



***LBT Italian Coordination Facility***

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**Call for **Adaptive Optics** Observing Programs**

**at the Large Binocular Telescope**

**Italian time**

**Sep 15th 2021 – July 15th 2022**

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Submission expires:

**Friday June 18th, 2021, 24:00 CEST**

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Send questions to the INAF LBT staff:

**[ibt-italia@inaf.it](mailto:ibt-italia@inaf.it)**

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## 1. ITALIAN OBSERVING STRATEGY and CONSTRAINTS

The Large Binocular Telescope (LBT) is a binocular facility composed of two 8.4m telescopes rigidly mounted, located atop Mount Graham, Arizona, USA at an elevation of 3221 m, as part of the Mount Graham International Observatory (MGIO).

LBT is an international joint project among Italy, Germany and the United States of America, of which Italy has 25% of the total observing time.

### 1.1 - Scheduling and strategy for this AO call

This call has been issued after the approval by the board (end of April) regarding the use of the LBT AO channel (SOUL+LUCI1/LBTI) in the next observing season and following the successful "SOUL science commissioning run" occurred in Nov 2020.

INAF will allocate a **minimum of five nights** to be dedicated to the AO observing programs that will be executed during the regular INAF runs.

To optimize the scientific return of this AO campaign, and due to the relatively small number of nights available to the Italian community, we envisage submitting programs with a maximum of **8 hours of open shutter time distributed over a maximum of 5 targets**.

## 2. ADAPTIVE OPTICS FED INSTRUMENTS

In the present call, the AO fed instruments offered to the community are:

- LUCI1+SOUL (imaging zJHK)
- LBTI

The other AO facilities (SOUL-LUCI2, ARGOS-LUCI1, ARGOS-LUCI2), due to temporary technical reasons, are not available. LBTI is offered in single dish mode for the full period, while the interferometric mode could be available in 2022.

### 2.1 - LUCI1+SOUL

LUCI1 with SOUL AO correction will be offered in the full period of this call. This imaging mode uses the N30-camera of LUCI with a scale of **0.015 arcsec/pix and provides** a FOV of **30"x30" in the zJHK bands**. Imaging mode only is available with two read-out modes: LIR (double-correlated sampling) and SUR (sample up the ramp). The list of available filters and other infos about the N-30 camera are available in sect. 2 of

#### [LUCI user manual](http://lbt.inaf.it/LUCI_UserMan.pdf)

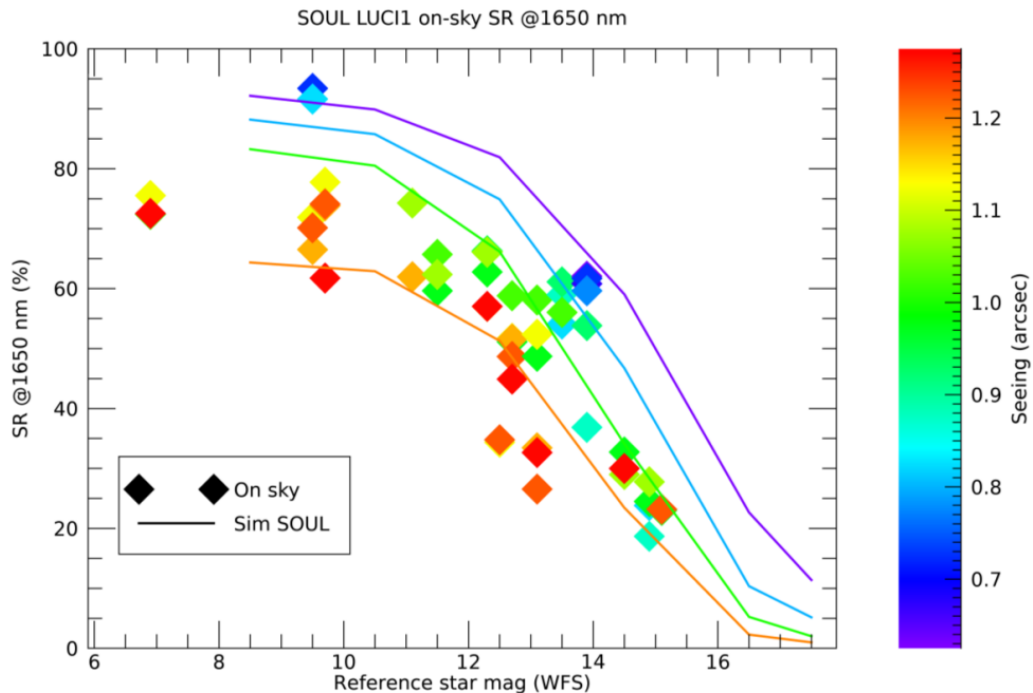
([http://lbt.inaf.it/LUCI\\_UserMan.pdf](http://lbt.inaf.it/LUCI_UserMan.pdf))

SOUL is a Natural Guide Star (NGS) AO system with single conjugation (upgrade of FLAO). The NGS can be the science target itself (even if not properly a star) or a nearby different object. The performances of the system are mainly dependent on the brightness of the NGS, its distance from the target and the seeing conditions. With "bright" NGSs the system is able to provide diffraction limited images in all bands and high contrasts in the diffraction pattern of the NGS. The current characterization of on-sky AO performances for SOUL-LUCI1 is detailed in:

### [SOUL-T06 SOUL-LUCI1 performance](http://soul.arcetri.astro.it/wp-content/uploads/2020/09/SOUL-T06_SOUL-LUCI1_performance_V1.0_20200918.pdf)

([http://soul.arcetri.astro.it/wp-content/uploads/2020/09/SOUL-T06\\_SOUL-LUCI1\\_performance\\_V1.0\\_20200918.pdf](http://soul.arcetri.astro.it/wp-content/uploads/2020/09/SOUL-T06_SOUL-LUCI1_performance_V1.0_20200918.pdf))

In the above document are reported measurements of SR at different bands, examples of contrast at different NGS magnitudes and examples of off-axis performance. In fig.1 we report the plot of SR in H-band as a function of the NGS expressed in WFS mag.



