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CHANGES LOG

Issue	Date	Modifications
1.0	2025-02-05	First public version
1.1	2025-02-13	Changed the name of one of the WG from "Stars and planetary systems" to "Stars and their environment", the latter being the correct name as agreed by the NASST
1.2	2025-02-20	Clarified the definition of Science Support WG. Clarified deadline for submitting abstracts for the A&A Special Issue

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1 REFERENCES

1.1 Reference Documents

Title of the document	Reference
Cruise et al., 2025, "*The NewAthena mission concept in the context of the next decade of X-ray Astronomy*", Nature Astronomy, doi:10.1038/s41550-024-02416-3	RD1

1.2 Applicable Documents

Title of the Document	Reference
Nandra et al., 2013, "*The Hot and Energetic Universe. A White Paper presenting the science theme motivating the Athena+ mission*", arXiv:1306.2307	AD1
NASST, 2024, "*NewAthena Science Requirement Document*", TBD	AD2

1.3 Acronyms

Abbr.	Signification
ACO	Athena Community Office
CoC	Code-of-Conduct
DSR	Definition Study Report
ESA	European Space Agency
GDPR	General Data Protection Regulation
HEW	Half Energy Width
MOL	Mock Observation List
NASST	NewAthena Science Study Team
SciRD	Science Requirement Document
SRDT	Science Redefinition Team
WFI	Wide Field Imager
WG	Working Group
X-IFU	X-ray Integral Field Unit

2 Introduction

2.1 Purpose of the Document

This document presents the **scope and structure of the NewAthena Science Community (NASC)**. This document is elaborated and maintained by the NewAthena Science Study Team (NASST) in strict coordination with the Athena Community Office (ACO). The European Space Agency (ESA) Study Scientist is the Chief Editor of this document in their quality of NASST Chair. The document shall constitute the reference underpinning the calls for membership of the NASC, periodically issued by the ACO.

3 The NewAthena mission

NewAthena has been conceived as a powerful X-ray observatory with an unprecedented combination of collecting area, survey capabilities and energy resolution. It will be operated as an open observatory. Most of the observing time will be allocated through peer-reviewed proposals open to the worldwide astronomical community. NewAthena is poised to have a transformational impact on most areas of modern astrophysics. Its performance is an excellent match to large ground-based and space-borne observational facilities to be operational in the 2030s. NewAthena will also provide a key contribution to multi-messenger astrophysics in synergy with gravitational wave arrays and neutrino telescopes.

At the June 2014 meeting of the ESA Science Programme Committee (SPC), an observatory named "*Athena*" was selected for the 2nd Large-mission opportunity of the Cosmic Vision Program, based on the proposal in [AD1 and references therein]. After assessing that the cost to ESA would exceed the level of resources of the Science Program, the SPC endorsed a rescoped version of Athena at the November 2023 meeting (christened "NewAthena"). The mission is currently in the “Study Phase” (broadly corresponding to “Phase A” and “Phase B1” in the standard ESA nomenclature). Mission “Adoption” is planned for the first quarter of 2027. The launch is expected in 2037. The NewAthena science case and scientific capabilities are described in [RD1] and references therein.

NewAthena features a large mirror based on the Silicon Pore Optics (SPO) technology. The diameter of the mirror assembly is larger than 2 meters. The mirror will deliver a collecting area larger than 1 square meter at 1 keV, and an on-axis angular resolution better than 9” (Half-Energy Width, HEW). Two instruments will be alternately illuminated by the focal beam:

- the X-Ray Integral Field Unit (X-IFU; led by CNES and IRAP) is a micro-calorimeter sensor operated in a cryogenic Dewar at a temperature of 50 mK. The X-IFU is designed to enable non-dispersive spectroscopy with an energy resolution better than 4 eV at 7 keV over more than 1500 pixels, about 5” side each, covering a field-of-view with an equivalent diameter of 4’. In the 2-9 keV energy band, the X-IFU will be more sensitive to the detection of weak emission lines by a factor of ∼7 with respect to the XRISM/*Resolve*;

- the Wide Field Imager (WFI; led by MPE) will enable moderate-resolution spectroscopy of celestial sources over a large 40’x40’ field-of-view, with a grasp exceeding that of eROSITA by a factor ∼2. The gradual off-axis degradation of the mirror Point Spread Function enables a vignetting-averaged HEW better than 10” over the WFI field-of-view.

