



DEPARTMENT OF ENERGY

Request for Information Related to High Energy Physics and Space-Based Astrophysics

AGENCIES: Office of High Energy Physics (HEP), Office of Science (SC), U.S. Department of Energy (DOE), and the Astrophysics Division (APD) and Biological and Physical Sciences Division (BPS), Science Mission Directorate (SMD), National Aeronautics and Space Administration (NASA).

ACTION: Request for Information (RFI).

SUMMARY: The Office of High Energy Physics (HEP) in the Department of Energy (DOE) and the Astrophysics Division (APD) and Biological and Physical Sciences Division (BPS) in the National Aeronautics and Space Administration (NASA) invite interested parties to provide information on topics that provide mutually beneficial collaborative activities that can further scientific advances in specific, focused areas in the fields of high energy physics and space-based astrophysics aligned with the science goals of the program offices. This information will inform the program offices (HEP, APD, and BPS) on potential partnerships and collaborative activities that may be pursued. As additional opportunities for mutually beneficial collaboration between the Parties continue to emerge, RFIs for subsequent topics may be released. Individuals or collaborations are welcome to respond.

DATES: Written comments and information are requested on or before **[INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**.

ADDRESSES: The DOE Office of Science is using the <http://www.regulations.gov> system for the submission and posting of public comments in this proceeding. All comments in response to this notice are therefore to be submitted electronically through <http://www.regulations.gov>, via the web form accessed by following the “Submit a Formal Comment” link near the top right of the *Federal Register* web page for this document.

Format: The comments and information provided should be in the form of a PDF file, with a

minimum 12 point font size and one inch margins. The file should be a maximum of 11 pages, with the first page clearly listing the focus area, title of the information, author(s) and institution(s), and a short abstract. The body of the file (10 pages max) should provide the information requested, and responses to the specific questions should be clearly labeled according to the labels below.

FOR FURTHER INFORMATION CONTACT: Requests for additional information may be submitted to Dr. Kathy Turner at 301-903-1759 or by email at *HEP-APD-BPS-RFI2021@science.doe.gov*.

SUPPLEMENTARY INFORMATION: The DOE HEP and NASA APD and BPS program offices request information in the three (3) focused areas described below in which cooperation or partnerships between DOE and NASA can further scientific advances. The objective of the RFI is to gather information about these focused areas, including scientific and technology benefits and obstacles, how it will make use of each agency's capabilities, infrastructure and resources, and other pertinent information.

The information received in response to this RFI will inform and be considered by the DOE and NASA program offices regarding the potential development of partnerships and collaborative activities.

Please note that this RFI *is not* a Funding Opportunity Announcement, a Request for Proposals, or any other form of solicitation or bid of DOE or NASA to fund potential research and development work.

Focus Area 1

The radio quiet environment of the Moon's far side offers the potential for deployment of sensitive radio telescopes or sensors to explore the early eras of the universe or to test the standard cosmological model. Information from the community is requested for near term contributions or partnerships on planned and future lunar surface missions; longer term efforts on a future NASA lunar ground station, a lunar orbiting radio telescope, or lunar ground-based far side observatory are

also of interest. Development of such a mission or observatory will be dependent on the National Academies of Science, Engineering, and Medicine (NASEM) Astronomy and Astrophysics Decadal Survey study (“Astro2020”), which is expected to report to the agencies in spring 2021. Particular areas of interest include sensor technology demonstrations and precursor or early science investigations as well as fully developed scientific studies on future missions.

Information is requested pertaining to the following specific questions:

Science Topics:

- a. What are key science topics aligned with HEP and/or APD science drivers which may significantly advance scientific knowledge using a lunar far side or orbiting observatory. What are the opportunities and challenges to make progress on these topics? Would the efforts to achieve these compelling science goals best be done on a lunar surface or an orbital platform?
- b. Are precursor scientific measurements or demonstrations needed before lunar ground or orbiting platforms can be used, or will need to be used, to achieve the compelling science goals?
- c. What key obstacles, impediments, or bottlenecks are there to advancing the scientific research?

Technology capabilities:

- d. What are existing or near-term technology capabilities available in HEP and/or APD that can be used to advance these key science goals on lunar surface missions currently being developed? What longer term technology development is needed for future missions?
- e. Are precursor technology developments or demonstrations needed before lunar ground or orbiting platforms would be effective?
- f. What key obstacles, impediments, or bottlenecks are there to advancing the technology development?

Collaboration and Partnerships

- g. What cooperation or partnerships between DOE and NASA could further the scientific and technology advances?
- h. What mix of institutions or collaboration models could best carry out the envisioned research and/or development?
- i. What resources, capabilities and infrastructure at DOE National Laboratories or the NASA Centers (including the Jet Propulsion Laboratory (JPL)) would be beneficial for and could accelerate or facilitate research in this topic?

Other

- j. Are there other factors, not addressed by the questions above, which should be considered in planning HEP and APD activities in this subject area?

