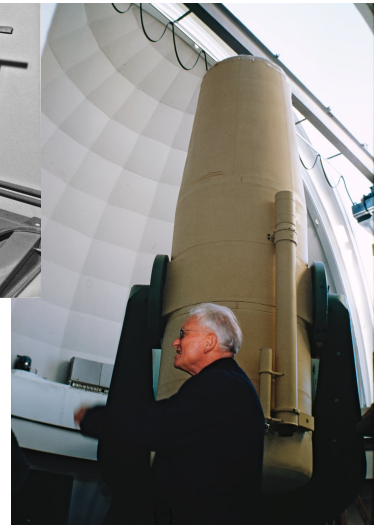
The ESO Survey Landscape

Bruno Leibundgut

ESO and Imaging Surveys

- Original ESO project
  - Quick Blue southern sky survey
  - (red part done by SERC with UKST)



- ESO Imaging Survey
  - Summary (Renzini & da Costa 1999)
  - Mostly considered a failure
    - Not sufficient support within ESO
- Ad hoc participation in multi-observatory surveys
  - e.g. K-band for GOODS
- ESO provides many facilities for survey follow-up observations

ESO and Imaging Surveys

Messenger 115 (2004)
Workshop May 2003

REPORT ON THE ESO WORKSHOP ON

LARGE PROGRAMMES AND SURVEYS

STEFAN WAGNER (LANDESSTERNWARTE HEIDELBERG)
AND BRUNO LEIBUNDGUT (ESO)

DURING THE 1980s ESO introduced "Key Programmes" to make best use of the observational resources. A first assessment of the success of the Key Programmes was done in 1993 and came to the result that the concept had severe shortcomings (cf. *Messenger* article by Cesarsky and Kudritzki 1994, Messenger 75, 45). In particular, a large fraction of the available observing time was committed to these Key Programmes and they were severely limiting the access to ESO telescopes for general users. In addition, the scientific impact of these Key Programmes was not very high. To avoid this mistake for the VLT a working group of community astronomers was formed in 1996 to discuss ways of achieving the best possible scientific return of the VLT. The report Large Programmes and to discuss planning for future surveys at ESO. Several members of the OPC and STC actively participated in the workshop.

Every PI of a Large Programme (LP) approved up to ESO Period 69 was invited to present the results of their project. All LPs but one were presented in half-hour talks. A two-hour discussion session was held to assess whether the current scheme of LPs is adequate or should be adjusted.

We experienced very good presentations with a range of very interesting results. After all, these Large Programmes were supposed to be amongst the most exciting current projects. Not all programmes had finished taking data at the time of the workshop, but it was possible nevertheless to get a good overview. The first day of the workshop was devoted to extragalactic topics. The progress constrain the cluster ages and give lower limits to the dynamical age of the universe. The first stars formed are still around and can be observed as metal-poor inhabitants of the Milky Way. While Gamma-Ray Bursts and Supernovae have not been observed in our Galaxy (at least during the existence of ESO), they have stellar progenitors. One Large Programme has been devoted to each problem. The characterisation of the GRBs themselves and their host galaxies is providing more and more clues to the nature of these explosions. A search for progenitor systems of Type Ia Supernovae among the known white dwarfs has been conducted at the VLT and yielded some tentative results. Before the discussion session Jacques Breysacher gave an assessment of the scheduling impact Large Programmes have had.

Announcements

A NEW START FOR PUBLIC SURVEYS

ALVIO RENZINI (ESO)

With VST and OmegaCam nearing completion it became urgent to define new procedures for the most efficient exploitation of these survey facilities, also in view of the VISTA infrared survey telescope expected to join the Paranal Observatory in 2007. Moreover, even before VISTA, the UKIDSS project (Warren 2002) will provide the ESO community with major infrared surveys that may be in need of an extensive optical counterpart.

The issue was extensively discussed at the dedicated ESO Workshop on "Large Programmes and Public Surveys" that was held in Garching in May, 2003 (see Wagner & Leibundgut 2004, for a summary of the Workshop). A set of guidelines emerged from the discussion which are worth summarizing here again.

