APS Study Questions Feasibility of Boost-Phase Missile Defense

Boost-phase intercept (BPI) will not be a viable defense against solid-propellant ICBMs, which could be available to countries of concern by the time a US defense system can be deployed. This finding comes from the long-awaited independent APS study that assesses the scientific feasibility of BPI missile defense of the US, in terms of fundamental science and engineering requirements, including specific analyses of threats from missiles launched in North Korea and Iran.

The APS study was co-chaired by Daniel Kleppner of MIT and Frederic Lamb of the University of Illinois, and conducted by a distinguished group of scientific experts (seebox, page 5). The last APS study, released in 1987, focused on the use of directed energy weapons for missile defense. "It is crucial that decisions about large-scale investments in weapons systems at least be based on scientific feasibility," said APS President Myriam Sarachik of the rationale for the APS study. "This is a much-needed study that fills a gap in our understanding of the problems of missile defense."

Among other findings, the study determined that BPI has only limited applicability for defense against slower liquid-propelled ICBMs. However, BPI seems technically possible against short- or medium-range missiles launched from sea platforms off US coasts, provided that the interceptor missiles could be based within about 40 kilometers of an offensive missile's launch point. Other key issues examined in the study include munitions shortfall, re-targeting, determination of firing solutions, airborne/laser requirements, maneuverability of interceptors, and geographic constraints on missile defense.

BPI strategies have received a great deal of media attention recently due to the relative ease of detecting a missile during boost phase (due to the bright plume) and the supposed difficulty in deploying countermeasures. However, the report identifies effective countermeasures that have previously been used by misiles and shows that the key issue is one of timing.

According to Lamb, even assuming improvements in technology well beyond what is expected in the next 10-15 years, the basic problem is that the BPI strategy only gives two to three minutes for intercept. "Interceptors simply couldn't catch offensive ICBMs in time," he said. "The most optimistic scenarios still provide no time for human decisions and any system would need to be fully automated."

The APS study looked at BPI defense by ground-based interceptors, space-based interceptors and the Airborne Laser (ABL). Ground-based interceptors are primarily limited by the short window of opportunity for intercept and the requirement for basing interceptors close to the launch sites, generally within unfriendly foreign territory for missiles launched from North Korea or Iran.

Space-based interception would require a fleet of thousands of satellites in orbit just to intercept a single missile. Deploying such a fleet would exceed the US' space-launch capabilities by a factor of five to ten over the next decade. The ABL, currently in developmental phase, is limited by is the issue of timing.

Visa Issue Impacts 2004 March Meeting

Due to added security concerns, physicists who will be traveling from the US to attend the 2004 March meeting in Montreal, Canada will have to think more carefully about their plans. Foreign students, post-docs and visitors are likely to be the ones most directly affected. But recent visitors are likely to be the ones most directly affected. But recent concerns, physicists who will be traveling from the US to attend the 2004 March meeting in Montreal, Canada will have to think more carefully about their plans. Foreign students, post-docs and visitors are likely to be the ones most directly affected. But recent concerns, physicists who will be traveling from the US to attend the 2004 March meeting in Montreal, Canada will have to think more carefully about their plans. Foreign students, post-docs and visitors are likely to be the ones most directly affected. But recent

A Publication of The American Physical Society
http://www.aps.org/apsnews

August/September 2003
Volume 12, No. 8
Visual Rules Must Promote Science As Well As Security

The APS Council has approved a statement addressing the difficulties of foreign students and scientists in entering and working in the United States. The statement was passed by e-mail vote on June 6.

The Council took note, especially after September 11, of the paramount importance of national security concerns, but pointed out that there are many faces to national security. The background material to the statement asserts that "national security has many aspects, and it is balanced in a modern and diverse society. In particular, the nation must maintain leadership in science and technology."

The document goes on to say that "recent procedures and rules imposing delays on the nation's borders have resulted in long delays and denials of US visas for many foreign scientists and students."

These and other problems have been widely reported, including front-page stories in APS News in March and May of this year, as well as in the current issue. The background concludes that "our foreign partners are increasingly reluctant to participate in joint ventures. This isolation threatens irreparable damage to US economic competitiveness and, ultimately, national security."

The text of the statement follows:

Natural security and economic vitality critically depend on science and technology and strongly profit from a diversity of views and minds. The American Physical Society calls on the United States Administration and Congress to implement appropriate and effective visa rules and government procedures that sustain science and technology.

Science and technology must maintain leadership in science and technology. They also help to promote national security. They must also promote continuing international scientific and technological cooperation and ensure the flow of knowledge and people and knowledge needed to guarantee economic strength and national security."

The statement follows:

The tip is mounted on a piezoelectric tube, which undergoes small movements when a voltage is applied. This produces a current in the sample, and hence the name of the instrument. Hence the name of the instrument.