Focus Area 2

The International Space Station (ISS) provides a unique platform for space-based probes of fundamental physics in a microgravity environment. Example topics include the search for dark matter and dark energy, the direct detection of gravitational waves, and the test of the equivalence principle. Information from the community is requested regarding developing and carrying out small experiments on the ISS in areas of fundamental physics that are aligned with or are closely related to the science goals of HEP, APD, and/or BPS. Experiments on the ISS that make use of quantum sensor technologies and capabilities in the HEP, APD, or BPS community are of particular interest.

Information is requested pertaining to the following specific questions:

Science Topics:

- a. Key science topics aligned with HEP, APD, and/or BPS science drivers which may significantly advance scientific knowledge using the ISS platform. What are the opportunities and challenges to make progress on these topics?
- b. Are precursor scientific measurements or demonstrations needed before the ISS platform can be used, or needs to be used, to achieve the compelling science goals?

- c. What key obstacles, impediments, or bottlenecks are there to advancing the scientific research?

Technology capabilities:

- d. What are existing or near-term technology capabilities available in HEP, APD, or BPS that can be used to advance these key science goals? What longer term technology development is need for future missions?
- e. How can quantum sensor technologies be used to carry out this science, with particular interest in applications unique to the microgravity environment?
- f. Are precursor technology developments or demonstrations needed before the ISS platform would be effective?
- g. What are key obstacles, impediments, or bottlenecks to advancing the technology development?

Collaboration and Partnerships

- h. What cooperation or partnerships between DOE and NASA could further the scientific and technology advances?
- i. What mix of institutions or collaboration models could best carry out the envisioned research and/or development?
- j. What resources, capabilities and infrastructure at DOE National Laboratories or the NASA Centers (including the Jet Propulsion Laboratory (JPL)) would be beneficial for and could accelerate or facilitate research in this topic?

Other

- k. Are there other factors, not addressed by the questions above, which should be considered in planning HEP, APD or BPS activities in this subject area?

Focus Area 3

DOE is partnering with NSF on the Vera C. Rubin Observatory, which is expected to start operations in Chile in FY2023. The study of the nature of dark energy is the primary science goal aligned with HEP. NASA is developing the Nancy Grace Roman Space Telescope, planned for

launch in 2026, and is partnering with the European Space Agency on the Euclid mission, planned for launch in 2022. Both these space missions have the study of the nature of dark energy as a priority science driver. The data from each is also of interest to the wider astronomy community for many additional scientific studies.

Due to the complementary and synergistic capabilities and data, the scientific community expects to carry out dark energy investigations using all 3 sets of data. Information from the community is requested regarding efforts that will enhance or extend the science reach provided by these observatories when considered together, including development of a common library of simulations and/or capabilities to enable joint processing and analysis of the data.

Information is requested pertaining to the following specific questions:

Science Enhancements:

- a. What are the key dark energy science areas that will be enhanced by these activities? What level of scientific enhancement is expected by carrying them out after the datasets are public? What additional enhancements are expected if plans are put in place in the near term to enable joint data processing and analysis of public data sets?
- b. What is the scope of work required, as well as the opportunities and costs?
- c. What are key obstacles, impediments, or bottlenecks to advancing development of these plans?
- d. Are there other science topics besides dark energy that drive the requirements for joint data processing or analysis?

Collaboration and Partnerships

- k. What cooperation or partnerships between DOE and NASA could further the scientific and technology advances?
- l. What mix of institutions or collaboration models could best carry out the envisioned research and/or development?
- m. What resources, capabilities and infrastructure at DOE National Laboratories or the NASA Centers (including the Jet Propulsion Laboratory (JPL)) would be beneficial for and could

accelerate or facilitate research in this topic?

- n. Are there other factors, not addressed by the questions above, which should be considered in planning HEP and APD activities in this subject area?

General Information

Comments containing references, studies, research, and other empirical data that are not widely published should include copies of the referenced materials. Note that comments will be made publicly available as submitted. Any information that may be confidential and exempt by law from public disclosure should be submitted as described below.

Confidential Business Information: Pursuant to 10 CFR 1004.11, any person submitting information he or she believes to be confidential and exempt by law from public disclosure should submit via email: one copy of the document marked “confidential” including all the information believed to be confidential, and one copy of the document marked “non-confidential” with the information believed to be confidential deleted. Both DOE and NASA will make their own determination about the confidential status of the information and treat it according to its determination. Factors of interest to DOE and NASA when evaluating requests to treat submitted information as confidential include: (1) a description of the items; (2) whether and why such items are customarily treated as confidential within the industry; (3) whether the information is generally known by or available from other sources; (4) whether the information has previously been made available to others without obligation concerning confidentiality; (5) an explanation of the competitive injury to the submitting person which would result from public disclosure; (6) when such information might lose its confidential character due to the passage of time; and (7) why disclosure of the information would be contrary to the public interest.

Signing Authority

This document of the Department of Energy was signed on January 14, 2021, by Chris Fall,

Director for the Office of Science, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, DC, on January 14, 2021.

Treena V. Garrett,
Federal Register Liaison Officer,
U.S. Department of Energy.

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