The AHEAD Program for Integrating Activities in High Energy Astrophysics

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FRONTIER OBJECTS IN ASTROPHYSICS AND PARTICLE PHYSICS
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This project is funded by the European Union

AHEAD in a nutshell

- AHEAD (Integrated Activities for High Energy Astrophysics Domain) is an Horizon 2020 Research Infrastructures program for Starting Communities.
- Goal: Development of technology and of the related research infrastructures for high energy astrophysics. The landmark for AHEAD is the Athena (Advanced Telescope for High Energy Astrophysics) mission, the large X-ray observatory that will be launched by ESA in 2028
- Started on 1 September 2015 and end on 28 February 2019 (duration: 3.5 years).

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The Consortium

- Large community across Europe:

26 beneficiaries, 1 third-party:

INAF(Italy), 7 departments

CSIC(Spain), 5 departments

CNRS (France), 7 departments

- Total of 42 Institutes/Laboratories
- 149 project contacts

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The AHEAD goals

- Integrate efforts in high-energy Astrophysics from national to European context
- Integrate key research infrastructures for on-ground test and calibration, offering wide access to the best facilities in Europe
- Keep the high energy community at the cutting edge of science and technology and ensure that space observatories for high-energy astrophysics, with particular regard to Athena, are at the state of the art
- Support the community via grants for collaborative studies, dissemination of results, and promotion of workshops. Promote the domain at the European and international level via a strong outreach package
- Exploit at best the existing observatories, offering wide/expert access to X-ray data analysis
- Innovation fall-out on society from AHEAD technology
- Feasibility studies of space-based instrumentation for future gamma-ray missions

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Workpackages

Work package No	Work Package Title	Lead Participant Short Name	Person-Months	Start Month	End month
WP1	AHEAD Management	INAF	60.5	1	42
WP2	NA1- General Networking. Support to Community	UNIVERSIDAD DE ALICANTE	19	1	42
WP3	NA2 -Public Outreach	NOA	77	1	42
WP4	TA1 -Access to facilities	INAF	13	1	42
WP5	TA2- Access to X-ray Data Analysis	ULEIC	23	1	42
WP6	JRA1 - Detectors for ATHENA: Innovations beyond the baseline	STICHTING SRON	155.5	1	42
WP7	JRA2 - ATHENA background simulation and scientific calibration	INAF	56	1	42
WP8	JRA 3- Characterization of optics for next generation X-ray observatories	MPG	123	1	42
WP9	JRA 4 - Assessment of gamma-ray experiments	CNRS	199.5	1	42
WP10	JRA 5 -Technology Innovation	THALES ALENIA SPACE ITALIA SPA	31	1	42
			757.5		

2 Networking Activities (NA)

2 TransNational Access (TA)

5 Joint Research Activities (NA)

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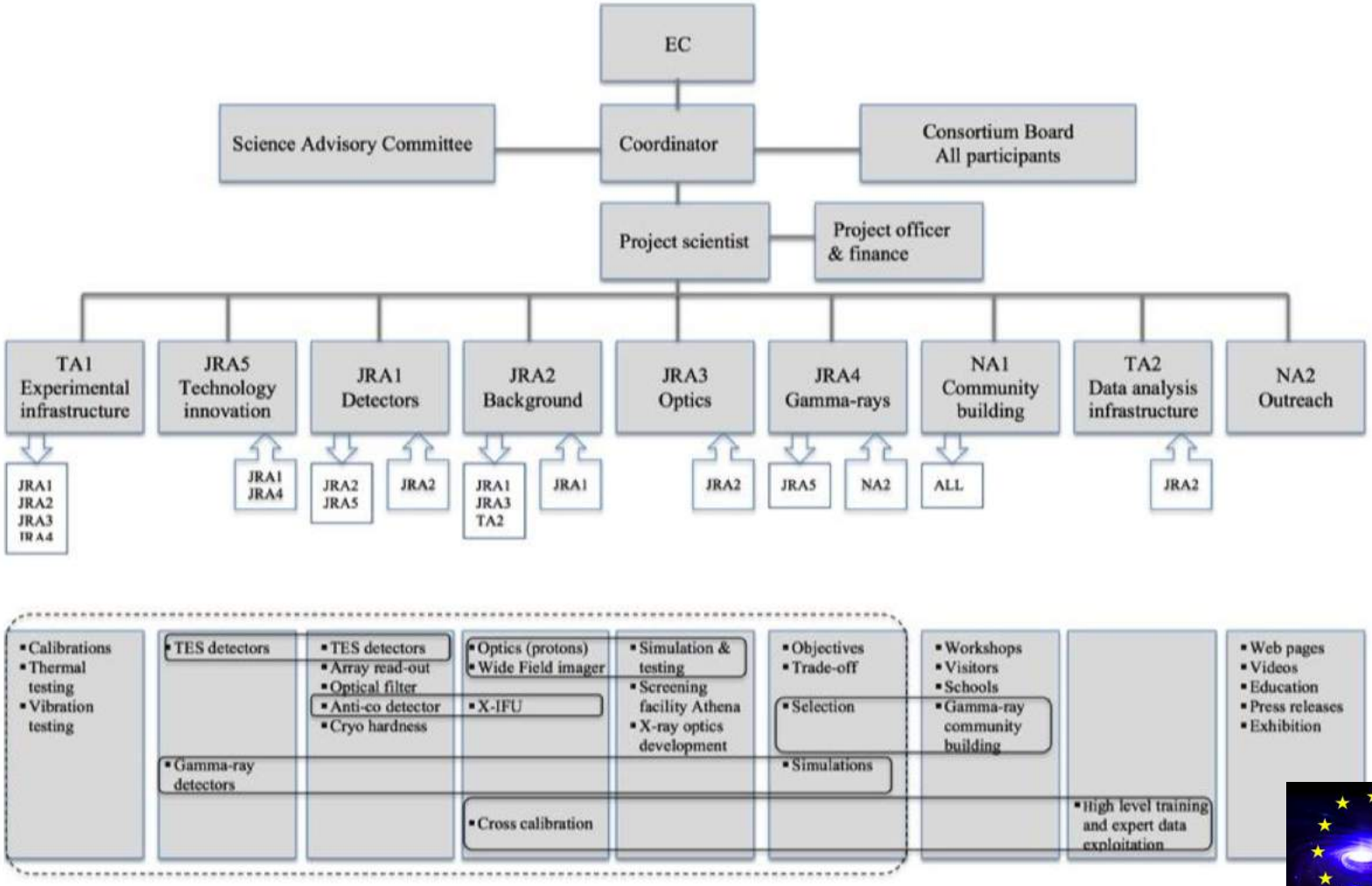

