



STScI | SPACE TELESCOPE
SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

STUC Telecon

Neill Reid, Associated Director for Science

28 February 2019



Topics

- UV Legacy DD Initiative
- Large-scale Legacy Archival Programs
- Orbit allocation for Cycle 27
- HST-TESS Advisory Committee



UV Legacy DD Initiative



Context

Director's Discretionary Time constitutes up to 10% of the time available each cycle, allocated in a number of ways:

- Small-scale allocations through the cycle for time-critical observations
 - ~25 programs/cycle for SNe, GRBs, comets, novae & other transient events
- Monitoring programs & heritage-style programs
 - OPAL, anniversary images
- Supplementary orbits for GO programs
 - Multi-Cycle Treasury programs, Cycle 26 Fundamental Physics initiative
- Large-scale programs
 - Hubble Deep Field
 - Hubble Ultra-Deep Field
 - Frontier Fields

These past programs have used deep imaging to probe galaxy evolution and the high redshift universe; the present initiative comes closer to home.



UV Legacy DD Initiative – charter

Challenge: explore the potential for a large-scale program that takes advantage of Hubble’s unique UV capabilities to probe star formation processes and related stellar astrophysics.

Following discussion with the STUC in April 2018, a charter was developed and a Working Group was constituted:

“...The charge to the Working Group is to identify the most effective strategy for achieving high scientific impact and return for an investment of 600-1000 orbits of ultraviolet observations related to star formation and the associated stellar physics. A program (or set of programs) on this scale presents scientific opportunities that are not ordinarily available through the normal time allocation process...”

The HST Ultraviolet Legacy Working Group has the following primary tasks:

- Define the overarching science case and a set of science goals for a comprehensive set of ultraviolet observations related to **star formation and associated stellar physics** that advance scientific discovery and provide lasting archival value.
- Solicit input from the astronomical community in defining the science goals.
- Recommend representative suites of observations necessary to accomplish the science goals of this initiative. Prioritize if possible.
- Identify opportunities for coordinated observations over the full wavelength regime with other ground-based and space-based observatories.
- Produce a short (10-15 page) white paper describing the results of the above tasks by the end of January 2019. “

See

<https://outerspace.stsci.edu/display/HPR/HST+UltraViolet+Legacy+DD+Program+for+Star+Formation+and+related+Stellar+Astrophysics>



Working Group membership

Constituted in August 2018:

- Sally Oey, University of Michigan (chair)
- Nate Bastian, Liverpool John Moores University
- Nuria Calvet, University of Michigan (*)
- Paul Crowther, Sheffield University
- Andrew Fox, STScI
- Jay Gallagher, University of Wisconsin
- Gregory Herczeg, Kavli Institute for Astronomy, Peking University (*)
- Ana Gomez de Castro, Univ. Complutense de Madrid (STUC)
- Claus Leitherer, STScI
- Christy Tremonti, University of Wisconsin

(*) Joined WG in December 2018



Soliciting community input

WG developed outlines for possible science themes during the initial telecons

- Solicited community input
 - 4-question survey distributed 11/1/2019
 - Opportunity for community to submit suggested science themes
 - short white papers outlining science cases
 - Deadline December 7 2019
 - 196 survey responses, 34 white papers
- Key focus for the WG: what can't you do as a GO program?
- Two themes emerged as predominant choices
 - Spectroscopy of young OB stars, particularly at lower metallicities
 - Stellar population modelling
 - Spectroscopy of young low-mass stars
 - Accretion processes



The report

WG recruited additional members with expertise in low-mass star formation

Developed science case through telecons and face-to-face meeting at University of Michigan (Ann Arbor) on January 17-18 2019

Final report submitted to the STScI Director on February 5:

“..the HST UV Legacy Science Definition Working Group recommends that the HST UV Initiative be devoted to obtaining a **Hubble UV Legacy Library of Young Stars as Essential Standards (ULLYSES)** to serve as a UV spectroscopic reference sample of high-mass and low-mass, young stars. The recommended library will provide observations that uniformly sample the fundamental astrophysical parameter space for each class of stars, i.e., spectral type, luminosity class, and metallicity for massive stars; and spectral type, age, and disk accretion rate in low-mass stars...”

Up to 1,000 orbits for spectroscopy of 70 LMC/70 SMC OB stars & lower metallicity high-mass stars + 40 K & M-type T Tauris & brown dwarfs in Galactic star-forming regions.



Review & decision

WG Report was distributed for high-level review to 4 researchers who were asked to assess:

- The likely scientific impact of the proposed program;
- The potential for supplementary and complementary observations, with Hubble and other facilities; and
- The potential for related theoretical investigations or simulations.

Unanimous feedback in support of executing the program

The Director has decided to undertake the program, starting in Cycle 27.

- The Ultraviolet Legacy program will be modeled after the Frontier Fields program. All data obtained will be non-proprietary, as will contributed data and information, which in return will be recognized with appropriate citation and attribution.