4 The NewAthena science community (NASC)

4.1 Principles and Scope

The NASC is the ensemble of scientists supporting the development of the science case of the mission in the current phase of the mission (cf. Sect. 3) and before Adoption. A key goal of the NASC is to support the NASST in:

1. The definition and maintenance of the NewAthena Science Requirement Document (SciRD) [AD2]
2. The analysis of trade-offs affecting the scientific performance of the mission
3. The definition of the calibration requirements of the scientific payload
4. Enhancing and strengthening the scope of the NewAthena SciRD [AD2], adapting the mission science objectives to the continuously evolving scientific landscape while *remaining within the boundary of the scientific performance (and therefore costs) endorsed by the SPC*
5. The definition of possible synergy strategies between NewAthena and other multi-wavelength and -messenger facilities
6. The definition and optimization of the Mock Observing List (MOL), a set of putative observations that would allow fulfilling the Science Requirements of the mission within its nominal 5 yr lifetime
7. The preparation of the Definition Study Report (DSR, a.k.a. “The Red Book”; cf. Sect. 4.3)

The NASC will also have the opportunity to:

8. Contribute to the Astronomy & Astrophysics Special Issue on the NewAthena science case, which is planned to be published concurrently with the NewAthena Adoption process (cf. Sect. 4.3.1)
9. Advertise the mission scientific capabilities and science case at conferences, workshops and public seminars
10. Organize, develop material for, or participate in public outreach events on the NewAthena science
11. Act as ambassadors and advocates for NewAthena and its science in public fora, astronomical events, funding agency committees and other relevant bodies

Whenever relevant, activities #3, and #8 to #10 above should be carried out in coordination with the ACO and/or the X-IFU and WFI Instrument Consortia.

Interested scientists may join the NASC by responding to the announcements issued periodically (baseline: yearly) by the ACO. NASC membership is open to scientists worldwide, at any stage of their career (master and Ph.D. students, post-doctoral researchers, faculty members in academia, staff scientists in research institutes, retirees). Applications from scientists working at private enterprises involved in the NewAthena Study are welcome. No further formal prerequisite to join the NASC exists. In their application, prospective interested scientists shall express their motivation to join the NASC, which shall be compliant and commensurate with the aforementioned goals. It is recommended to apply for a maximum of two Working Groups, but applying for a higher number of WGs would be considered if duly justified. The NASST reserves the faculty of rejecting applications while committing to provide a written justification of the reasons for the rejection. Prospective NASC members shall also specify the level of involvement in the community structure they are willing to commit to (cf. Sect. 4.2). The membership to the NASC is expected to last until Adoption, after which a new scientific advisory structure for NewAthena will be appointed. NASC members can revoke their membership at any time through a simple communication via e-mail to the ACO.

The ACO is responsible for managing the NASC database. The ACO is the single point of contact of the NASC to the NASST (and, through the NASST, to the ESA Study).

By applying to the NASC, prospective members must adhere to the NASC Code of Conduct (CoC) and accept the rules of treatment of "personal data" as specified in Sect. 6 of this document.

Important note for members of the *Athena* science community: due to the GDPR of the European Parliament, members of the *Athena* science community must re-apply to the NASC. They shall not assume that their membership in the *Athena* science community can be transferred to the NASC without taking any actions. **Responding to the ACO call for membership is mandatory to become a member of the NASC!**

4.2 STRUCTURE

The NASC is organized into the following thematic Working Groups (WGs):

- **Large-scale structure of the Universe**:
  This WG will coordinate investigations on how NewAthena can enable advancement in our understanding of the hot gas that permeates structures in the Universe at intergalactic and larger scales. This includes groups and clusters of galaxies, as well as feedback of accreting supermassive black holes in Active Galactic Nuclei (AGN) onto the intra-cluster medium. At the core of the scientific purview of this WG is the study of the hot gas origin, chemical composition and physical properties as a probe of large-scale structure formation and evolution
- **Galaxies and supermassive black holes**:
  This WG will encompass NewAthena studies of galaxies and their AGN, and their coevolution at all scales, including the geometry and origin of the X-ray emitting regions, the energetics, incidence and effects of AGN outflows, the effects of kinetic and radiative AGN feedback and of stellar feedback on their host galaxies, and AGN population studies up to high redshift to put constraints on the seeds and growth mechanisms of supermassive black holes
- **Stars and their environment**:
  This WG will coordinate the study of prospective NewAthena observations of stars (stellar activity, colliding winds, magnetospheric accretion, mass loss, to mention just a few examples), their planetary systems and star-planet interactions, supernova remnants, and the physics and chemistry of the Interstellar Medium
- **Compact objects**:
  This WG will coordinate scientific activities related to NewAthena studies of compact objects — white dwarfs (WDs), neutron stars (NSs), and black holes (BHs) — in the Milky Way and nearby galaxies. The main focus will be on extreme systems both in isolation and within binary systems. This includes, *e.g.* pulsars, magnetars, central compact objects, the potential detection of isolated black holes, cataclysmic variables, low-mass and high-mass X-ray binaries hosting neutron stars and black holes, transitional and classical millisecond pulsars, and ultra-luminous X-ray sources.
- **Transients and multi-messenger astrophysics**:
  This WG will coordinate the study of the "transient universe" with NewAthena. This will include the determination of the astrophysical nature of the most common celestial sources of neutrinos and gravitational waves, as well as non-persistent electromagnetic sources, such as *e.g.* supernovae explosions, tidal disruption events, and gamma ray bursts
- **Cosmology and fundamental physics**:
  This WG will coordinate studies employing X-ray observations with NewAthena to constrain cosmological parameters (*e.g.* using clusters or quasars); probe particle physics beyond the

