LSOforESA proposal: some ideas

Work in the period 2025/06/18 – 2025/09/22

JR+PG

LSO meeting, TL, 2025/09/23

ESA possibilities for LSO

ESA RPA - Requesting Party Activities - for Slovakia:

RPA „Requesting Party Activities“ je otvorenou výzvou na predkladanie projektových návrhov agentúre ESA a svojím spôsobom „akoby pokračovaním“ doposiaľ uskutočňovaných výziev v rámci predchádzajúcej formy spolupráce s ESA v programe PECS – t.j. výzvy RPA sú otvorené iba pre slovenské entity, kde majú možnosť zlepšovať svoje zručnosti vo vybraných oblastiach a tiež začínať skúmať nové oblasti za podpory ESA a to formou vlastného projektového návrhu i výberu témy.

Calls: 1,2,3 (2025) + 4 (2026)

ESA possibilities for LSO

ESA RPA - Requesting Party Activities - for Slovakia: the approved proposals from our branch of science - calls: 1,2,3

Types: Research and preparatory activity, Space science activities

- Small NEO characterization through Spectroscopy (SNEOS) – FMFI UK, BA
- Development of SCSS-Net: Solar Corona Structures Segmentation algorithm by deep neural networks - FEI, TUKE, KE
- Artificial space objects characterization using laboratory and ground-based optical measurements (ArtSPOC)
- ESADOS - ESA Support for Aircrew Dosimetry Services - IEP SAS, KE
- Preparatory development of a Spectral Tracking System (STS) for detailed meteoroid and re-entry emission analysis – FMFI UK, BA

ESA possibilities for LSO

ESA RPA - Requesting Party Activities - for Slovakia: currently the last call (#3)

- total budget: 1.4 ME
- maximum possible budget for one proposal: 478 kE
- maximum of proposal per one institution: 2
- 10 projects selected
- types of possible activities:
  - **Type A - Research and preparatory activity**
  - Type B - Flight and ground segment related research and development activities
  - **Type D - Space science activities**
  - Type G1 - Education activities – University courses
- Call for Proposals: published 13/01/2025, submission deadline 26/02/2025, first contracts Q3 2025

ESA possibilities for LSO

ESA RPA - Requesting Party Activities - for Slovakia: currently the last call (#3)

- **Type A - Research and preparatory activity:** Aimed at preparing the participation in ESA optional programs or the initial steps of a product development for Space, with potential for use in future ESA missions or commercial missions. E.g., feasibility studies/demonstrators, conceptual design work, competitive landscape survey, user requirements and breadboard-based demonstrators

  Constraints:

  - Expected duration: 9-15 months
  - Price not higher than 150,000 EUR
  - Prime contractorship may be led by either industry, universities/research, organizations or other national entities depending on the context
  - **Inclusion of an end-user is mandatory** – either as a subcontractor or as an external service !!!

ESA possibilities for LSO

ESA RPA - Requesting Party Activities - for Slovakia: currently the last call (#3)

- **Type D – Space science activities:** - Supporting the involvement of Slovak researchers leading to potential future involvement in ESA science mission core team and publication of peer reviewed scientific papers

  Constraints:

  - Expected duration: 48 months
  - Price not higher than 80,000 EUR
  - Prime contractorship MUST be led by Academia
  - MUST be in line with Slovak national space strategy
  - **MUST include non-Slovak entity with ESA core science team experience**
  - Number of Type D activities to be funded: maximum of 2
  - (Sub-contractors are highly encouraged generally)

LSO ESA PECS proposal 2019

TITLE OF THE PROPOSAL: Lomnicky Stit Observatory - instrumentation upgrade and the ground-based support of the ESA solar coronagraphy (LSOforESA)

