The Broader Context

Exploration of the time domain of the observable parameter space, using synoptic sky surveys
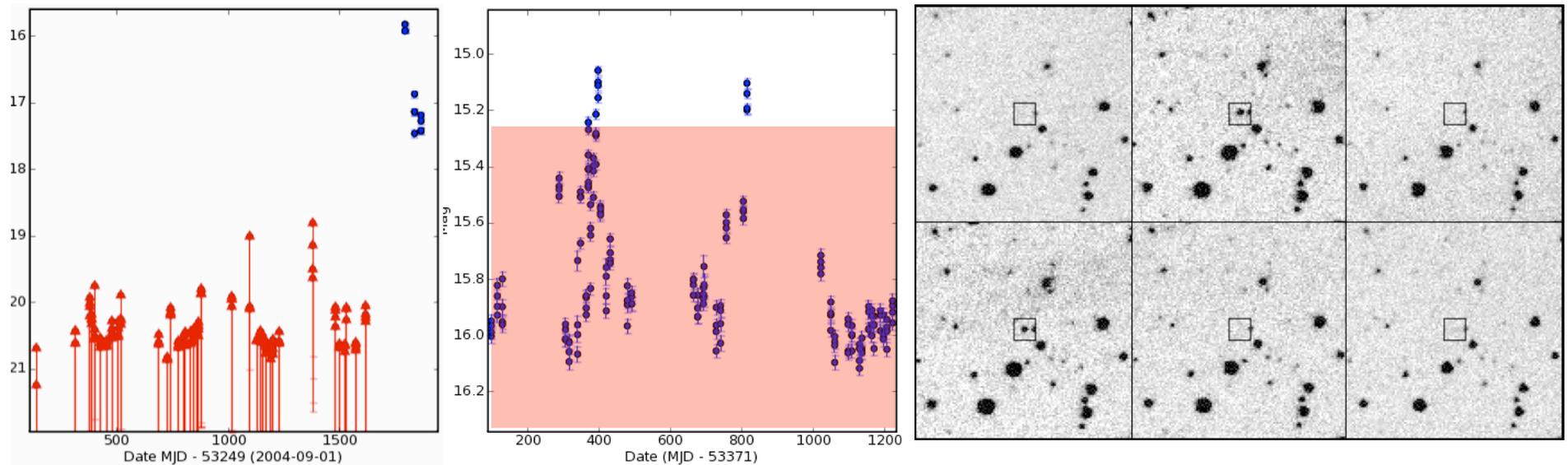
Or:

Real-time mining of Petascale data streams
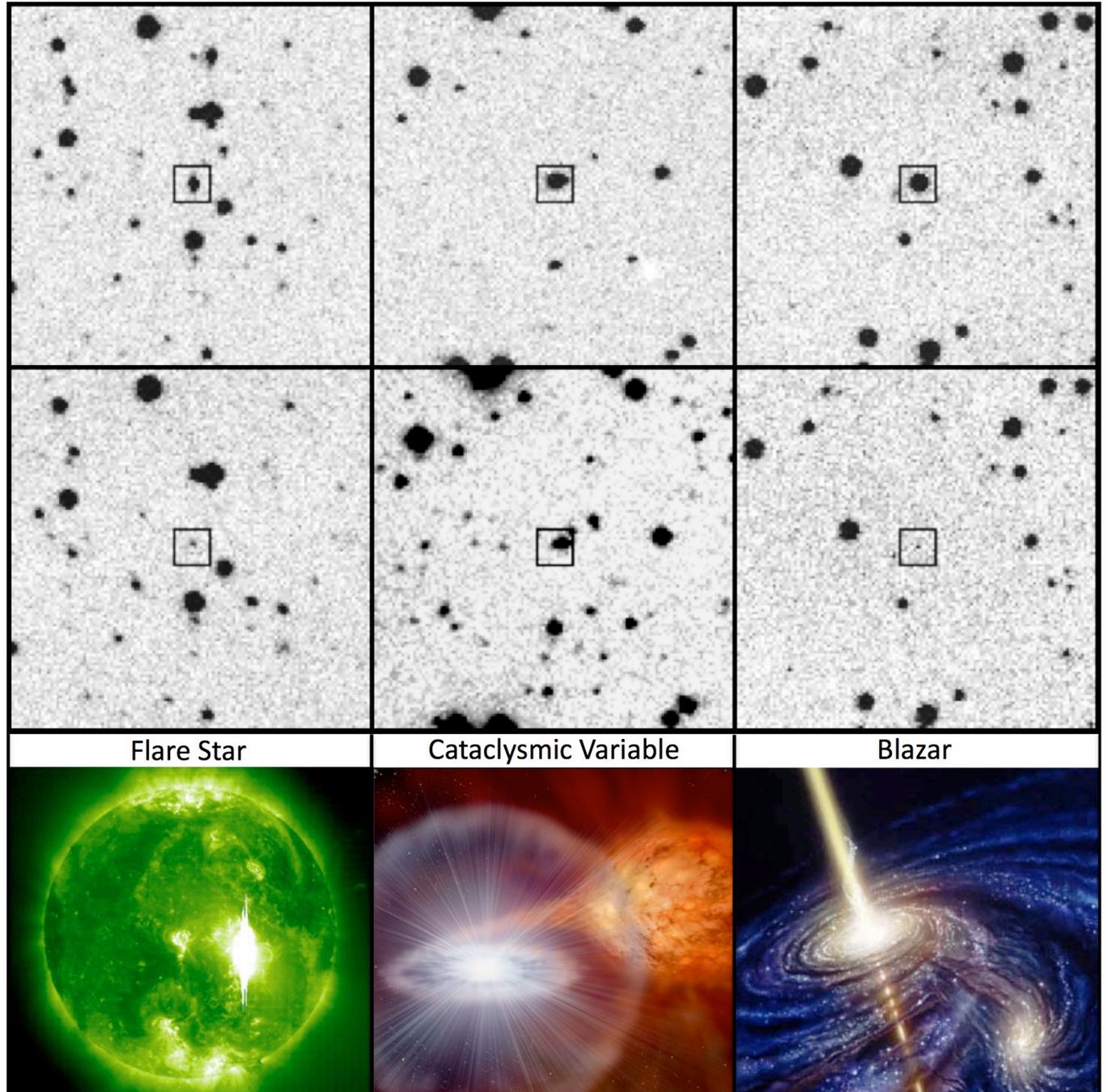
Problem #1:

