

# Strategic Planning for Laboratory Astrophysics: Charge to the AAAC to establish an *ad hoc* Taskforce

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Panelist: Prof. Karin Öberg, Harvard University, member of the Astro2020 Panel on an  
Enabling Foundation for Research



# Laboratory Astrophysics

Atoms

Molecules

Astrophysical  
plasmas

Dust & Ices

Enabling science

**Experimental and  
theoretical studies of  
properties and processes  
important to astrophysics**

Serves a critical need

Accurate  
interpretation  
of  
astrophysical  
phenomena

Optimum  
exploitation  
of  
observatories  
and missions



# 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



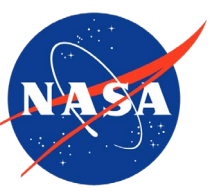
# Astro2020 Findings

- 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.”



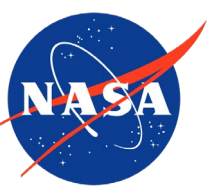
# AAAC Taskforce on Laboratory Astrophysics: Purpose and Composition

- 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.
- Taskforce Composition:
  - Laboratory astrophysicists (experimentalists and theorists)
  - Observational astronomers and modelers
  - Database curators



# AAAC Taskforce on Laboratory Astrophysics: Charge

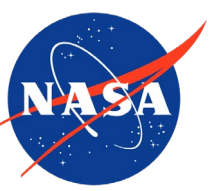
- **Survey the current state of laboratory astrophysics, drawing from the wide range of available materials (e.g., Decadal Survey reports, white papers, community workshop reports, etc.)**
  - Assess resources that currently support laboratory astrophysics, including grant programs, databases, facilities, and 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.



# AAAC Taskforce on Laboratory Astrophysics: Charge

- **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 laboratory astrophysics should be integrated into the planning and operation phases of observatories and 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 Taskforce on Laboratory Astrophysics: Timeline and Deliverables

- Assemble taskforce: Q4 of CY2022
  - Agency points of contact will assist as necessary
- Report on initial findings: mid-2023
- Final report: early 2024
  - Discussed and approved by AAAC, then transmitted to the agencies
- Findings will:
  - Inform agencies on strategic needs for federal support of laboratory astrophysics
  - Allow agencies to devise a robust plan for such support
    - Implementation will require sustained effort over the medium and long term

[N.B. Formation of taskforce does not imply commitment for specific support.]

**We look forward to working with you!**



# Thanks! Questions?

- Slava Lukin (NSF/PHY – Plasma Physics program lead) for helpful discussions
- Karin Öberg for Perspectives from the *Enabling Foundations* panel