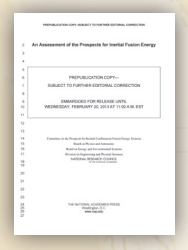
BOARD ON PHYSICS AND ASTRONOMY (BPA)

The important questions in physics and astronomy change as we learn more about nature, and the rate of change has been increasing. The BPA seeks to inform the government and the public regarding important scientific opportunities and issues as well as the changing nature of science. The BPA builds bridges between the evolving sub-disciplines of physics and astronomy and between these and other areas of science. The BPA is successful if it helps both the science community and society understand what is needed to continue the advance of physics and astronomy and why doing so is important.

Selected Recent Reports

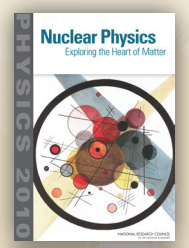


An Assessment of the Prospects for Inertial Fusion Energy (2013)

Harnessing fusion energy offers the prospect of a nearly carbon-free energy source with a virtually unlimited supply of fuel. Unlike nuclear fission plants, appropriately designed fusion power plants would not produce the large amounts of high-level nuclear waste that requires long-term disposal. Due to these prospects, many nations have initiated research and development (R&D) programs aimed at developing fusion as an energy source. Two R&D approaches are being explored: magnetic fusion energy and inertial fusion energy (IFE). This report describes and assesses the current status of IFE research in the United States; compares the various technical approaches to IFE; and identifies the scientific and engineering challenges associated with developing inertial confinement fusion (ICF) in particular as an energy source. It also provides guidance on an R&D roadmap at the conceptual level for a national program focusing on the design and construction of an inertial fusion energy demonstration plant.

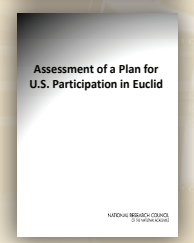
Assessment of Inertial Confinement Fusion Targets (2013)

A key test of viability for inertial fusion energy (IFE)—ignition—could be demonstrated in the relatively near term at the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory. This report, which provided input to the Committee on the Prospects for Inertial Confinement Fusion Energy Systems, describes the R&D challenges in developing suitable IFE targets and some potential impacts of IFE concepts on the proliferation of nuclear weapons information and technology. While the focus of this panel was on ICF target physics, the need to evaluate driver-target interactions required that it consider driver characteristics as well, which led the panel to make two overarching conclusions on IFE concepts and an overarching recommendation against pursuing down-selects both for IFE concepts and for IFE targets at this time. It states that further R&D will be needed on indirect drive and other ICF concepts, even following successful ignition at the NIF, to determine the best path for IFE in the coming decades. The report also gives several specific conclusions and recommendations regarding proliferation, various targets, and methods.



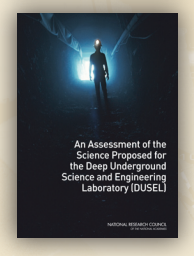
Nuclear Physics: Exploring the Heart of Matter (2012)

Nuclear physics today is a diverse field, encompassing research that spans dimensions from a tiny fraction of the volume of the individual particles (neutrons and protons) in the atomic nucleus to the enormous scales of astrophysical objects in the cosmos. This report explains the research objectives, which include the desire not only to better understand the nature of matter interacting at the nuclear level, but also to describe the state of the universe that existed at the big bang. This report explains how the universe can now be studied in the most advanced colliding-beam accelerators, where strong forces are the dominant interactions, as well as the nature of neutrinos.



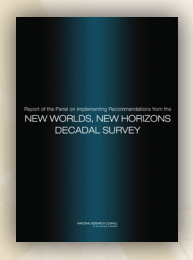
Assessment of a Plan for U.S. Participation in Euclid (2012)

In this report, the NRC recommends that NASA provide a small investment (around $20 million in hardware) to the European Space Agency's Euclid mission in exchange for U.S. membership on the Euclid Science Team and access to science data. The Euclid mission will employ a space telescope that will make potentially important contributions to probing dark energy and measuring cosmological parameters. It will image a large fraction of the extragalactic sky at unprecedented resolution and measure spectra for millions of galaxies. The contribution would represent a valuable first step toward meeting one of the science goals, furthering dark energy research, outlined in the 2010 decadal survey report *New Worlds, New Horizons in Astronomy and Astrophysics*.



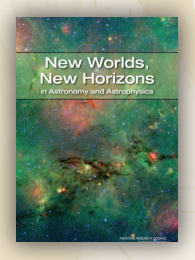
An Assessment of the Deep Underground Science and Engineering Laboratory (2011)

Underground laboratories provide the extremely quiet environment needed to investigate spontaneous but very rare phenomena in matter and to detect the weak effects of neutrinos—highly elusive particles with very little mass and no net charge that only weakly engage with most "normal" matter. To date, the United States' efforts to develop such facilities have been modest and consist primarily of small underground laboratories. This report evaluates the scientific value of the major physics questions and experiments that could be explored with the proposed Deep Underground Science and Engineering Laboratory.



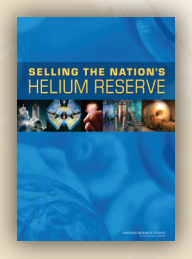
Report of the Panel on Implementing Recommendations from the New Worlds, New Horizons Decadal Survey (2011)

New Worlds, New Horizons in Astronomy and Astrophysics (NWNH), outlines a scientifically exciting and programmatically integrated plan for astronomy and astrophysics in the 2012-2021 decade. However, late in the survey process, NASA's budgetary outlook shifted downward from its initial estimates. In response to these circumstances, NASA has asked that the United States consider alternatives to the program proposed in NWNH. This report is the result of a workshop requested by the Office of Science and Technology Policy to consider the impact of the new proposal on NASA's broader strategy and on the recommendations offered in NWNH.



New Worlds, New Horizons in Astronomy and Astrophysics (2010)

Driven by discoveries, and enabled by leaps in technology and imagination, our understanding of the universe has changed dramatically over the course of the last few decades. Based on a broad and comprehensive survey of scientific opportunities, infrastructure, and organization in a national and international context, this report outlines a plan for ground- and space-based astronomy and astrophysics for the decade of the 2010s. It recommends a balanced and executable program that will support the search for habitable planets, shed light on dark energy and dark matter, and aid our understanding of the history of the universe and how the earliest stars and galaxies formed.



Selling the Nation's Helium Reserve (2010)

Helium has long been the subject of public policy deliberation, largely because of its many strategic uses and its unusual source—it is a derived product of natural gas. At the beginning of the last century, the U.S. government placed the production and availability of helium under strict governmental control. Cold War-era policies resulted in the accumulation of a large reserve of federally-owned helium. The Helium Privatization Act of 1996 directs that substantially all of the government reserve be sold off by 2015 at prices sufficient to repay the federal government for its outlays associated with the helium program. This study assesses whether the interests of the United States have been well served by the 1996 Act and, in particular, whether selling off the helium reserve has had any adverse effect on U.S. scientific, technical, biomedical, and national security users of helium.

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