

Charge to P5

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Dear Dr. Hewett:

The 2014 report of the Particle Physics Project Prioritization Panel (P5), developed under the auspices of the High Energy Physics Advisory Panel (HEPAP), successfully laid out a compelling scientific program that recommended world-leading facilities with exciting new capabilities, as well as a robust scientific research program. That report was well received by the community, the U.S. Department of Energy (DOE) and the National Science Foundation (NSF), and Congress as a well-thought-out and strategic plan that could be successfully implemented. HEPAP's 2019 review of the implementation of this plan demonstrated that many of the report's recommendations are being realized, and the community has made excellent progress on the P5 science drivers.

As the landscape of high-energy physics continues to evolve and the decadal timeframe addressed in the 2014 P5 report nears its end, we believe it is timely to initiate the next long-range planning guidance to the DOE and NSF. To that end, we ask that you constitute a new P5 panel to develop an updated strategic plan for U.S. high-energy physics that can be executed over a 10-year timeframe in the context of a 20-year, globally aware strategy for the field.

- The 2014 report was successful
- 2019 implementation review by HEPAP showed progress on the plan
- 2023 P5 to update strategic plan over 10-yr timeframe in 20-yr context

A critical element of this charge is to assess the continued importance of the science drivers identified by the 2014 P5 report and, if necessary, to identify new science drivers that have the potential to enable compelling new avenues of pursuit for particle physics. Specifically, we request that HEPAP 1) evaluate ongoing projects and identify potential new projects to address these science drivers; 2) make the science case for new facilities and capabilities that will advance the field and enhance U.S. leadership and global partnership roles; and 3) recommend a program portfolio that the agencies should pursue in this timeframe, along with any other strategic actions needed to ensure the broad success of the program in the coming decades.

In developing the plan, we would like the panel to take into consideration several particularly relevant aspects of constructing a compelling and well-balanced portfolio:

- Re-evaluate the 2014 science drivers
- Evaluate ongoing projects
- Identify new projects
- Make science case for new facilities and capabilities
- Recommend program portfolio

- A core tenet of the 2014 P5 Report is that particle physics is fundamentally a global enterprise. Thus far, the U.S. program has achieved high impact through U.S. researchers participating in the programs at world-class facilities outside the U.S. and international researchers working at world-class U.S. facilities. The recommendations developed for this report should carefully consider the current and future international landscape for particle physics. The panel's report should include an explicit discussion of the choices made in this context, including the extent to which it is necessary to construct, maintain, and/or upgrade leading U.S.-hosted high-energy physics facilities so that our leadership position in the global scientific arena continues, while at the same time preserving the essential roles of, and contributions by, the National Laboratories and universities to global collaboration on large-scale initiatives.
- A number of the projects recommended by the 2014 P5 report are still being built, and the agencies take their commitments to complete them very seriously. Understanding the continued strength of the science case for these projects is quite valuable, and the panel should provide its assessment of these projects in this context.
- Remember HEP is a global field
- Support decisions to retain US leadership as a global partner
- Preserve essential roles of Universities and National Labs
- Assess science case for on-going projects

- A successful plan should maintain a balance of large, medium, and small projects that can deliver scientific results throughout the decadal timeframe. We do not expect the panel to consider the large number of possible small-scale projects individually, but advice on research areas where focused investments in smallscale projects can have a significant impact is welcome.
 - There are elements of DOE HEP-operated infrastructure that are a stewardship responsibility for HEP. Investments to maintain that infrastructure in a safe and reliable condition are an HEP responsibility and are outside the scope of the panel. Major infrastructure upgrades that create new science capabilities are within the scope of the charge and should be considered by the panel.
 - Successfully exploiting a newly built project requires funding for the commissioning and operation of the project and to support the researchers who will use these new capabilities to do world-leading science. Funding is also needed for research and development (R&D) that develops new technologies for future projects. Scientists and technical personnel working in experimental particle physics often contribute to all these project phases, while theoretical physics provides both the framework to evolve our fundamental understanding of the known universe as well as the innovative concepts that will expand our knowledge into new frontiers. The panel should deliver a research portfolio that will balance all these factors and consider related issues such as training and workforce development.
- Maintain balance of large, medium & small projects
 - Advise on science topics to focus small projects
 - Assess infrastructure upgrades that create new science capabilities
 - Remember costs of R&D, commissioning, and operations for future projects
 - Remember that a balanced core research budget is paramount to producing science from current projects and developing ideas for new ones

