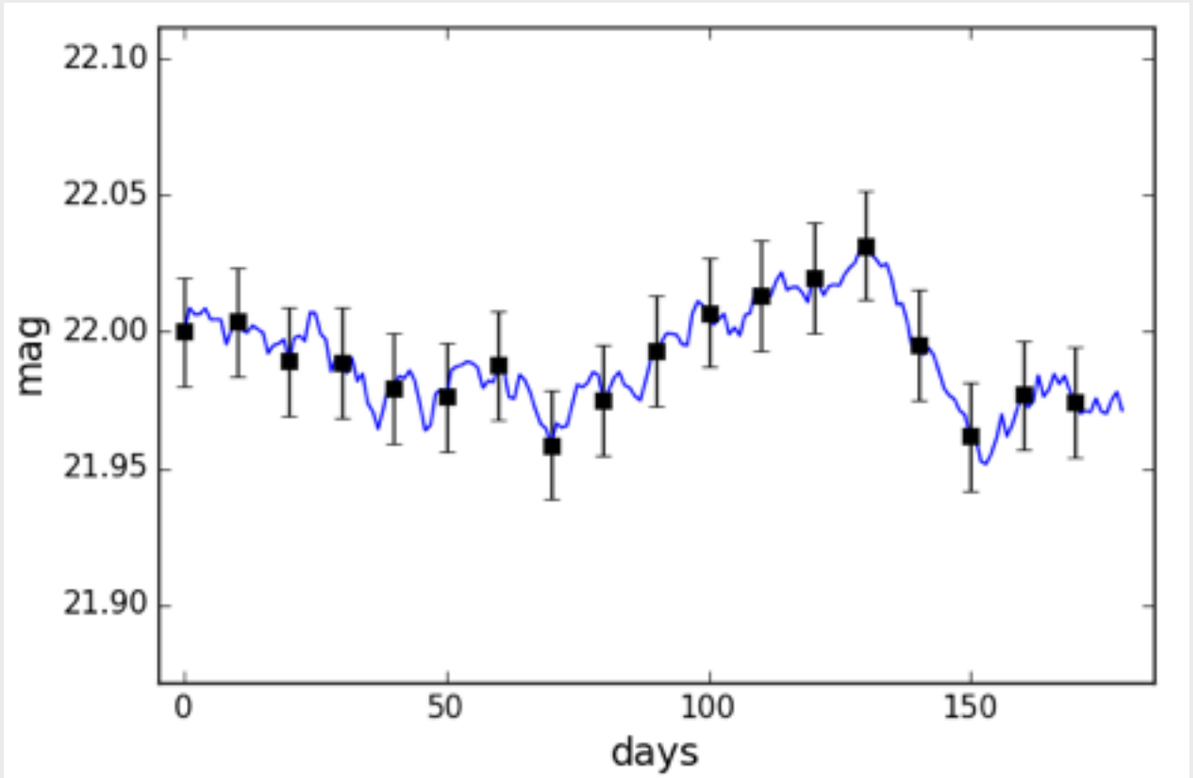
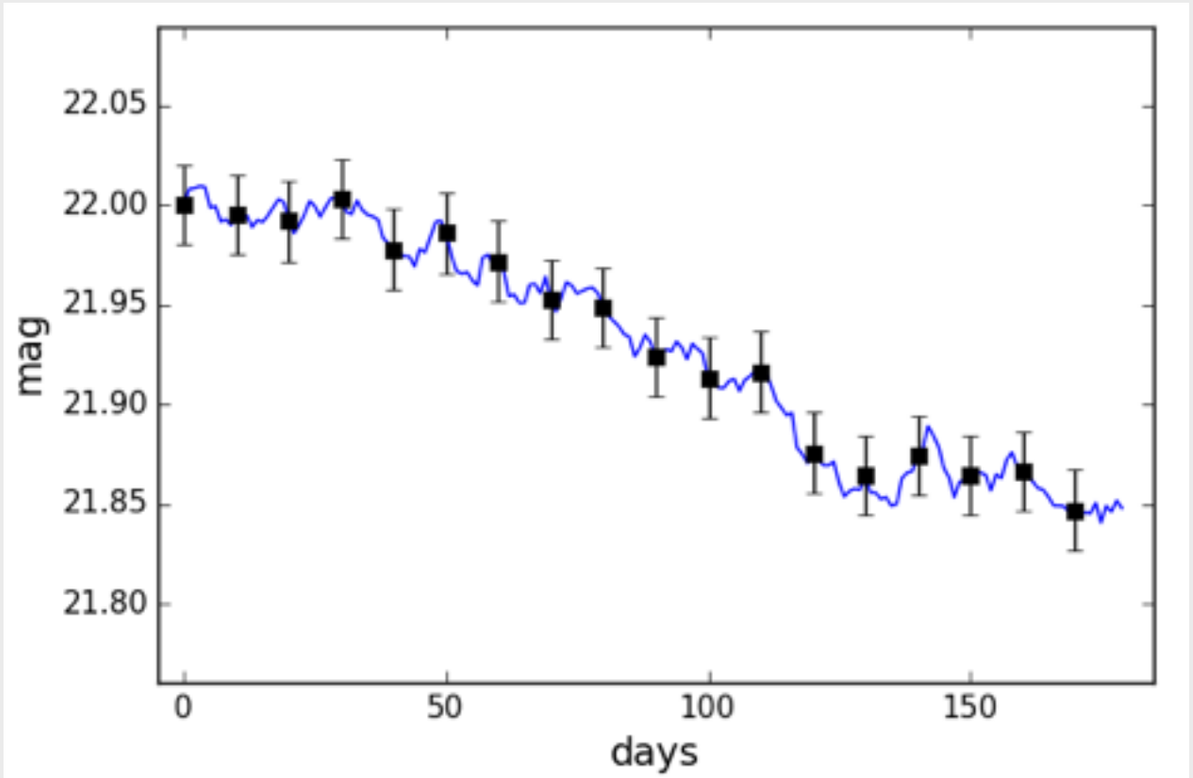