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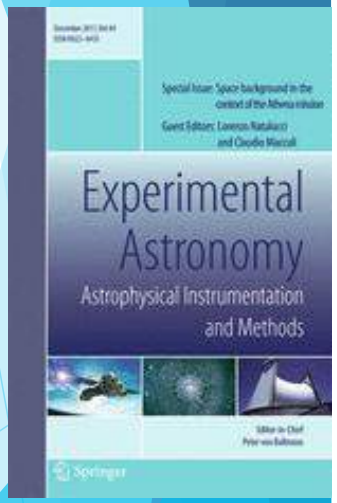
Joint Research Activities

- The 3 JRAs on Detectors, Optics and Background are strongly linked to **improving the performance of Athena beyond the baseline**
- They are all providing expected results, with some improvements achieved within AHEAD already incorporated in the design of the Athena scientific payload (Background optimisation, Mirror assembly)
- The Technology Innovation WP has already identified a number of promising concepts to be followed on and has started detailed system engineering.
- The Gamma-ray WP has been successful in clustering the community around key ideas for science priorities and developed mission concepts, including a strong simulation activity.

Some achievements (JRA)

- JRA1 (Detectors): Tradeoff review completed for different XIFU detector components (sensors, readout, harness, CryoAC etc). Supported testing activity on advanced prototypes for Optical Blocking Filters, cryo-harness and sensor
- JRA2 (Background): Published Special Issue on “Particle background for space instrumentation in the context of the Athena mission”, Experimental Astronomy. Improved X-IFU detector design
- JRA3 (Optics): Testing of different optics at PANTER, design of a screening test facility under implementation at INAF/OAB
- JRA4 (Gamma-rays): “Science White Paper” with prioritizazion of science objectives; selection of instrument concepts for studies; fuelled proposals for GRB and gamma-ray missions submitted to ESA
- JRA5 (Technology Innovation): Application survey completed. System engineering study started for use of TES for environmental and archeology/art



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Networking Activities

- Visitor program (exploited through the AHEAD Announcements of Opportunity)
- Organisation of 3 Workshops and 2 Schools
- Public Outreach activities: production of videos and educational material, press releases and organization of exhibitions

The AHEAD Geant4 School (2016)

AHEAD workshop "The Power of X-ray Spectroscopy, Warsaw (2017)

Projection of the AHEAD Video "The Hot and Energetic Universe" at Researcher's Night 2017 in Frascati

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AHEAD School "*High Resolution Spectroscopy*"

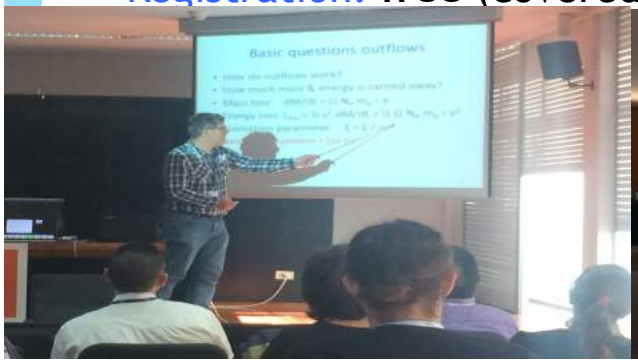
Alicante, Spain, 14-17 November 2017

Addressed to: Young astronomers, students and postdocs. 25 Students from all over Europe (UK, Netherlands, France, Italy, Spain, Germany, Hungary, Czech Republic, Turkey)

Topics: AGNs, Galaxy Clusters, Atomic Data, Stars, X-ray Binaries, Solar System, current and future X-ray instrumentation.