- Both NSF and DOE are deeply committed to diversity, equity, inclusion, and accessibility principles in all the scientific communities they support. Creating a more diverse and inclusive workforce in particle physics will be necessary to implement the plan that this panel recommends, and the panel may further recommend strategic actions that could be taken to address or mitigate barriers to achieving these goals.
- Broad national initiatives relevant to the science and technology of particle physics have been developed by the administration and are being implemented by the funding agencies. These include, but are not limited to, investments in advanced electronics and instrumentation, artificial intelligence and machine learning, and quantum information science. Potential synergies between these initiatives and elements of the recommended portfolio should be considered.
- Remember that a diverse workforce results in improved science
- Address synergies with broad national initiatives

We request that the panel include these considerations in their deliberations and discuss how they affect their recommendations in the report narrative.

The panel's report should identify priorities and make recommendations for an optimized particle physics program over 10 years, FY 2024–FY 2033, under the following budget scenarios:

- 1) Increases of 2.0 percent per year during fiscal years 2024 to 2033 with the FY 2024 level calculated from the FY 2023 President's Budget Request for HEP.
- 2) Budget levels for HEP for fiscal years 2023 to 2027 specified in the Creating Helpful Incentives to Produce Semiconductors and Science Act of 2022, followed by increases of 3.0 percent per year from fiscal years 2028 to 2033.

The recommended projects and initiatives should be implementable under reasonable assumptions and be based on generally accepted estimates of science reach and capability. Estimated costs for future projects and facility operations should be given particular scrutiny and may be adjusted if the panel finds it prudent to do so. Given the long timescales for realizing these initiatives, we expect the funding required to enable the priorities the panel identifies may extend well past the 10-year budget profile, but any recommendation should be technically and fiscally plausible to execute in a 20-year timeframe.

- Scenario A: 2% increase per year
- Scenario B: Budgets in Chips and Science Act, followed by 3% increase per year
- Evaluate projected project costs
- Plan should be executable in 20-yr timeframe

In addition to articulating the scientific opportunities that can and cannot be pursued in the various scenarios, the panel may provide their opinions on the approximate overall level of support that is needed for core particle physics research and advanced technology R&D programs to be successful in the context of the science goals of the recommended plan.

We expect the “Snowmass” community planning reports and HEPAP’s 2022 study on international benchmarking of scientific resources and capabilities will be useful inputs and that the panel will make efforts to maximize community input and participation in the overall process. Coordination and congruence with the National Academies of Sciences, Engineering, and Medicine’s recent and ongoing decadal studies in astronomy, astrophysics, and particle physics are also important considerations.

- Evaluate level of core research budget and technology R&D programs
- Include Snowmass report and Benchmarking subpanel report in deliberations
- Strive towards coordination and congruence with EPP2024

Finally, effective communication about the excitement, impact, and vitality of particle physics that can be shared with a general audience and other disciplines continues to be critical when advocating the strategic plan. It would be particularly valuable if the panel could re-state the key scientific questions that drive the field so that they are accessible to non-specialists and crisply articulate the value of basic research and the broader benefits of particle physics on other sciences and society.

We would appreciate the panel's preliminary comments by August 2023 and a final report by October 2023. We recognize that this is a challenging task; nevertheless, your assessments will be an essential input to planning at both the DOE and NSF.

Sincerely,



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- Effectively communicate the 2023 P5 plan once it's finished
- Preliminary comments in August 2023
- Report due by October 2023