standard model; perform tests of general relativity (*e.g.* through accretion processes in the strong gravity regime or via X-ray counterparts to gravitational wave sources); alongside any other studies that address our fundamental models of physics. It is anticipated that many science projects will use the astrophysical objects that are the focus of other WGs, and thus overlap with those efforts.

- **Science Support**:
  This WG will provide assistance to the NASC, notably through supporting the theory and simulation effort required to assess the expected mission performance. This transverse WG will aid in undertaking and optimising synthetic observations of a wide variety of high-energy astrophysical sources, and will investigate novel analysis techniques appropriate to NewAthena data. Scientists involved in the development of software for the reduction and scientific analysis of NewAthena data, the planning of the calibration activities and of the corresponding facilities, or in the monitoring of the instrument scientific performance are also encouraged to apply.

During the Study Phase, the WGs will assist the NASST by carrying out the following tasks:

- Coordinate and stimulate discussion, studies and simulations of observational programs enabling investigations that uniquely exploit the scientific capabilities of NewAthena
- Identify the optimal observational strategy (sample size, observation time and – whenever pertinent – source list) to achieve the science requirements within the purview of the WG, thus contributing to the overall NewAthena observing plan
- Identify the need for multi-wavelength ancillary data to enable the best and broadest range of science with NewAthena, and the optimal strategy to gather them
- Review, update and/or finalize the formulation of the science objectives [AD2] within the purview of the WG
- Carry out trade-off and sensitivity analysis as requested by the NASST
- Coordinate the preparation of a set of manuscripts for the Astronomy & Astrophysics Special Issue (cf. Sect. 4.3.1)
- Coordinate the elaboration of specific sections of the DSR, including the preparation of high-quality, camera-ready graphical material, upon request by the NASST
- Organize scientific events (seminars, workshops, conferences) on the NewAthena science pertinent to the WG purview
- Contribute to the ~monthly ACO "NewAthena science nuggets"
- Propose speakers for the NewAthena webinar program
- Advertise the NewAthena science pertinent to the WG scope at scientific events

Each WG will be Chaired by WG members (up to 3). Chairs are selected by the NASST among those WG members who have expressed interest in assuming such a role in their NASC membership application. The NASST will make every effort to ensure a geographically and gender-balanced chair distribution. Expressions of interest from early-career scientists (Ph.D students and post-doctoral researchers) are encouraged. Chairs are appointed for a nominal duration of three (3) years. Their appointment can be renewed. Appointed Chairs can step down at any time, if they wish, through a simple e-mail communication to the ACO. In extraordinary circumstances, entailing a violation of the NASC CoC, the NASST can dismiss a Chair. Each WG shall include a NASST liaison (different from the chairs) to ensure a fluid communication between the WG and the NASST.

4.3 Timeline and deliverables during the study phase

The NASST is expected to deliver a set of documents during the Study Phase and in preparation for Adoption. In this Section, the status and milestones of these documents are described, alongside the prospective contribution by the NASC:

