

US contributions to the Athena mission

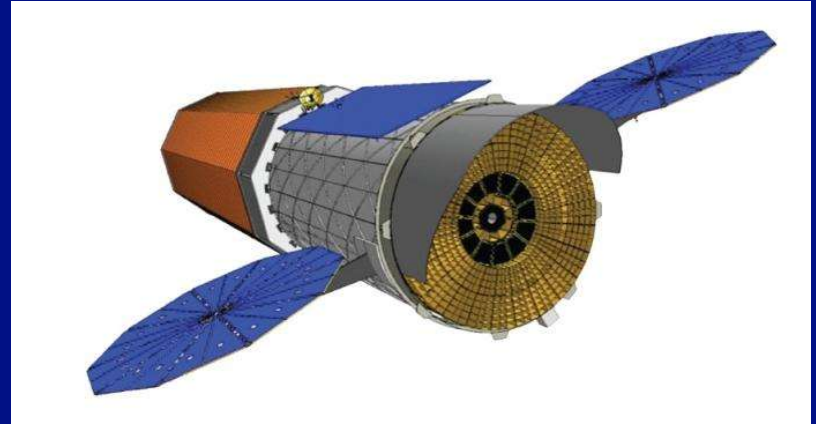
Randall Smith
US Representative
Athena Science Study Team

US Partnership in Athena

- Long history of international collaborations in X-ray astronomy
 - More international missions, in fact, than solo
 - Athena sprang from the head of XEUS, but it could be argued an IXO was used to “crack the skull.”
- IXO X-ray science highly rated by US Decadal review
 - IXO’s cost & complexity responsible for ultimate result

Decadal Report Slides

IXO – Science



- Large area, high spectral resolution x-ray observatory to explore hottest regions in the universe
- Clusters of galaxies, intergalactic medium, black hole accretion disks
- IXO would revolutionize X-ray astronomy and address many high priority science objectives in the spirit of Chandra and XMM-Newton

Decadal Report Slides

IXO – Program Details

- 3m² aperture, 5 arcsec imaging, microcalorimeter spectrometer
- More ambitious successor to Constellation-X (AANM rec.)
- Joint with ESA, JAXA:
 - Candidate for ESA L-class mission (with LISA, Laplace)
 - Proposed U.S share 50%
 - Current mission appraised at \$5.0B, total; Medium-High risk
- If space recommendations 1-3 go ahead, unless there is a substantial budget increase there will be **funds only for technology development** this decade aimed at reducing the mission cost and risk for next decade
- **RECOMMEND \$180M for the decade**



ESA's L2 Advanced X-ray Observatory: Athena

- The Advanced Telescope for High Energy Astrophysics (Athena) has been selected for the ESA L2 slot. Launch date ~2028.
- NASA and ESA are discussing a potential NASA contribution.
 - The Decadal Survey recommended an international partnership for an advanced X-ray observatory.
 - NASA solicited applications for a U.S. representative on the ESA Athena Science Study Team. Randall Smith (CfA) is U.S. member. Robert Petre (GSFC) and Michael Garcia (HQ) are ex officio. First meeting July 2014.
 - An ESA instrument AO will be released in early 2015.
- NASA's FY15 budget request supports a potential Athena partnership.
 - NASA will continue investing in technologies likely to be appropriate for an Athena contribution; investments include both directed and competed SAT investigations.
 - NASA is budgeting for development of contributed flight hardware, U.S. participation in the Athena science team, and a U.S. data center and GO program.
- NASA has suggested the following types of contributions, limited to \$100-150M for contributed flight hardware.
 - Portions of the calorimeter instrument
 - Inner mirror shells
 - Portions of the wide field imager
 - Contribution to science data center (U.S. node)

Same is true of the FY16 budget request

Athena Phase A Approach

The Phase A will be split in two parts, A.1 and A.2

- **Phase A.1 is devoted to Mission Architecture Trade-offs and ends with a baseline selection**
 - The instrument definition is handled by the instrument teams
 - *Potential contributions of JAXA and NASA may be refined at the end of the Phase A.1*
 - The Mission Requirements are updated at the end of Phase A.1, in accordance with the selected baseline.
- **Phase A.2 is devoted to the Consolidation of the Mission Baseline and ends with the PRR**
 - Technical consolidation
 - Programmatic consolidation
 - Partnership consolidation

NASA Instrument RFI

- Request for Information was due February 2015
 - Asked for possible hardware and non-hardware contributions, in support of the instruments
 - Endorsement of PI of instrument proto-consortia required
 - Multiple ideas received
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- NASA and X-IFU proto-consortium have agreed that the US will provide the microcalorimeter arrays.

Regarding Other US contributions

- FY15 budget supports \$100-150M in NASA funds for Athena hardware, well within 20% ESA cap.
- A substantial X-IFU contribution has been identified (*albeit not costing \$150M*).
- As ESA & NASA will have to agree on any contributions, it is not too early to identify & initiate studies of other potential ideas.
- For science support, all 7 US scientists named as WG co-chairs plus 18 others will have NASA support to travel to meetings regarding Athena.

...and now to switch gears...

e2e Athena Simulations

- SIXTE is the standard Athena simulator, available at <http://www.sternwarte.uni-erlangen.de/research/sixte/>
- “simx” is another Athena simulator, designed for speed, but without the detailed instrument models of SIXTE.
- Latest release is version 2.2.1. Available at:
<http://hea-www.harvard.edu/simx>
- **Not** a ray-trace code: uses PSF images to generate realistic simulations; also includes vignetting, background and detector response information to reproduce many observed effects
 - Excludes single-scattering, pile-up, attitude files

SIMPUP & simx

- simx now by default automatically **generates** a SIMPUT file if you provide an input spectrum/image/etc.
- This SIMPUT file can be
 - Reused to generate the same results
 - Stored to provide a permanent record of what was used for a given simulation
 - Fed into SIXTE for more detailed simulation

SIMPUT & simx

- Uses the standard SIMPUT library distribution, which also includes standard tools to:
 - Merge simput files. E.g., if you wish to combine a pulsing point source with a background image to create a model of a pulsar wind nebula, you can.
 - Create new simput files from an input deck
 - Develop complex simput files from an MHD model, etc.