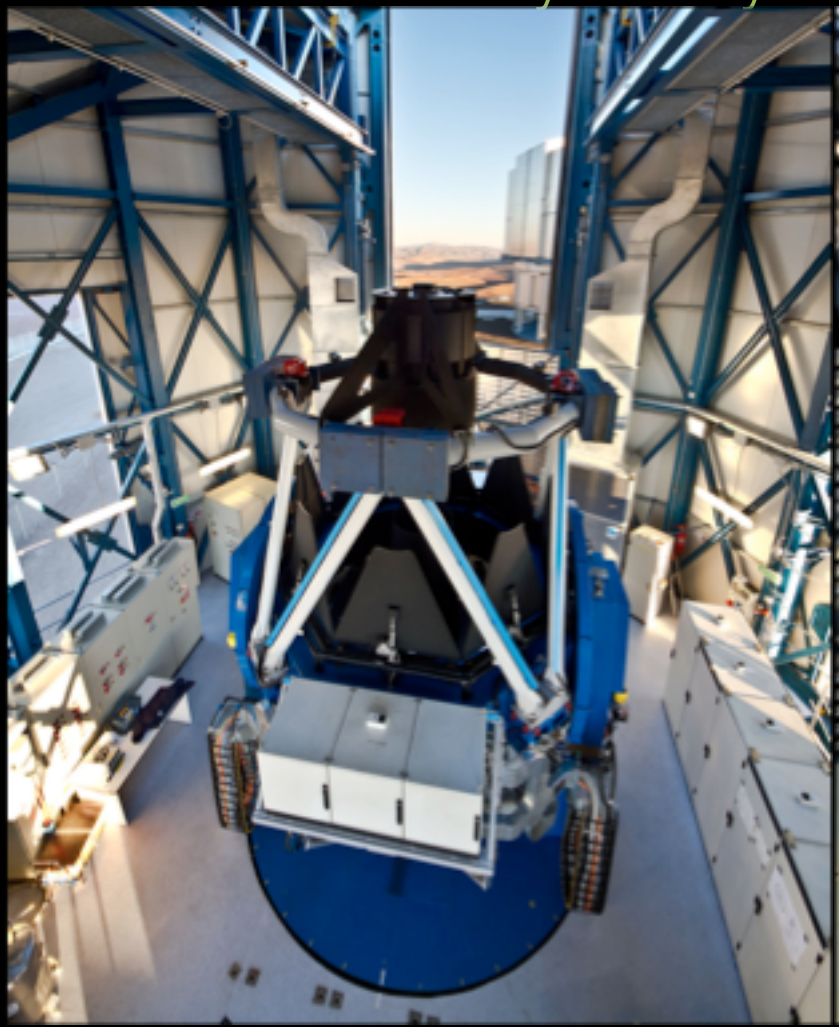
Public Imaging Surveys ought to be conducted with the widest direct involvement of the community and should comply with the effort for the benefit of the community, if there was a clear perspective of scientific follow up at the VLT/VLTI. As a result, the new procedures foresee that a team proposing itself for carrying out a survey can also submit to OPC a proposal for the scientific follow-up at the VLT/VLTI, which will be evaluated jointly with the survey proposal. Such a procedure will both help motivating the team, and ensuring that the survey products comply with their scientific specifications.