GOOD lightcurve!

The future with LSST: Opportunistic RM



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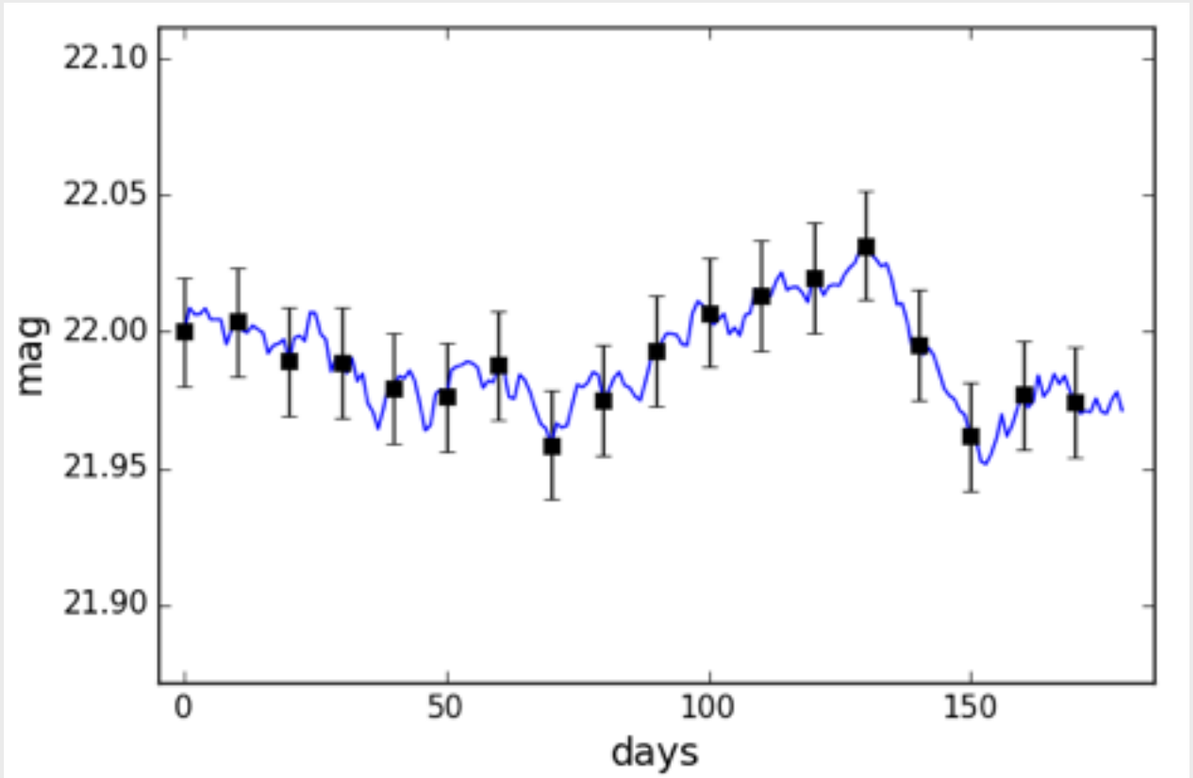

GOOD lightcurve!

~thousands of ToO RM time lag measurements!

Why monitor quasars with ARTN?

- easy to schedule - low priority, spread over sky
- some monitoring can happen for free with wide-field cameras