Detection of transient/variable sources from multiple sub-significant detections

- Case #1: there is at least one significant detection
- Case #2: *all* detections are sub-significant
- Could be from heterogeneous surveys, other wavelengths
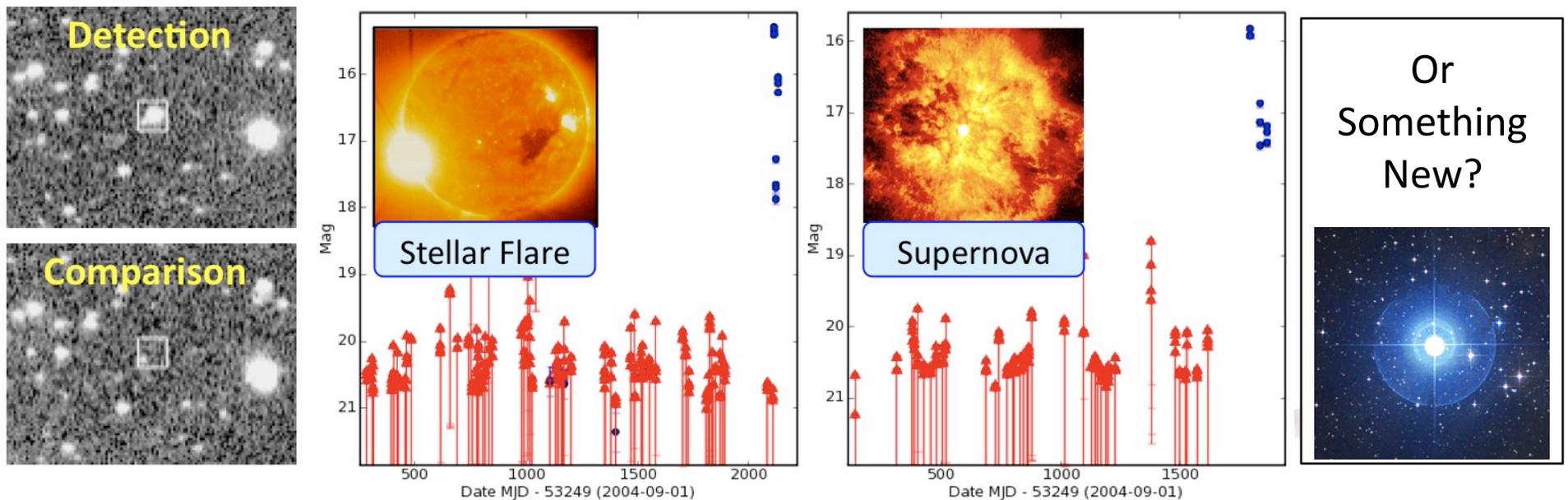- Most data may not contain *any* detections

All transients *look* the same, but can represent *vastly different* physical phenomena