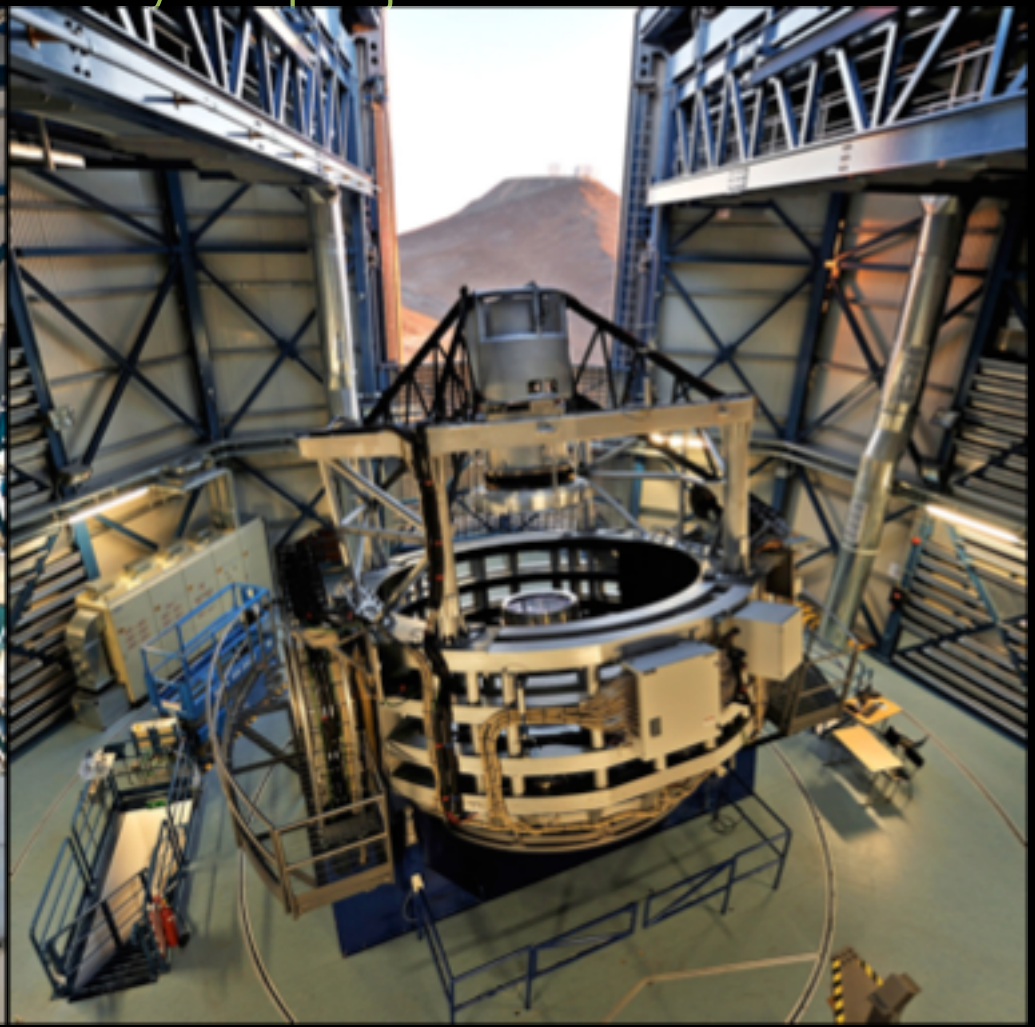
Before proceeding to appoint the Public Survey Panel (PSP), ESO issued on September 15 a call for "Letters of Intent" for public survey proposals. Teams intending to submit such proposals will be asked to provide a succinct description of the survey, including its scientific objectives and a brief description of the observations. With this information in hand ESO will then proceed to appoint the PSP members, making sure that the PSP scientific expertise will match the whole range of astronomical applications of the surveys to be proposed.

Messenger 117 (2004)

The Survey Telescopes

- VST 2.6m for optical and VISTA 4.1m for infrared observations
- Coordinated sky surveys in 5-year projects





ESO and Imaging Surveys

Procedures for ESO Public Surveys

A Public Survey is understood to be an observing programme in which the investigators commit to produce and make publicly available, within a defined time, a fully reduced and scientifically usable data set that is likely to be of general use to a broader community of astronomers. The practical implementation of Public Imaging Surveys will proceed as follows.

1. ESO will periodically issue a "Call for Public Imaging Survey Proposals", for groups in the community to propose Public Imaging Surveys. Proposals shall include a scientific rationale, observing strategy, estimated observing time, and its distribution over observing Periods, as well as a detailed description of the responsibilities the team would be ready to take in case of approval of the proposed survey.

2. ESO will ask INAF (for the VST Consortium) and the *OmegaCam* Consortium to provide detailed descriptions for the observing programmes they intend to conduct in their guaranteed time (GTO) at the VST over the first 4 semesters. A similar procedure will be repeated every two years until the completion of the GTO time.