What happens next? Recruit implementation team

STScI will identify an in-house team to implement the program and produce high-level data products for dissemination to the community.

Implementation team lead:

- Overall responsibility for implementing the program, in consultation with the community including
 - Target selection
 - Finalise instrument set-ups and observing strategy
 - Coordinate observations with other facilities
 - Communications strategy
 - Outline for higher-level data products
- Reports to STUC and community on progress

Technical lead(s):

- Implement observing program(s)
 - Develop APT files
 - Develop detailed schedule
 - Oversight of observation execution

Science data products lead:

- Develop data products
 - Defines detailed characteristics of the higher-level data products
 - Oversight of the production and checking of actual data products
 - Develops appropriate mechanisms to enhance community access to data products

E/PO Lead:

- Publicises the ULLYSES program and its results
- Leads E/PO team

Science advisors (STScI & external):

- Advise the implementation team lead on science-related issues arising from the program

Program advisory council:

- Advises the implementation team lead on policy-related issues arising from the program



What happens next? Informing the community

Opportunities to supplement these core observations and perform archival research will be available through the standard HST Calls for Proposals.

Program has been defined conceptually

- Target list & detailed observing modes remain to be finalized

We need to provide sufficient information to enable proposals for:

- Pure parallel programs
- Archival & theory programs
- Complementary/supplementary GO programs

We don't want to pre-empt or preclude Cycle 27 GO programs in these science areas

- We plan to release the Executive Summary, but withhold the full report until after the proposal deadline
- The Cycle 27 TAC will be instructed to grade each proposal as it stands; don't assume that any program is redundant with ULLYSES



What happens next? Outline schedule

STUC briefing – February 28

Community announcement – March 4

Highlight as News item in Call for Proposals

STIC briefing – March 5

Call for implementation team lead – March 5

- Select team lead – March 20

Call for technical lead(s), data science lead, E/PO lead – March 20

- Select leads – April 5

Poll community for input on target lists and operational configurations – start April 5

- Deadline for input - end of May
- Science advisors will help assess input

Develop website for ULLYSES – start April 5

- Primary tool for communication with users

Release full report – April 8

Circulate guidance on program selections to Cycle 27 TAC members - May 1

- Cycle 27 TAC meeting – June 9-14
- Cycle 27 TAC results announced – June 28

ULLYSES primary target list & observations announced – July 1

- Initial plan for release of higher-level data products

Cycle 27 Long Range Plan – first iteration available by mid-August



Large-scale Legacy Archival Programs



Archival & Theory programs

HST currently offers two program categories:

- Regular AR/theory proposals, up to \$120K
 - Median value ~\$60K
- Legacy AR/theory proposals, >\$120K with no upper limit
 - Median value ~\$300K

There have been suggestions that STScI should provide an opportunity for larger-scale AR and Theory programs, spanning the full range of science topics.



Some numbers

Cycle 26 accepted programs

- Legacy AR/theory programs
 - 5 proposals, \$240K - \$550K for total of \$2 million
- Large GO programs
 - 7 proposals, \$99K - \$1.1 million for a total of \$3.3 million
- Treasury GO programs
 - 3 proposals, \$843K - \$1.5 million for a total of \$3.5 million

Funding allocations recommended by the Financial Review Committee are based on the work outlined in the budget proposal

- Funding requests for GO programs include data reduction in addition to data analysis and the possible production of higher-level data products



Encouraging larger-scale archival programs

With the growth of the HST archive and its availability via the Amazon cloud, STScI is interested in encouraging ambitious archival/theory programs.

We could create a separate category (super-Legacy?), but we currently have no criteria for setting the funding threshold between Legacy and the new category.

Instead, we propose to adjust the description of Legacy ARs in the Call for Proposals,

- Current: “While there is no lower limit on the requested amount of funding, it is expected that most Legacy AR Proposals will require at least \$120,000, and possibly up to **a few** times this amount, to accomplish their goals.”
- Proposed: “While there is no lower limit on the requested amount of funding, it is expected that most Legacy AR Proposals will require at least \$120,000, and possibly **several** times this amount, to accomplish their goals. **STScI encourages the submission of such large-scale Archival and Theory proposals.**”

All funding allocations would still be contingent on review of the proposed work by the FRC.



Cycle 27 TAC orbit allocation



HST orbit tail

The orbit allocation for each new cycle includes a “tail” of unexecuted orbits from programs in past cycles

- Maintaining a tail is essential to maximizing observing efficiency
 - The “over-pressure” ensures that there are more scheduling opportunities at any given time
- However, if the tail grows too much, the completion rate decreases for individual programs
 - Programs can extend through multiple cycles, potentially impacting the science return
- Need to maintain an appropriate balance between efficiency and science return
 - Current tail exceeds 1,300 orbits, which is becoming uncomfortably high



Cycle 27 Orbit Allocation

Standard GO allocation in recent TACs has been $\sim 3,400$ orbits/cycle

- If adopted for Cycle 27, the tail likely increases to $\sim 1,900$ orbits

Why?

