LCOGT and MSIP
An Opportunity to Prepare for LSST
Summary

• LCO operates a global telescope network for time domain follow-up
• Through MSIP, NSF has purchased open-access time to help the community prepare for LSST follow-up
• Allocations to be made by NOAO TAC process with additional criteria
• Additionally, encourage community discussion and development of time-domain system infrastructure
• LCO seeks LSST and community input to guide program and ensure effectiveness
LCOGT Network

- Texas
- Hawaii
- Tenerife
- South Africa
- Chile
- Israel
- China/Tibet (2017)
- Australia

**1m: 30 arcmin FOV imager, R=50K fiber-coupled spectrograph**

**2m: 10 arcmin FOV imager, R=500 spectrograph**

0.4m 1.0m 2.0m
Overview of LCOGT Network

• Telescopes operate robotically
• Observations are assigned by a single software system that repeatedly optimizes the schedule over the entire network
• Data are uniformly reduced and made available through archive
• Full science operations since May 1, 2014
• Applicability to LSST
  – Brighter objects (hundreds per night)
  – Model for follow-up infrastructure
• Well matched to current surveys (iPTF/ZTF, ASAS-SN, Pan-STARRS, ATLAS)
Siding Spring, Australia
2m and two 1m telescopes

CTIO, Chile
Three 1m telescopes
Observing modes & time use

- Cadence-driven monitoring
  - Scheduler runs as often as needed – runtime ~ 5 min
- Target-of-opportunity
  - Expected response time < 15 minutes (achieved: 6 min median)
- Time divided among ~12 institutional members of LCOGT Science Collaboration
  - Other groups have purchased time
- 3 Key projects – supernovae, microlensing, AGN reverberation mapping
  - Significant projects on exoplanet transits, NEO tracking, TDE follow up, stellar rotation
- Community will get 9000/1500 hrs on 1m/2m telescopes over 7 semesters
  - Can also participate in key projects – additional hrs provided by LCO
  - Hours comparable to largest science collaboration partners
Relevance to LSST

- Expectation that LSST will generate several hundred alerts for new objects per night suitable for LCOGT follow up
  - Confirm with ZTF
  - These are the discoveries that can be studied in detail

- Volume of data and number of alerts from LSST demand efficient follow-up
  - LCOGT network can be used now to develop understanding and tools
MSIP

• Through MSIP, NSF has purchased open-access time for the U.S. astronomical community.
  – 1300 (1-m) and 200 (2-m) hours per semester for 7 semesters starting April 1, 2017

• NSF would like to see this time used to:
  – Effectively follow up on time domain discoveries coming out of current surveys
  – Gain community experience with carrying out real time domain follow-up projects in preparation for LSST
  – Motivate community development of infrastructure for time domain follow-up that will be useful in LSST era
Part 1 – Community Access

• Network time will be made available through NOAO proposal submission/review process
  – TAC will be asked to give priority to proposals that address NSF goals
  – First semester will require a standalone TAC for schedule reasons – subsequently will shift LCOGT semesters
  – Need to publicize opportunity
    • Jan AAS (including splinter session)
Part 2 – Developing a System

Multi-purpose alert broker DB

Survey alerts

Project-defined filter

Configurable project View of targets of interest

Project-defined filter

Configurable project View of targets of interest

Manual telescope interface

Robotic telescope API
Part 2 – Developing a System

• Use this program as opportunity for development and use of intermediate elements of a time domain system
• Define interfaces to discovery surveys and follow-up capabilities
• Encourage development and public release of brokers and software systems to manage large science projects
• Engage interested groups at NOAO spring meeting on alerts
  – Surveys, brokers, large science projects, other follow-up facilities
Concerns and Challenges

• Community interest
  – Advertise widely – LSST, ZTF, AAS, Hot-wired, NOAO, science conferences

• Make sure that lessons learned are documented
  – Annual workshop to share experience in both science and development areas

• No resources to award for development
  – Motivation has to be desire to be part of overall LSST effort
  – See this as a bottom-up activity; little management
  – Definition of good interfaces will allow modular development
Input desired

- Help publicize opportunity
- NSF goals
  - Follow up current surveys
  - Prepare community for LSST
- Review criteria for proposals
- Engagement of survey projects, software development projects, science projects aimed at producing integrated system