3. ESO will establish a *Public Survey Panel* (PSP) including scientists expert in a broad range of current astronomical research, with particular emphasis on those areas that can profit from Public Surveys. The PSP prime mandate will be to review the Public Survey Proposals and, taking into account the GTO programmes, elaborate a scientifically and observationally well coordinated set of Public Surveys. This process may well imply merging different proposals, or expanding their aims beyond the original ones e.g., in the filter set, depth, area, coordinates, etc. In order to achieve these goals the PSP will involve representatives from both the GTO teams and selected teams having submitted Survey Proposals. On the basis of the achieved coordination the selected survey teams will modify the survey proposals, describing the scientific rationale, observational strategy, and data product specifications (e.g. photometric and astrometric accuracy, images, catalogs, delivery time, etc.) as agreed in the course of these activities.

4. The PSP will review these modified proposals and forward them to the OPC along with a document illustrating the criteria adopted for the optimization and coordination of the recommended set of surveys, and the motivations for having rejected others.

5. These resulting proposals for Public Survey may include proposals for subsequent proprietary observations with other ESO facilities which are designed to exploit the results of the survey in question. The OPC will then provide simultaneous recommendations on the time to allocate both to the survey and to its followup. A Management Plan for each survey will also be attached to the proposal for ESO review.

6. For each approved Public Survey ESO will negotiate with the PI the extent of ESO support that could be given, and the timeline of product delivery. The allocation of observing time for the scientific follow up of the survey will be subject to the timely delivery of the survey products and their compliance to the specifications.

7. The PSP Document, the final proposals for Public Surveys and the description of the GTO programmes will be made available on the web prior to the regular *Call for Proposals* for the VST.

8. Proposals for *Proprietary Surveys* can be submitted as usual following the regular *Calls for Proposals*, thus ensuring that the OPC evaluates all survey proposals (public and proprietary).

9. The ESO/ST-ECF *Science Archive Facility* (SAF) will be the collection point for the survey products and the primary point of publication/availability of these products to the ESO community. ESO will assist the survey teams to define and package their data products in a manner consistent with *SAF* and *Virtual Observatory* standards and will integrate the products into the SAF.

10. Survey programs that directly complement other public surveys should themselves be carried out as Public Surveys. In case of GTO programs in this category, ESO will encourage the GTO Teams making their survey products public and to submit proposals for the scientific follow up at other ESO telescopes, following the same procedures outlined in item 5 above. In all cases the allocation of the OPC recommended observing time for the scientific follow up will be subject to the timely delivery of the survey products and their compliance to the specifications.

11. The PSP will periodically review the progress of the surveys and will assess the compliance to the specification of the survey products. The PSP will then forward to ESO Directorate its recommendations concerning the continuation of each survey and the allocation of the associated follow-up time at other facilities.

Messenger 117 (2004)

Procedures for Public Surveys

- Periodic calls
  - done for VISTA (2006 and 2016), VST (2005), spectroscopic surveys (2011 and 2014)
- Start of operations
  - VISTA: 2010 and 2017 (second round of surveys)
  - VST: 2011
  - Gaia-ESO and PESSTO: 2012
  - VANDELS and LEGA-C: 2015

Procedures for Public Surveys

- Public Survey Panel
  - (Imaging - PSP) Established in 2005
    - Chair: Duccio Macchetto (until 2014)
      - selection of VISTA round1 and VST
    - Chair: Danny Lennon (2014 until 2017)
      - VISTA round 2
  - (Spectroscopy - PSSP) Established in 2010
    - Chair: Simon White (until 2017)
      - selection of all spectroscopic surveys
  - Panels merged into a single PSP in 2017
    - Chair: Miguel Mas Hesse

Procedures for Public Surveys

- Public Survey Panel
  - Functions
    - select surveys
      - take into account GTO allocations, if appropriate
    - propose mergers of surveys as appropriate
    - assist ESO in science decisions concerning surveys
    - periodic reviews of survey progress
      - imaging surveys: 2011 (VISTA only), 2012, 2014
      - spectroscopic surveys: 2014, 2015
- Observing Programmes Committee
  - discusses selection proposed by PSP
  - recommends surveys for implementation to ESO DG

