STScI | SPACE TELESCOPE SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

STUC Review of Gap Filler Proposals

HST STUC Presentation

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With Thanks to Laura, Neill, and Tom

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Background

- Gap Filler Program was instituted to use HST scheduling opportunities not usable by any other programs (e.g. SNAP, CAL, etc.)
  - Started in Cycle 24 as internal initiative (Program 14840)
  - Obtained ~10 targets per month from a catalog of 500 NGC galaxies
  - ACS WFC F606W – two dithered 337s exposures per visit
  - Total visit duration keep to ~25 minutes: shorter than most SNAPs, appropriate for filling “gaps”
  - ACS/WFC selected for max FOV, avoid using WFC3 Channel Select Mechanism
- Discussion with STUC in 2017 resulted in call to community for proposals
  - “The STUC supports the new Schedule Gap program, and encourages the STScI to consider additional factors without adding extra work in scheduling, including (i) additional source catalogs or additional filters in the current program; and (ii) opportunities to engage the public to provide targets for EPO purposes.”

Selected Proposals and Outcomes

- Pilot Program
  - GO 14840 observed 151 NGC galaxies from catalog of 500 [Bellini et al.2017 STScI ISR ACS 2017-12]
- 2018 Selections (per Nov 2017 STUC meeting plan)
  - GO 15444 “An ACS Schedule Gap Imaging Survey of Nearby Active Galaxies” (PI: Aaron Barth, UC Irvine) for 543 targets [Kim et al., 2021 ApJ Suppl. 256, 40]
  - GO 15445 “Gems of Galaxy Zoos” (PI: William Keel, U. Alabama) for 300 targets [Keel et al. 2022 AJ163, 150]
  - GO 15446 “HST’s Low Redshift Archive of Interacting Systems” (PI: Julianne Dalcanton, U. Washington) for 350 targets [https://www.zooniverse.org/projects/ngc3314/zoogems/talk/1396]

Key Constraints

- The proposal must provide basic observing parameters (filters, exposure time, # exposures)
- Visit duration of <=25 minutes or less
- Broad distribution on on the sky is desired
- ACS/WFC only
- No opportunity for changes in the proposal after the start of execution
- No observatory level special requirements (e.g. ORIENT)
- The data will be non-proprietary and no funding will be provided
- It is not possible to predict in advance what fraction of each catalog will be observed, when the observations will occur, or which objects will be selected for observation – this is based on scheduling efficiency and minimal effort
- The successful proposer(s) will be expected to submit an APT file in consultation with STScI staff

Selection Process for 2022/2023

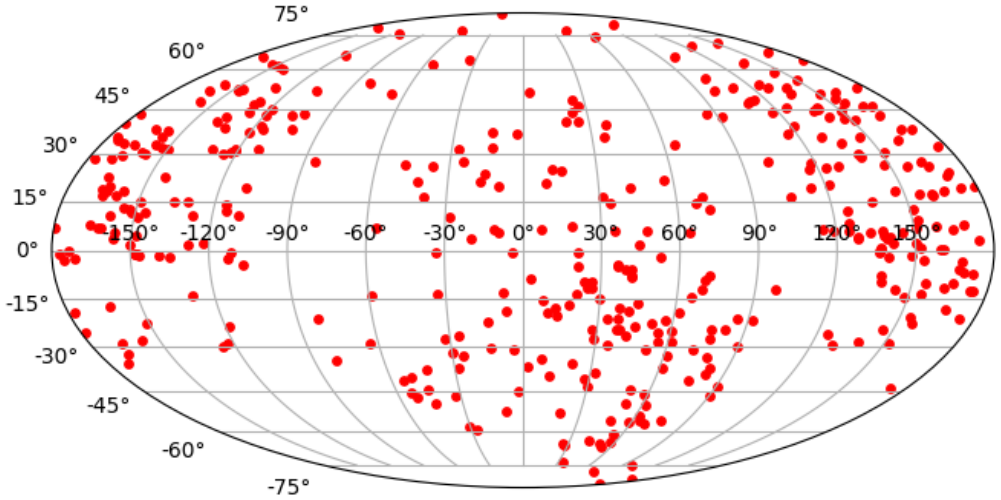
- Call issued in November 2022 with responses due 12.22.2022
- 39 proposals received (53 were received in 2018)
- 33 deemed compliant per my review
  - 5 requested WFC3 and 1 required two separate visits for each of 16 targets
- Twelve STScI staff members reviewed 5 proposals each
  - Beaton, Bellini, Coe, Fox, Kakkad, Kendrew, MacKenty, Mingozzi, Petric, Revalski, Reid, Schlafly, Smith, Zucker
- Top 8 proposals provided to STUC for review, scoring, and discussion
  - No strong consensus/break point except one scored lowest and is probably non-compliant in its desired integration time
- Please note: all non-selected proposals should remain confidential as some may be re-proposed as SNAP or GO programs