**Fig. 1** - SOUL-LUCI1 performance measured on sky during the commissioning, extracted from [SOUL-T06 SOUL-LUCI1 performance](http://soul.arcetri.astro.it/wp-content/uploads/2020/09/SOUL-T06_SOUL-LUCI1_performance_V1.0_20200918.pdf). Each point represents the average of a set of SR measurements done on the PSF acquired on LUCI1-N30 camera. The solid line represents the performance expected via simulation. The performances at WFS mag >15 are not yet released. The conversion from catalog mags to WFS mag is available in the SR-calculator tool and detailed in the document.

In order to estimate the expected AO performance on a object we provide a dedicated web tool:

### [SOUL SR Calculator](http://soul.arcetri.astro.it/science-with-soul/#SR)

(<http://soul.arcetri.astro.it/science-with-soul/#SR>)

Finally, we report the link to the LUCI ETC that is provided with a diffraction limited option, requiring the input of the expected SR value on the object:

### [LUCI Exposure Time Calculator](http://luci-etc.lbto.org/calculator.py)

(<http://luci-etc.lbto.org/calculator.py>)

In summary, the suggested steps to assess the feasibility on a particular observation are:

1. Identify the AO reference (Natural Guide Star);
2. Go to the [SR calculator](#), fill the parameters and obtain estimated SR value;
3. Pickup the obtained SR value and use into the [LUCI ETC](#) to estimate the SNR vs time on your target;
4. Compare the expected performance with respect to those needed for your scientific goal;
5. Observers are welcome to contact the SOUL PI in case of doubts or for a preliminary evaluation of a target ([enrico.pinna@inaf.it](mailto:enrico.pinna@inaf.it)).

We remind here that, for the proposal evaluation, it is mandatory to report the estimation of the minimal AO performance required to achieve the proposed scientific goal. This estimation must be reported in the proposal form in terms of SR or PSF FWHM or flux contrast.

More details about diffraction limited observation with LUCI1+SOUL and info on the OB preparations are available on [LBT full AO webpage](#).

## 2.2 - LBTI

LBTI (Large Binocular Telescope Interferometer) is a uniquely powerful common-mount, dual-aperture system that fully exploits the AO capabilities of LBT. LBTI can be used both as an imager and as an interferometer. The LBT Interferometer combines the light from the two 8.4 m apertures of the LBT, to synthesize a 23 m telescope. The system is optimized for observations in the thermal infrared. Visible light is used to feed the SOUL adaptive optics systems. After the beam combiner, infrared light is sent to one of two scientific cameras:

- **LMIRCam**: high resolution imaging camera, coronagraph and IFU; optimized from **3-5 $\mu$ m** and available in H and K too. Offered as a single dish or Fizeau interferometer.
- **NOMIC**: high resolution camera in the **8-13 $\mu$ m** band. Offered as imager, Fizeau and nulling interferometer.

The full description of the cameras and respective observing modes is available at

### [LBTI web page](#)

(<https://sites.google.com/a/lbto.org/lbti/home>)

LBTI is offered in **single-dish mode** (no interferometry) for the full period of this call. Interferometric mode may become available in 2022, depending on the availability of the AO systems. LBTI focal stations are **fed by SOUL systems** and, as for LUCI1, an estimation of AO performance on specific targets is provided by the web tool:

### [SOUL SR Calculator](#)

(<http://soul.arcetri.astro.it/science-with-soul/#SR>)

LBTI is a PI instrument and all proposals must be send **1 week before the deadline** to:

[lbtipi@lbto.org](mailto:lbtipi@lbto.org)

in order to check for resource availability of the LBTI team and support the proposal redaction. All details about the access to LBTI for users can be found at

### [LBTI User Policy](#)

(<https://sites.google.com/a/lbto.org/lbti/home/lbti-user-policy>)

## **3. PROPOSAL SUBMISSION**

### **3.1 - Who can apply**

The PI of a proposal must be a researcher associated with an Italian astronomical institute or university. Researchers that belong to institutions that are not LBT partners are allowed in the CoI list up to 50% of the total number of applicants. Proposals that do not fulfill this requirement will not be evaluated by the TAC.

### **3.2 - How to apply**

Fill the proposal form available on the AO call page of our web site (.docx only) <https://lbt.inaf.it/AOcallforproposals.html> and send it to [lbt-italia@inaf.it](mailto:lbt-italia@inaf.it).

### **3.3 - Proposal Evaluation**

The AO proposals will receive a dedicated rank by the INAF-TAC. They will be evaluated primarily on the basis of their scientific relevance, taking also into account other factors: the scheduling constraints, the likelihood of completion and the previous record in the use of LBT data. The likelihood of completion of any program will be evaluated by the LBT team and will be taken in consideration by the TAC in assessing the rank.

## **4. DATA FLOW**

All the scientific data at the IA2 italian archive in raw form and are accessible to the P.I. within a few days from the observations. The new LBT web interface access method is changed. Please visit the help page [here](#) for further details.

Imaging data can be reduced at the LBC Survey Center (LSC) at OA Roma.

The reduction teams will proceed with data reduction only if data have been acquired with standard configurations and are obtained with OB and masks prepared in strict accordance with the prescriptions reported in the relative document.

For further information, contact the LBT-Italia staff at [lbt-italia@inaf.it](mailto:lbt-italia@inaf.it).