PART 1 TECHNICAL AND APPLICATION PART

1.0 INTRODUCTION AND SCOPE

Observations of the solar corona can be performed using the space-born or the ground-based instruments separately. Yet cooperative simultaneously observations utilizing both approaches together allow to target the cross-calibration of the instruments involved as well as to broaden possibilities of the solar corona investigation. Two ESA satellites of a close launch date, PROBA-3 and Solar Orbiter, are expected to start the scientific data acquisition using their coronagraphic ASPIICS and METIS instruments at the end of 2021. Instrumentation of the high-altitude Lomnicky Stit Observatory (LSO) of the Astronomical Institute of the Slovak Academy of Sciences (AISAS) can provide a ground-based support for those ESA instruments. In particular, cooperative simultaneous observations of the above mentioned ESA instruments and the upgraded LSO instrumentation can be very useful as number of the ground-based high-altitude observatories, devoted to the solar coronagraphic research, is extremely limited.

1.1 TECHNICAL OBJECTIVES:

The main technical objectives of the project can be specified as:

- **an upgrade of the high-altitude Lomnicky Stit Observatory (LSO) instrumentation** to the state-of-art level of the solar ground-based coronagraphy – the intermediate goal of the project
- cooperative ground-based observations of the LSO instrumentation as a **support of the PROBA-3/ASPIICS and Solar Orbiter/METIS instruments** for purposes of cross-calibration and scientific analysis – the end goal of the project.

Moreover, the following programmatic objectives of the call will be reached:

- **in future,** the upgraded LSO observing capabilities could be used by the European scientific users, and by ESA in particular, to support further scientific projects or an instrumental development
- familiarisation of the LSO and its mother institute AISAS with ESA practices and standards

1.2 REQUIREMENTS:

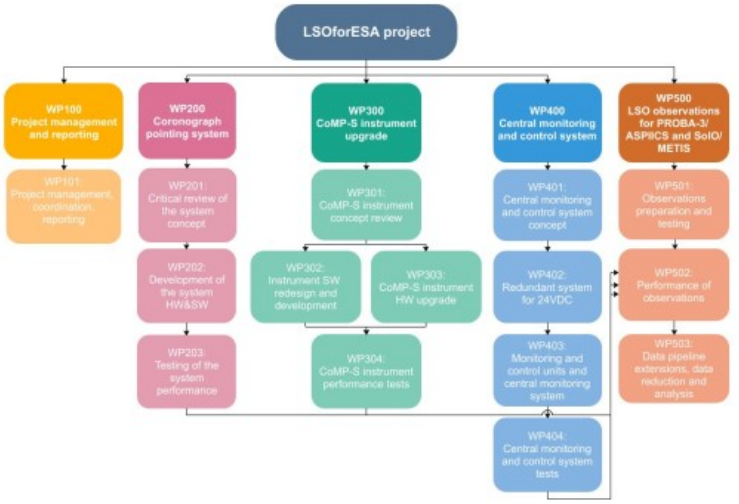
Achievement of the main project objectives demands realization of the following requirements:

- development and realization of a **new coronagraph pointing system** at the LSO to perform observations with inevitable pointing precision to maintain an artificial solar eclipse in the ZEISS 200/3000 coronagraph with the following target system properties:
  - correction of the hour drive speed imperfections
  - introduction of new correction to handle the changing declination of the Sun
  - correction of a general image jitter caused by seeing and by a coronagraph's structure bending
  - resulting image stabilization better than typical seeing-limited spatial resolution (~1-2")
  - closed loop operation with frequency higher than 1 Hz
- the **CoMP-S instrument HW upgrade and SW redesign** to achieve the required quality of the coronagraphic measurements with the target instrument performance of:
  - proper subtraction of the scattered light due to sky brightness and the instrumental parasitic light
  - spatial resolution of measurements limited just by the actual seeing and not by the CoMP-S instrument itself
  - the minimum spectral line list: Fe XIV 530.3 nm, He I 587.6 nm, H I 656.3 nm, Ca II 854.2 nm

We present here a simplified logical flowchart showing a general logic of the project while more detailed structuring down to individual WPs is provided in sect. 1.7.2.1 in form of the WBS.