Procedures for Public Surveys

- Survey Management Plan
  - negotiated between ESO and survey team
  - defines
    - observational parameters, e.g. total execution time
    - observing schedule
    - deliverables, e.g. reduced data, catalogues
  - approved by ESO DG
  - published on ESO Web
- Phase 3
  - archiving
    - reduced data
    - data products
    - catalogues

Current Surveys

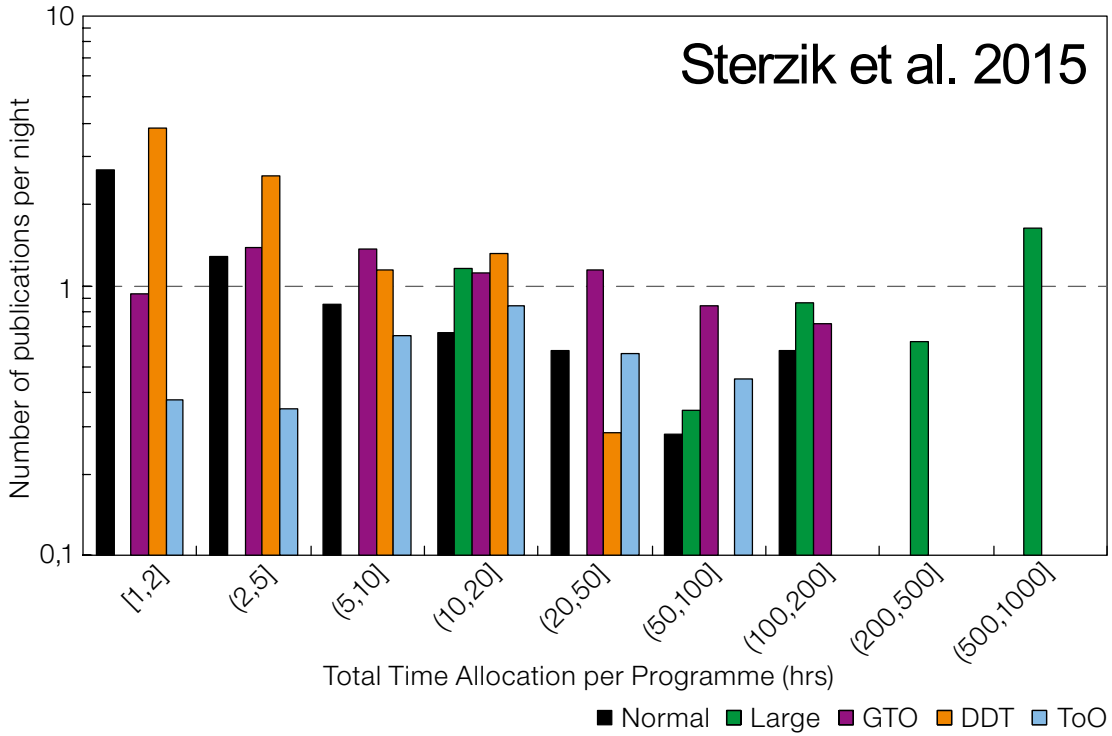
- Details in Magda's talk
- VISTA
  - several surveys completed
  - second round of observations started
- VST
  - all surveys still ongoing, incl. several GTO surveys
    - some extensions granted by PSP
- Spectroscopic (started 2012 and 2015)
  - Gaia-ESO completed
  - PESSTO completed
    - continues as ePESSTO LP
  - VANDELS, LEGA-C completed
    - VIMOS decommissioned

Considerations

- Dedicate 4m telescopes to specific science topics
  - 3.6m → radial velocity monitoring
    - HARPS/NIRPS
  - NTT → transients
    - PESSTO, ePESSTO, *UltraCam,* SOXS
  - VISTA → massive spectroscopic surveys
    - Gaia follow-up, redshift surveys; 4MOST

