Where we are
LSST and friends
Follow-up / preparation
Not new: extreme variability

Khachikian and Weedman 1971

Lawrence Pye and Elvis 1977

Penston and Perez 1984
New(1): large sample discovery
unstable discs?

New (2): three models

shredded stars?

lensing?
New (3): Gsec timescales

New (4): Msec sampling
questions

- which are which?
- do they repeat?
- is everything an extreme variable?
- are the wavelengths simultaneous?
- dependence on $L, M_H, \lambda_{Edd}$, etc
- 3D structure of BLR
what do we need?

• even larger samples
• even longer term coverage
• good cadence
• multiple spectroscopic epochs
• massive spectroscopic monitoring
upcoming photometric facilities

• now: PS2, DES
• v.soon: ZTF
• soon: LSST

upcoming MOS facilities

• now: AAOmega, TDSS
• soon: WEAVE, 4MOST, ReSpeQ, BigBOSS, PFS, MOONS
LSST: nearly there

Jan 2020: ComCam
Oct 2020: LSST Cam
Mar 2021: SV start
Oct 2022: Full operations
deep and wide
long and fast

18,000 sq.deg
10 years
6 bands
825 visits
r=24.5 per visit

Quasar Estimates
$10^7$ quasars total
$10^3$ z~6
$10^5$ extreme variables?
$10^4$ TDEs/yr
$10^4$ macrolensed quasars

cf POSS/UKS
sixty year light curves

$10^6$ alerts per night
tens of high-amp events?
**data flow**

**Level-1:**  **alert stream**  
- some simple access via DAC  
- fed to third party systems (brokers)  

**Level-2:**  **stacked images, catalogues**  
annual releases  
access via DAC  
cutouts, SQL queries, Jupyter notebook access  

**Level-3:**  **community products/sw**  
e.g. weak lensing analysis  
VO multi-wavelength federation  
classification, light curves  
transient filtering and action  

*AGN community has some work to do*  

*cf PESSTO*
types of variability project

fast AGN transients

slow AGN transients

macro lensed AGN

sixty year AGN LCs
Uniform cadence

- any filter: median 3 days
- r-band: median 15 days
- worst case: 200 days
can increase sampling by reducing season

TDEs: rolling cadence better
mulens: uniform cadence better
CLQs ???

what we should be doing

- model light curves
- simulate with OpSim
- contribute to Obs.Strat. White Paper
need for brokers

- Find TDEs
- Find CLQ outbursts?
- Find slow-risers
- Feed to follow-up
  - Spectra
  - Dense photometry

alert stream → DAC → broker → targets

junk removal VO integn

community software

other telescopes

Science
massive spectroscopy

long term light curves ✓

transient characterisation ✓

RM campaigns ✓

long term massive spectroscopy get this going!

(1) ResPeQ medium tier
(2) Repeat 2QZ and S82