1.7.2 Contents of the proposed work

1.7.2.1 Work Breakdown Structure (WBS)



1.7.2.2 Work Package Description (WPD)

WP100: Project management and reporting

Company: Astronomical Institute, SAS
WP Manager: Jan Rybak
Start Event: Kick Off Meeting (KOM) Planned Date: T0
End Event: Final presentation Planned Date: T0+24M

LSO ESA PECS proposal 2019

- call: ESA AO/1-10044/19/NL/SC - 5th call under “Plan for European Cooperating States (PECS) in Slovakia"
- Title: Lomnicky Stit Observatory - instrumentation upgrade and the ground-based support of the ESA solar coronagraphy (LSOforESA)
- The main technical objectives:
  - an upgrade of the high-altitude Lomnicky Stit Observatory (LSO) instrumentation to the state-of-art level of the solar ground-based coronagraphy
  - cooperative ground-based observations of the LSO instrumentation as a support of the PROBA-3/ASPIICS and Solar Orbiter/METIS instruments for purposes of cross-calibration and scientific analysis

LSO ESA PECS proposal 2019

- Achievement of the project objectives demands realization of the following requirements:
  - development and realization of a new coronagraph pointing system at the LSO
  - the CoMP-S instrument HW upgrade and SW redesign
  - development and realization of the Central monitoring and control system
  - the LSO service to support the ESA PROBA-3/ASPIICS and Solar Orbiter/METIS instruments
  - public access to the LSO scientific data by the “LSO archive” incorporated in the VSO
- budget required from ESA: 188 235 Euro

LSO ESA PECS proposal 2019

- Work packages:
  - Project management and reporting
  - Coronagraph Pointing System
  - CoMP-S instrument upgrade
  - Central Monitoring and Control System
  - LSO observations for PROBA-3/ASPIICS and SolO/METIS
- LSO plans in 2019 and LSO status in 2025:
  - Some things right and some naive...

LSO ESA RPA call 4 proposal?

- RPA call 4, submission ~01/2026, start since Q3/2026
- Can we fit with our needs/possibilities to this call?
- Do we really have to apply?
- Preliminary actions already done:
  - Information on RPC calls
  - A draft of the proposal call with alternatives and open questions: PG+JR
- Next actions to be performed:
  - discussion/consideration on the draft → preliminary proposal description
  - Discussion of the preliminary proposal description with the SK space office – informative days (November 2025)
  - The final proposal preparation

LSO ESA RPA proposal draft

TECHNICAL OBJECTIVES:

1) **cooperative ground-based spectro-polarimetric observations** of the solar prominences and the solar emission corona using the LSO/CoMP-S instrument as a support of the Solar Orbiter observations (instruments METIS+...):
   - **LSO campaigns following the SolO targets**: coronagraph R + CoMP-S instrument - UJ2P pointing system → the g-b coronagraphic spectro-polarimetric observations in H I 656 nm, He I 587 nm, He I 854 nm, and Fe X 637 nm line

2) **an upgrade of the LSO instrumentation** to the state-of-art level of the solar ground-based coronagraphy **creating a testbed** for the testing of instrumentation to be developed for the ESA solar coronagraphy in future
   - **Variable coronagraphic occulter:** development
   - **Instrumentation - corR→corL:** UJ2P; AISAS Mechanisms - diffuser, focusing, rotation, target and abso masks, polarimetric calibration assembly, variable occulter; post-focus instrument interface

LSO ESA RPA proposal draft

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   - **Instrumentation - corR→corL:** UJ2P; AISAS Mechanisms - diffuser, focusing, rotation, target and abso masks, polarimetric calibration assembly, variable occulter; post-focus instrument interface