STUC Selection Process

- We would like ~1500 targets in 2-4 proposals
  - More targets possible but trade against lower completion fraction
- Expectation is that this will provide a rich sample for several years
- Proposed procedure:
  - Summarize each proposal
  - Comments/discussion by STUC members
  - Concur upon number of targets (for very large target pools)
- Each STUC member provide ranking 1-7 of the proposals (1=first choice)
- ** break to analyze** (sum of your scores)
- Discussion of balance if desired
- Generate consensus recommendation

#16 -- An HST gap program for lensed quasars: a community legacy dataset (Targets = 408)

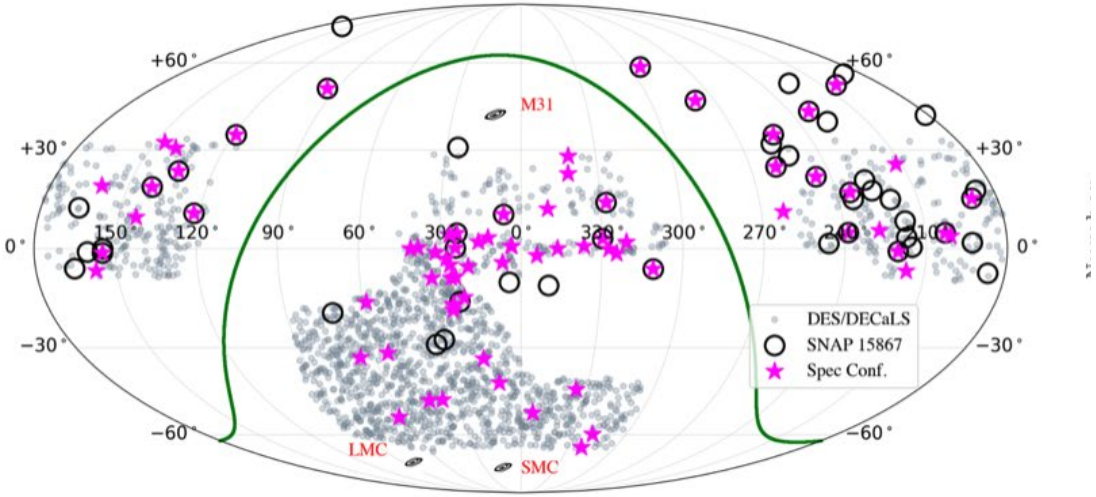
- Gravitationally lensed quasars probe a wide range of astronomical scales – from the source quasar accretion disk and the lensing galaxy IMF [1, 2], to galaxy mass distributions and the Hubble constant [3, 4]. High-resolution imaging reveals the lensed quasar host galaxy, offering not only a unique probe of quasar-host relations at high-redshift, but also constraints on the mass distribution of the lensing galaxy. Previous HST observations (∼70 systems) have revealed exciting details in individual systems, such as those with extra sources [5]. We propose a target catalogue of 408 lensed quasars and likely candidates lacking high-resolution imaging for F814W observations to build a legacy dataset for the astronomical community, highlighting several science cases below.
- The legacy value of a subset of this catalog will surpass Euclid, which lacks the necessary depth and resolution for our proposed studies. These observations will serve the astronomical community immediately, in cosmology, dark matter, quasar-host relations, and dual quasar studies.



- Science: Time-delay cosmography (Hubble tension); High redshift lenses or quasar mergers?; SMBH and their host galaxies at z = 2; Galaxy masses

#20 -- A Legacy Library of 500 Strong Gravitational Lenses (Targets = 500)

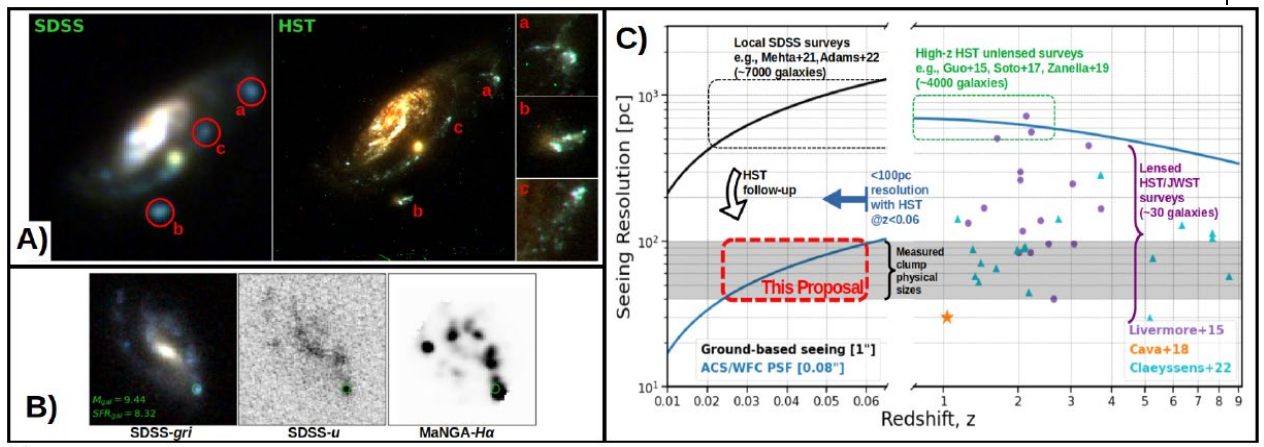
- The targeted sample of 500 strong lens systems is compiled from searches performed on DES imaging using machine learning (ML; Jacobs et al. 2019a,b) and visual inspection (O'Donnell et al. 2022). A follow-up campaign with groundbased spectroscopy for the ML-selected lens candidates has a reassuringly high confirmation rate of 88% (Tran et al. 2022). These lensing systems are all brighter than r = 22 mag (Fig. 2) and perfect for placing on one of the two WFC chips. The ACS field of view (3'×3') is ideal for quantifying the environment, e.g., group/cluster vs. field. The strong lens candidates in DES span the range in RA and can be observed by telescopes in both hemispheres (Fig. 1). They establish a unique training set for developing and calibrating machine learning algorithms to sift through upcoming all-sky surveys.