Considerations

- Good return from surveys
- Good return from Large Programmes

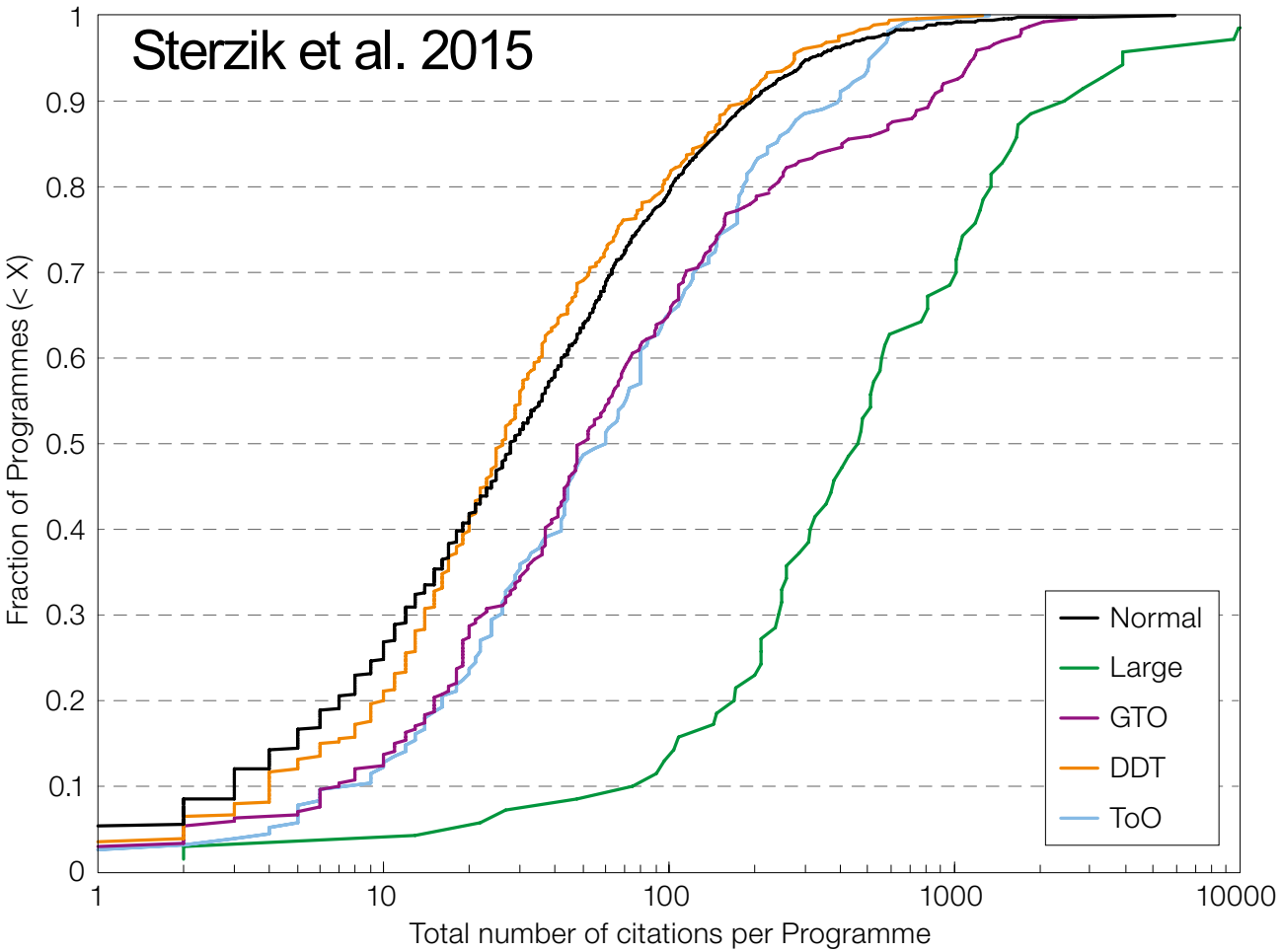


	Pubs
VST	
KIDS	41
ATLAS	27
VPHAS+	21
VISTA	
UltraVISTA	107
VIKING	43
VMC	39
VVV	153
VHS	61
VIDEO	29
Spectroscopic	
Gaia-ESO	77
PESSTO	58
VANDELS	2
LEGA-C	4