3) **New technology for the solar g-b and s-b coronagraphy**

   - **Variable coronagraphic occulter:** development

LSO ESA RPA proposal draft

WORKING PACKAGES AND DELIVERABLES:

- **WP1 - management**
- **WP2 - observations:** CoMP-S observations of the SolO targets (if reasonable) → data available in VSO or inhouse
- **WP3 - instrumentation - corR→corL:** UJ2P; AISAS Mechanisms - diffuser, focusing, rotation, target and abso masks, polarimetric calibration assembly, variable occulter; post-focus instrument interface→realization + report
- **WP4 - variable coronagraphic occulter:** study, prototype, testing, final product → report, prototype?, patent?
- **Other WPs?** Dome motion automatization, dome thermal control, diffraction grating test spectrometer, remote operation, SCD repair, ~~SLED,~~ pipeline ?

LSO ESA RPA proposal draft

THINGS TO BE DISCUSSED:

- **Less:**
  - skip observations ?
  - skip instrumentation upgrade for the testbed ?
- **More:**
  - adding cooperative CoMP-S+SolO data analysis and resulting publications ?
  - adding diffraction grating spectrograph to the testbed ?
  - adding SCD at least for 656 line and coronagraphic observations with variable AM ?
  - adding the Proba-3 support ? Although its timeline should finish in 12/2026 (if extended ?)
  - ?
- **Duration:** type A – 15 months (MAX)? Start: 7/2026 or later?
- **Sub-contractor ~ external service ?**

LSO ESA RPA proposal draft

SUB-CONTRACTOR ~ EXTERNAL SERVICE ?

- **EXTERNAL SERVICES** cover services such as hire of facilities, computer services, manpower services (e.g. consultancy), plating of parts, services for procurement of HIREL parts (HIREL = High-Reliability components are specialized parts designed to operate under extreme conditions and deliver consistent performance over extended periods), etc.

  (The costs for these should be shown on the PSS A2 form of the Prime Contractor under Other Cost Elements Point 3.7 and further detailed on Exhibit.)

- A Third Party should be involved as **SUBCONTRACTOR** (not as external services) when they are contributing to the development work of the project, when they are responsible for the realization of specific work packages.

  (To include a Third Party as Subcontractor also involves a firm commitment by the Third Party (contract between Prime contractor and Subcontractor) and is especially recommended when this Third Party is essential to carry out the activity.)

LSO ESA RPA proposal draft

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  Possibilities:

  - variable occulter: 3D printing of metal parts, special adaptations of parts, …?
  - professional production of printed circuit boards?
  - Software development?
  - ?

LSO ESA RPA proposal draft

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  Possibilities:

  - development work of ?

LSO ESA RPA proposal draft

TEAM: in case of the proposed objectives and WPs

- **WP1 - management:** 2 persons + 1 supporting person
- **WP2 - observations:** 1 planner, 4 observers, 2 persons for data reduction and VO posting (JR+MT), sysadmin support (MT+RK)
- **WP3: instrumentation - corR → corL:**
  - UJ2P (MT+MH)
  - AISAS Mechanisms: diffuser, focusing, rotation, target and abso masks (JA+MT+MH)
  - AISAS Mechanisms: polarimetric calibration assembly and variable occulter (JAjr+MH), post-focus instrument interface (JAjr)
- **WP4: variable coronagraphic occulter:** 1 person + X (JAjr + ? + MH?)

LSO ESA RPA proposal: todo

- TO DISCUSS – internally till Oct 15:
  - Proposed draft of the proposal
  - Other ideas and objectives + WPs, deliverables, time plan
- TO PREPARE:
  - preliminary proposal description: Nov 1
- TO CONSULT:
  - preliminary proposal description – externally: November
    - All 2(3) objectives?
    - ?
- TO PREPARE:
  - Final proposal documents: January 2026

LSO ESA RPA proposal: todo

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  - Proposed draft of the proposal
  - Other ideas and objectives + WPs, deliverables, time plan