- Science: Dark matter profile in massive galaxies and clusters; Central Dark Matter (DM) profile in clusters; Dark matter substructure through gravitational imaging; Arc statistics; Dark energy using multiple-source-plane systems; Stellar initial mass function (IMF); Star formation at cosmic noon; Lensed transients; Lensed gravitational waves Preparing for LSST, Euclid, Roman

#27 -- Resolved imaging survey of the analogs of high-z massive, star-forming clumps (Targets = 381)

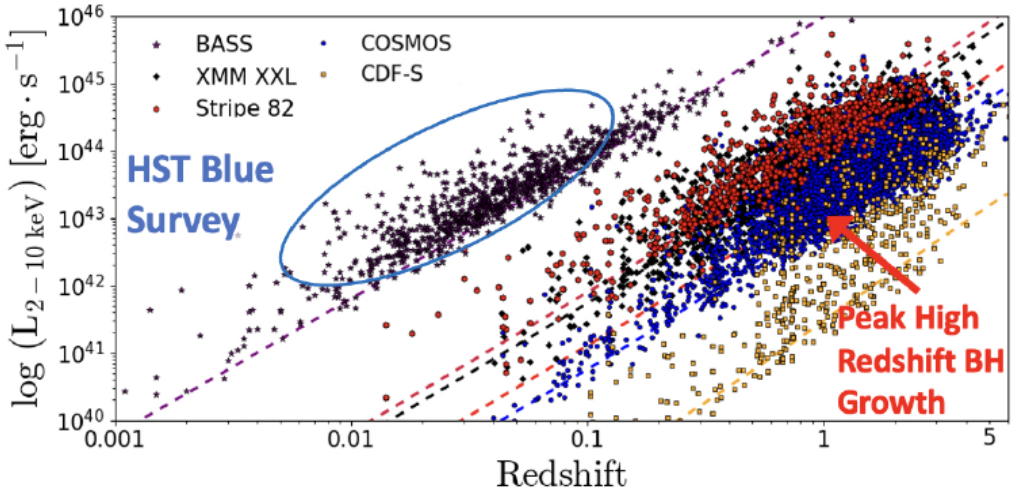
- We propose a program to obtain HST/ACS imaging of 381 clumpy galaxies selected from SDSS (0.02<z<0.06) with the help of machine learning. imaging with F435W and F775W filters (which avoid strong optical emission lines) with an exposure time of 350 seconds in each, which will be sufficient to achieve an S/N of >5 (ETCv30.2) even in our most conservative estimate (i.e., an extended source with a surface brightness of 22.5 mag arcsec□ 2 in a 0.200 aperture). We will use the 2k2k sub-array and split the integration time over 2 dithered exposures



- Science: This survey will produce the largest to-date sample of resolved clumps that are analogous to those found in high-redshift starforming galaxies. It will improve the number statistics by an order of magnitude compared to existing studies of resolved clumps. We will measure the resolved clumps' physical properties as well as the clump luminosity and mass functions and the results will be compared against expectations from theoretical models to distinguish between competing theories for clump formation and evolution and their role in galaxy evolution.

#33 -- A Blue Gap Survey of Nearby Active Galaxies (Targets = 389)

- We propose the first large (N > 30) systematic survey using the bluest wide ACS filter (F435W) to accurately trace the nuclear star formation and AGN-related PSF emission at typical scales of 50 pc. Despite having hundreds of HST I band (F814W) images of BAT AGN (306/858), only 30 AGN have been observed in blue wide filters (e.g., F435W, F438W, F439W, and F450W) which trace younger stars. We selected all z < 0.1 unbeamed AGN4, which have reliable measurements of MBH through broad Balmer emission lines or velocity dispersions (639 AGN) final sample of unobserved AGN then totals 389, of which 199 have existing broadband redder HST imaging (F606W or F814W) enabling studies of integrated colors and color gradients. Follow the past I-band program of BAT AGN (current GAP FILLER).



- Science: Bluer wavelengths are critical for understanding the role of younger stars in black hole growth. These ~50 pc resolution observations will resolve the power output of local AGN using simultaneous spectral coverage and study the link of nuclear star formation with AGN activity.