



AAAC Laboratory Astrophysics Task Force update

<https://www.nsf.gov/mps/ast/aaac/labastro.jsp>

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+ 19 AAAC LATF members



Laboratory Astrophysics

Atoms

Molecules

Astrophysical plasmas

Dust & Ices

Experimental and theoretical studies of properties and processes important to astrophysics

Foundational research in an astronomical context

Enables discoveries and advances across astrophysics

Accurate interpretation of astrophysical phenomena

Optimum exploitation of observatories and missions

- **Astro2020 recognized laboratory astrophysics as a “foundational activity,” essential for “enabling science across astrophysics” and realizing “the full potential of recent and imminent major observatories.”**
- **Panel on an Enabling Foundation for Research: current state of resources, major challenges, suggestions regarding support for laboratory astrophysics**



Astro2020 Findings

- Key findings of *Enabling Foundation* panel w.r.t. laboratory astrophysics (cf. appendix H.2.6 of Astro2020 report):
 - Few groups in the US making critical measurements; small funding envelope limits expansion and will limit scientific return of astronomy investments in the 2020s
 - Erosion of support and infrastructure
 - Attrition in the community, training the next generation, lowering barriers to entry
 - Despite limited resources, laboratory astrophysics has been instrumental in advancing astronomical discoveries in the 2010s in interstellar chemistry, star and planet formation, exoplanetary atmospheres, stellar astrophysics, ...
 - Crucial laboratory measurements and theoretical data will be required for maximizing the scientific return of large observational surveys and new missions and observatories
 - Small investments – primarily through grants – are incommensurate with growing needs of missions, as well as stellar and exoplanet communities, putting the field under severe pressure



Astro2020 Conclusions and Recommendation

- Astro2020 Report concluded that supporting research in laboratory astrophysics *“be regarded as a high priority,”* and that *“the existing approaches are not sufficiently advancing the field.”* Accordingly, it made the following Recommendation:
 - **“NASA and the National Science Foundation should (1) convene a broad panel of experts to identify the needs for supporting laboratory data to interpret the results from the new generation of astronomical observatories, (2) identify the national resources that can be brought to bear to satisfy those needs, and (3) consider new approaches or programs for building the requisite databases. This panel should include experts in laboratory astrophysics as well as representative users of the data, who can best identify the highest-priority applications.”**
- 2021-2022 AAAC report reiterated this recommendation:
 - “Although all three agencies have laboratory astrophysics programs, their strategic alignment with national priorities and the community that they serve must be assessed. To this end, the AAAC recommends that an advisory group to NASA, NSF, and DOE be established to identify strategic and community needs, and to set priorities in laboratory astrophysics.”



Laboratory Astrophysics Task Force (LATF): Charge to AAAC from NSF and NASA

- **Survey the current state of laboratory astrophysics, drawing from the wide range of available materials (e.g., Decadal Survey reports, white papers, community workshop reports, etc.)**
 - Assess resources that currently support laboratory astrophysics, including grant programs, databases, facilities, infrastructure.
- **Identify the needs for supporting laboratory data to interpret results from observatories and missions**
 - Identify and prioritize the needs for interpretation of data from current and future observatories and missions.
 - Identify the corresponding requirements for laboratory and theoretical research to support those needs.
 - Identify workforce and infrastructure needs.
- **Identify the national resources that can be brought to bear to satisfy those needs**
 - Identify national resources and interagency synergies (e.g., DOE, DOD, NIST, ...) that are not being exploited at present.
 - Identify ways in which existing resources can be used more efficiently.
 - Identify the specific areas that might benefit from targeted additional investments.
 - Consider how resources for Lab Astro should be integrated into planning and operation phases of observatories & missions.
- **Consider new approaches or programs for building the requisite databases**
 - Identify the database gaps, both nationally and internationally.
 - Define database requirements that would enhance interpretation of astronomical observations.
 - Identify new modalities of support (e.g., “Centers” for laboratory astrophysics and databases).



AAAC LATF Activities

Internal meetings + community engagement:

- Monthly meetings since March 2023
- Created Three Subgroups
 - **ISM**: group leader Kyle Crabtree (UC Davis)
 - **Stellar, Nuclear, and Plasma Astrophysics**: group leader Stuart Loch (Auburn)
 - **Planets and Exoplanets**: group leader Iouli Gordon (CfA)
- Progress on charge elements – “tasks”
- Discussion sessions at summer AAS, ACS, ISMS



Questionnaires:

1. **Lab Astro community via AAS-LAD, ACS Astrochemistry, etc. – 95 responses**
2. **Broader astronomy community via AAS (coming soon, responses due October)**



AAAC LATF Activities

Current status:

- Task 1: Survey current state of Laboratory Astrophysics
- Task 2: Identify needs for supporting laboratory data from observatories and missions
- Task 3: Identify national resources to satisfy those needs
- Task 4: Consider new approaches or programs for building databases

LATF workshop 26-28 Sep 2023, CfA | Harvard & Smithsonian:

- Assess progress on tasks
- Address knowledge gaps, seek additional input
 - Astro2020 panel member perspective
 - Incorporating laboratory astrophysics into mission planning
 - Identify speakers for October LATF meeting
- Commence report for AAAC (submission planned 2024 Jan)



Thank You!





Astro2020 Considerations

- The 2020 Decadal Survey on Astronomy and Astrophysics (Astro2020) identified laboratory astrophysics as a “*foundational activity,*” recognizing that it is essential “*for enabling science across astrophysics*” and “*to realize the full potential of recent and imminent major observatories.*”
- Panel on an *Enabling Foundation for Research* asked to summarize current state of resources, identify major challenges, and make suggestions regarding support for laboratory astrophysics

<https://www.nationalacademies.org/our-work/decadal-survey-on-astronomy-and-astrophysics-2020-astro2020>

See chapter 4.5.5 of the Astro2020 report

LATF Status Update - AAAC 19 September 2023



AAAC Task Force on Laboratory Astrophysics: Purpose and Composition

- A key first step in the interagency effort to:
 - Conduct a robust assessment of scientific utility and priorities with focused input from observational, theoretical, and laboratory astrophysics communities.
 - Identify the most impactful ways to enhance the scientific return of observatories and missions by supporting the laboratory astrophysics community.
- Task force Composition:
 - Laboratory astrophysicists (experimentalists and theorists)
 - Observational astronomers and modelers
 - Database curators