- Additional HOPRs due to increased gyro jitter + 1 week downtime due to gyro 2 failure
- Need to allow for UV Legacy DD program Cycle 27 allocation
- Mild deficit spending in previous cycles

Cycle 27 nominal allocation

- 1500 orbits for regular programs
- 600 orbits for medium programs
- 600 orbits for large/treasury programs

Anticipate reducing the tail to $\sim 1,200$ orbits



HST and TESS

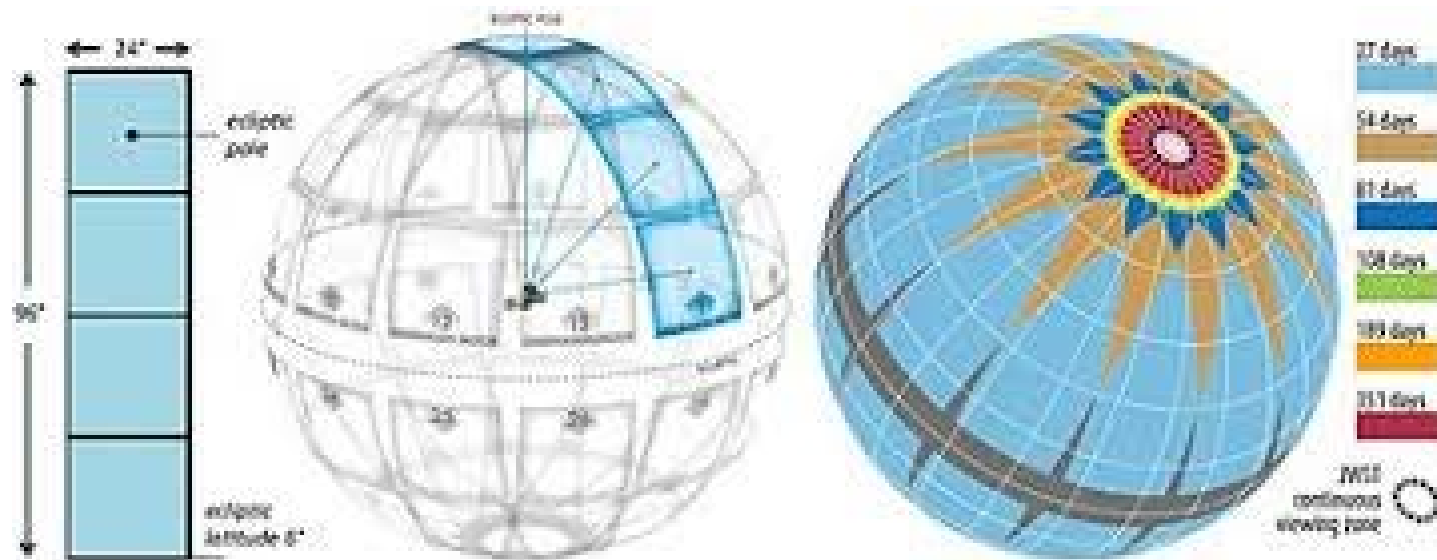


The Transiting Exoplanet Survey Satellite

TESS was launched on April 18 2018 and started science observations on July 25

The 2-year mission will survey 85% of the sky in $24^\circ \times 96^\circ$ segments, with observations spanning 27 days for each segment

The survey of the southern hemisphere will be completed in July 2019; TESS will flip 180° to observe the northern hemisphere





TESS, HST and JWST

TESS is already making exciting discoveries, and the planets discovered by TESS will be prime targets for observation with the James Webb Space Telescope.

- HST will play a crucial role in refining the JWST target list by providing initial characterization of selected exoplanets;
- Those observations will require significant investment of resources, time and effort;
- There is some urgency given the JWST proposal timeline (Cycle 1 GO, ~May 2020).

We would like to develop a coordinated approach rather than a piecemeal response to individual discoveries:

- We anticipate TESS-related programs will be supported in the Cy 26 mid-cycle call and the Cycle 27 TAC;
- Looking beyond that, we propose to constitute an Advisory Committee to provide counsel on how HST can best support TESS follow-up for JWST.



HST-TESS Advisory Committee

Charter:

The HST-TESS Advisory Committee is charged with providing guidance on optimal strategies for maximizing the scientific return from HST observations of TESS targets. In particular, the Working Group should address the following tasks:

- Solicit input from the community on how HST can capitalize on the discoveries made by TESS;
- Identify specific science themes and/or exoplanet types that should receive particular attention;
- Provide advice on the optimal timing for substantive follow-up observations and suggest mechanisms for enabling those observations;
- Comment on the appropriate scale of resources likely required to support those programs.

Committee members will be recruited from the community over the next month. The committee will be asked to summarise their conclusions in a report to the Director and presentations to the STUC in late summer 2019.