- NewAthena SciRD: it is the key element of the whole Study document architecture. It describes the scientific objectives of the mission alongside the mission performance requirements enabling their achievement. The NASST has submitted the first version of the SciRD, based on the final report of the NewAthena Science Redefinition Team (SRDT) [RD1], on whose basis the SPC reinstated NewAthena in the ESA Science Program. This SciRD version *is not complete*. The SRDT was not given sufficient time to finalize the reformulation of the whole corpus of *Athena* science objectives. About 50% of the requirements in the SciRD miss an updated definition or quantification that is compliant with the NewAthena performance. Furthermore, the definition of the NewAthena science objectives has not yet been presented and discussed in an open public community forum. **The NASST shall submit a complete and entirely self-consistent SciRD version by the end of 2025**, in preparation for, and as a pre-condition to the elaboration of the DSR. The NASC will be asked to provide feedback and input to consolidate the SciRD before this milestone. A community event will be organized for this purpose in the fall of 2025
- NewAthena MOL: in the framework of the DSL, the NASST shall be able to demonstrate that an instantiation of a strawman observation plan exists, capable of achieving all the scientific objectives in the SciRD. The NASC will be asked to provide inputs to consolidate this plan. As things stand now, these inputs shall be *solely enclosed in the DSR* (*i.e.*, no specific MOL document shall be delivered by the NASST in support of the mission Adoption)
- NewAthena DSR: it is a holistic description of all aspects of the mission having an impact on its science performance. The core of the DSR is a ~50-page description of the mission science case. NewAthena is an observatory, so it is conceivable that such a description will cover a wide spectrum of scientific topics, objectives, and themes. While the NASST is responsible for defining the content, gathering and compiling the inputs, and editing of the document, it is expected that the NASC – through the WGs – will provide the bulk of the manuscript text and graphical material
- NewAthena A&A Special Issue: see Sect. 4.3.1

4.3.1 The Astronomy & Astrophysics special issue

The NASST has agreed with the Editorial Board of Astronomy & Astrophysics to publish a special issue on the NewAthena science case to support the Adoption process. The issue is expected to feature about ~50 papers, each 4-6 pages long. In the second half of 2025, the ACO will issue a call for titles and abstracts. After a short consolidation process, which may imply that a few papers may be merged, the NASST will define the Table-of-Contents of the Special Issue in coordination with the A&A Editorial Board. Manuscripts shall be prepared during the first half of 2026. Following a short internal review process, the final version of the manuscripts shall be submitted before ~October 2026, aiming at a publication by May 2027. **The NASC WG Chairs will be responsible for coordinating the preparation of the manuscripts pertinent to the science objectives within the purview of their WG.** The NASST will publish, in due course, an editorial guide.

The A&A Special Issue papers will define specific scientific "Projects" within the WGs. A small number of WG members will be identified as "Project Leads". The NASST will use the ensemble of these Projects to structure the description of the science case in the Red Book, to ensure that it represents fairly and comprehensively the full breadth of the NewAthena observatory science.

5 Summary of important milestones

Milestone	Deadline
Call for NASC membership	5-Feb-2025
Deadline to respond to the NASC membership call	15-Mar-2025
WG Chairs appointment	30-Apr-2025
Submission of A&A Special Issue titles and abstracts (call issued in early July 2025)	30-Sep-2025
Definition of the ToC of the A&A Special Issue	30-Oct-2025
Community meeting on the NewAthena science case	Nov-Dec 2025
Preparation of the DSR ("The Red Book")	Jan-Sep 2026
Submission of manuscripts for the A&A Special Issue (internal review)	30-Sep-2026
Submission of manuscripts for the A&A Special Issue (refereeing)	31-Dec-2026
NewAthena science conference	Q4/2026
Mission Adoption	Q1/2027
Publication of the A&A Special Issue	~May 2027

6 Appendix A: Treatment of personal data

In accordance with the General Data Protection Regulation (GDPR) (Regulation (EU) 2016/679) of the European Parliament, "personal data" includes name, surname, title, professional affiliation, email address and reasons given for joining the project.

In the NewAthena context here mentioned and regarding the web page display, "personal data" only includes name, surname, title and professional affiliation. As far as mailing lists are concerned, "personal data" will refer only to the email address.

Joining the NASC implies giving authorisation to the Athena Community Office to collect, process and publish personal data as member of the NewAthena Community, in the terms specified below, on the public web page maintained by the ACO. This includes storing personal data in a file system or database for this purpose and their use for managing the mailing lists.

Personal data of NASC members will be available on the ACO web pages for the lifetime of the NewAthena mission, starting from filling out the call form or until the member notifies in writing of their wish to change or withdraw it.

The purpose is to keep the broad scientific community informed of the status of the NewAthena mission and the scientific groups involved in its design and development, as well as to manage the scientific and outreach activities required for this objective (meetings and events organisation, document distribution and research or dissemination activities in the framework of the NewAthena mission).

Applicants to NASC membership know that their authorised personal data can be consulted by anyone accessing the ACO website using the Internet or any other dedicated network.