Lecturers: J. Kaastra, J. de Plaa, L. Gu, N. Werner, Y. Nazé, G. Braduardi-Raymont, V. Grinberg, D. Barret

Registration: **free** (covered by AHEAD).




Some achievements (NA)

- NA1 (General Networking): Very good response of visitor program and Schools
- NA2 (Public Outreach): Golden Star Award won at the International Planetarium Movie Festival, for “The Hot and Energetic Universe”
- Movie played all around the world and translated in many languages
- Videos on new astrophysics topics using new technology such as Virtual Reality

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Transnational Access Activities

- Offering TransNational Access is a core activity of the AHEAD project as part of the H2020 Infrastructures work-programme.
- Transnational Access in AHEAD is split in two different activities:

  TA1) Funding team visits to 13 experimental facilities

  TA2) Funding visits to 10 research institutes for Access to X-ray data analysis
- Transnational Access is exploited by the Community through the AHEAD Announcement of Opportunity
- Open to European & associated countries SME

X-ray Beamlines. *LLTBF (Univ. of Leicester) and XACT (INAF/Palermo Observatory).* *The LARIX-A hard X-ray beamline (Univ. of Ferrara).*

Thermal vacuum and other test facilities. *Test equipments at ERIOS (Lab. d'Astrophysique Marseille) and SERMS (Univ. of Perugia).* *Plasma chamber at IAPS (INAF,Rome). High capacity shaker at the Centre Spatial de Liège (CSL)*

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Access to Data Analysis

Access to data through archives of existing observatories like XMM-Newton, INTEGRAL, Swift, NuSTAR, including tutorials and mentoring by experienced scientists

Training on advanced tools: geant4, XSTAR, SPEX, etc.

- Department of Physics and Astronomy, University of Leicester
- SRON Netherlands Institute for Space Research
- Department of Astronomy, University of Geneva
- National Institute for Astrophysics, INAF
  - Bologna: INAF-OABO, INAF-IASFBO in collaboration with the Department of Physics and Astronomy, Bologna University
  - Palermo: INAF-OAPA
  - Rome: INAF-OAR
  - Rome: INAF-IAPS
- Department of Physics and Earth Science: Università di Ferrara
- Institute of Astronomy Astrophysics, Space Applications & Remote Sensing (IAASARS), National Observatory of Athens
- AIM / Service d'Astrophysique, CEA Saclay

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A summary of exploited results

- **Technology development**: tradeoff studies and testing H/W components: relevant for Athena, for future implementation into a new mission design
- **Ground facilities**: design new facilities and improve the existing ones to increase the efficiency of X-ray optics testing & calibration
- **Instrument design and development of simulation tools**: (a) improvement in the knowledge of the instrumental background in L1/L2 orbit and update of the instrument design; (b) finalised proposal for a future gamma-ray mission; (c) development of optics simulators
- **Build up new collaborations**: (a) large teams for joint exploitation of space and ground based observations; (b) system engineering studies in the field of technology transfer
- **Realisation of video for planetaria and media and exhibitional material**: now used worlwide
- **Results of the application survey** for exporting technology in other fields, including areas of societal impact

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6th AHEAD Announcement of Opportunity

AOs to apply for AHEAD visitor program and TA programs are opened periodically with a time cadence of two per year until June 2018

The 6th AO of AHEAD has opened on 15 May 2018

It consists of 3 separate calls for proposals:

1. **Trans-national access to ground and test facilities** (test/calibration campaigns)
2. **Visitor Program** (scientific/engineering visits to a host institute of your choice)
3. **Trans-national access to X-ray data analysis** (training or use of data archives or data analysis facilities at a specialised centre or institute)

Deadline: 30 June 2018

Visits of successful applicants are fully funded (cost for the use of facilities, travel & lodging)

For info visit: ahead.iaps.inaf.it

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Conclusions

- ❑ AHEAD is performing as expected
- ❑ Recent tuning of the activities happened after the Mid-Term review. This includes:
  - ✓ Strenghtening of networking activities: increased funding for meetings, improvement of Public Outreach towards new innovative products (e.g. virtual reality video)
  - ✓ Increased funding to successful access providers, to allow further offer
  - ✓ Strenghtening of Technology Innovation WP (new collaboration)
- ❑ The above scheme is now fully in place
- ❑ Preparing for the forthcoming 2019-2020 calls of the Workprogramme for Research Infrastructures

More news upcoming. Stay tuned!

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