1 June 2018

Considerations

- Large Programmes have higher impact



Considerations

- Coherent programmes
  - better science focus
  - larger impact
- VLT will move towards coherent programmes
  - consider >30000 VLT nights observed to date
  - instrument development will slow down
    - parameter space diminishing
    - JWST, ELTs
    - expensive investment required
- Community discussion needed
  - VLT workshop planned for 2019
    - discuss future VLT directions, incl. more coherent programmes

Considerations

Surveys are becoming fashionable

Monday, June 4, 2018 at 11:54:49 AM Central European Summer Time

Subject: Announcement: the U.S. Extremely Large Telescope (ELT) Program
Date: Monday, 21. May 2018 at 19:02:36 Central European Summer Time
From: David Silva dsilva@noao.edu
To: currents-list@eso.org
Category: Observatories

U.S. EXTREMELY LARGE TELESCOPE PROGRAM

21 May 2018

U.S. national observatory and two extremely large telescope projects team up to enhance U.S. scientific leadership in astronomy and astrophysics

A new research frontier in astronomy and astrophysics will open in the mid-2020s with the advent of ground-based extremely large optical-infrared telescopes (ELTs) with primary mirrors in the 20-m – 40-m range. U.S. scientific leadership in astronomy and astrophysics will be significantly enhanced if the broad U.S. community can take advantage of the power of these new ELTs.

In that context, the National Science Foundation's (NSF) National Optical Astronomy Observatory (NOAO), the Giant Magellan Telescope Organization (GMTO), and the Thirty Meter Telescope International Observatory (TIO) have embarked on the development of a **U.S. Extremely Large Telescope (US-ELT) Program**.

NRAO eNews

Volume 11, Issue 6 • 31 May 2018

X-Proposal Expression of Interest Announcement

The National Radio Astronomy Observatory (NRAO), Long Baseline Observatory (LBO), and Green Bank Observatory (GBO) invite submission of brief Expressions of Interest (EoIs) in Principal Investigator-led "eXtra Large Proposals" (X-Proposals) for the Very Large Array (VLA), Very Long Baseline Array, and Green Bank Telescope requiring 1000 hours or more of telescope time, and running over multiple semesters (and possibly multiple VLA configurations).

Responses will be used to gauge the level of community interest in such proposals, and their scientific potential. NRAO, GBO, and LBO will seek advice from their advisory committees and the joint Time Allocation Committee on the EoIs submitted. It is important to note that the observatories may not proceed to a Call for X-Proposals if, for example, there is judged to be insufficient community interest, scientific merit, or differentiation from Large Proposals.

The deadline for submissions is **31 August 2018.**

OIR astronomy in the 2020s

- Exquisite angular resolution
  - 40m telescopes, interferometry
- Deep (all-)sky information
  - LSST and Euclid
  - PanSTARRS and SDSS
- Deep infrared observations possible
  - JWST
- Dynamic Milky Way and Local Group
  - Gaia and spectroscopy
- Tens of thousands of exo-planets
  - (Kepler), TESS, PLATO

Astronomy in the 2020s

- OIR sky measured to ~25 mag
- Thousands of transient alerts per day
- Matching capabilities at (almost) all other wavelengths
  - angular resolution
  - sensitivity
  - sky coverage
- Astroparticle detections
- Diverse astronomical community with considerable overlap with other sciences (chemistry, biology)

Near-Future Surveys

- No call recently
- 4MOST on VISTA in 2022
  - preparations of VISTA starting May 2021
  - survey planning started together with consortium
- Spectroscopic
  - assessment on how to proceed best
  - VLT workshop in 2019
  - implement for MOONS

Near-Future Surveys

- ESO 4m telescopes
  - SOXS on NTT
    - GTO surveys for transients
  - NIRPS at 3.6m
    - radial velocity surveys
  - VISTA with 4MOST
- Coordination of PLATO/TESS/CHEOPS follow-up observations
  - interaction with ESA on potential planning for these surveys
- VST?