Flare Star | Cataclysmic Variable | Blazar

Which ones are the most interesting and worthy of (costly) follow-up efforts?
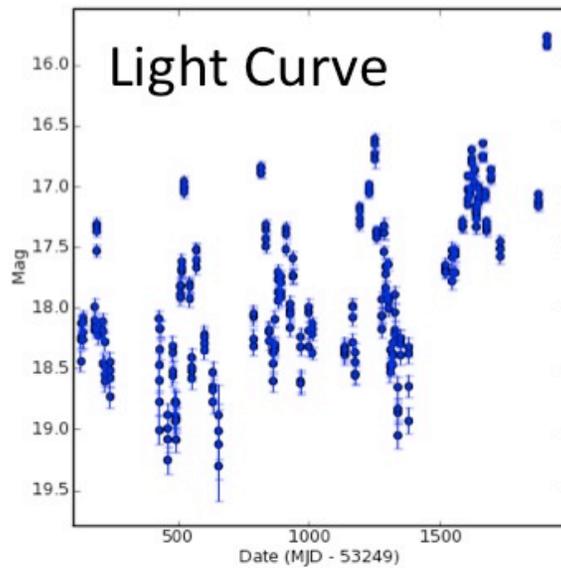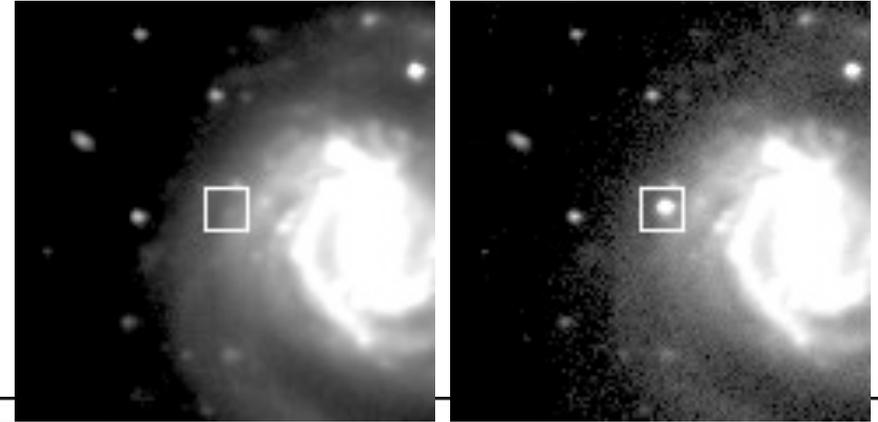
Problem #2:
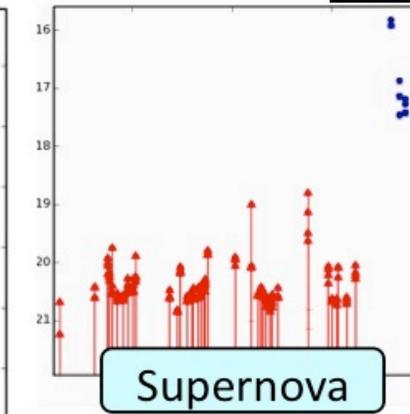## Classification-informed detection of transient/variable sources (and v.v.)

- Generalizing the concept of a matched filter
- Science (and follow-up observations) is limited by the *depth of accurate classification*, not by the flux depth
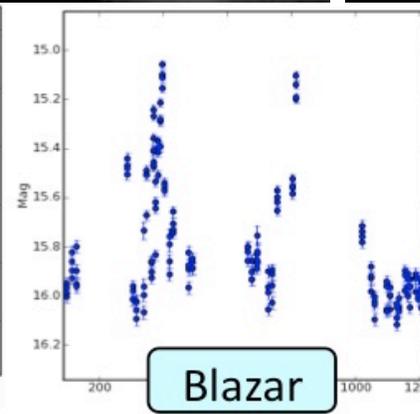
Contextual and archival information is essential
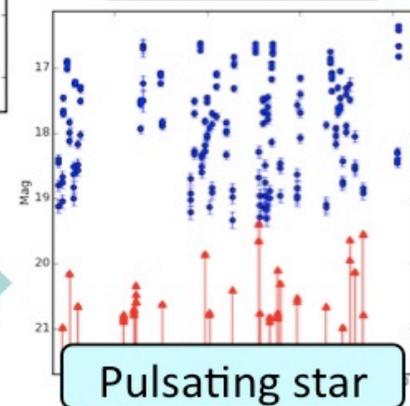
- Spatial
- Temporal
- Spectroscopic

Some Interesting Features
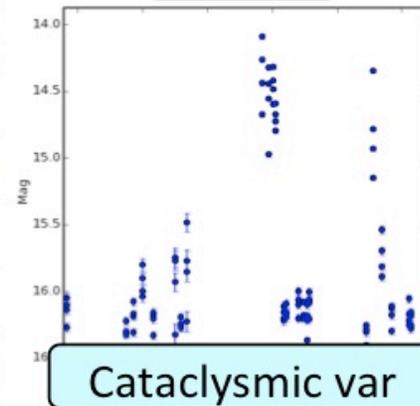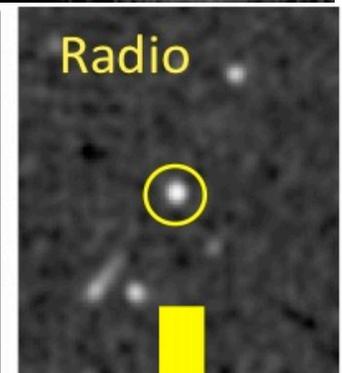
- Most of the information is not in the current data stream, but it is archival and/or contextual

- The data are heterogeneous, sparse, and incomplete
  - That suggests Bayesian approaches
  - But data models may be incomplete; new/unique phenomena

- The process is dynamical and iterative as new data come in

- Estimation of (evolving) uncertainties is almost certainly going to require some Monte-Carlo approach

- Classification is based on some (highly) multi-dimensional parameter space

- Data streams are growing from Terascale to Petascale

Computationally Intensive