This is followed by:

Scientific instrumentation was changed in the early 1980s with the development of scanning tunneling microscopy (STM), an analytical technique which allows the manipulation of a single quantum mechanical phenomenon called tunneling. An electrical potential is applied to the sample, and when the distance between two surfaces is small enough, there is a finite probability that an electron will jump from one surface to another of lower potential in the case of the STM, the tunneling current starts to modify the tip approach a conducting surface at a distance of approximately one nanometer. The tip is mounted on a piezoelectric tube, which undergoes small movements when a voltage is applied. This produces a current in the sample, and hence the name of the instrument.

This is followed by:

At Santa Cruz, she elected to specialize in condensed matter physics, working on photovoltaics (solar cells). During this time, she also became interested in science writing. "I have a very general interest in science, from biology to physics to ecology," she says. And I have a great interest in science writing. Helping the public understand science is an important part of my work."

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A Model of Leptons


This is the tenth in a series of articles by James Riordon. The first article appeared in the November 2002 issue. The articles are archived under “Special Features” on the APS News online web site.

The most-cited paper on our list of the top ten, highly cited Physical Review Letters, is the paper by Sheldon Lee Glashow (a co-author of the tenth most cited PRL) and Abdus Salam “for their contributions to the theory of the unified weak and electromagnetic interaction between elementary particles, including, inter alia, the prediction of the weak neutral current.”

In March, APS News correspondent James Riordon visited Weinberg in his ninth-floor office at the University of Texas at Austin, where he holds the Josey Regental Chair of Science in the Departments of Physics and Astronomy. An excerpt of that interview follows.

APS News: Did you recognize the significance of your 1967 paper at the time that you were writing it?

S. W.: I had the idea that the weak interactions were transmitted by a gauge field like the electromagnetic field, but that the gauge invariance was spontaneously broken, and that’s why the W-particle that transmits the force, the W-particle, is heavy. I thought that idea was very important. I presented that idea in the paper, modestly in the form of a specific example. What I couldn’t have known at that time was that nature had chosen this example to be in the real world. For some years afterwards, especially during the period when some experiments seemed to be bearing against my studies, I wasn’t convinced that this was the right model. But I was convinced of the underlying idea that the weak interactions are transmitted by the electromagnetic forces, with the difference being made by the phenomenon of spontaneous symmetry breaking.

APS News: Your paper took on much greater significance over the years. What proved that the theory was renormalizable in 1971? Why didn’t you immediately set about checking the renormalizability of the electroweak theory back in 1967?

S. W.: I thought that the theory was renormalizable, and I tried during this period to prove it (in a published paper later). But I had a hang-up which prevented me from doing what ’t Hooft did. There are essentially two approaches to quantum field theory. One is the quantum mechanical operator method. The other is Feynman’s path integral method. All the read-

ing I had done used the operator method. I knew about the path integral method, but I looked to me like a way of doing things with a lot of hand waving. Things I knew to be formally correct extremely well by direct calculation in the operator formalism. So it just seemed pointless. What I didn’t realize is that the path integral formalism opens up a lot of ways of doing calculations that really aren’t available in the operator formalism, at least, without it. I could never prove that the theory was renormalizable. It was because of ’t Hooft’s work that I then learned the path integral method. I have used it often since then, and of course teach it, and it’s in my treatise on quantum field theory, although I still start with the operator method. Anyway, I ass-

igned the problem of proving that the theory was renormalizable to a student, and the student was not able to do anything with it either. Also, I was writing a book on gravitation and cosmology, and I had taken over much of my time. And I had gotten very much involved with arms con-

The 1970s were the golden age of particle physics. Suddenly experiments were coming together with the theory. We haven’t really had such a period since then. We need another golden age. That’s the way progress is made. I think of the progress of physics a little bit like a log jam in a river. The logs are jammed and nothing is mov-

ing. Every once in a while you’re going to have a major event that moves a little bit, then they get stuck again. At a certain point, you pick out a crucial log and all the logs start flowing downstream. The ‘70s were a period when everything was flowing beautifully, then it jammed up again and we’re not really mak-

ing much progress. It isn’t that I think we’re departing from some correct way of doing physics, it’s just that after a period of success things get hard again. And they’re really hard now.

APS News: Many attempts had been made previously to unify the electromagnetic and weak interactions. Why did you decide to tackle a prob-

lem that had evaded so many others?

S. W.: This did not come out of my sitting down and saying “Let’s unify the weak and electromagnetic forces.” What I was trying to do was apply ideas of bro-

ken symmetry to the strong interactions. In particular I imagined a kind of gauge theory of the strong forces in which there was a sponta-

eous symmetry breaking which split the particles that transmit the force, so that some of them are much heavier than others. And what was really thinking of was that the rho meson, which is a negative parity, spin-one particle, and the omega particle, which is a posi-

tive parity spin-one particle, have really the same mass but get split by this sponta-

eous symmetry breaking.

The idea went nowhere partly because it turned out that the rho meson would have to have zero mass, which was obviously not true. The rho meson was a particle with a mass of about 750 MeV, which is not small at all by the stan-

dards of strong interaction physics. I was just going nowhere with it, and I was very frustrated. Then it suddenly occurred to me that this was the solution not of the strong interactions but of the weak interactions and that the thing analogous to the A1 was the W particle and the thing analogous to the rho was the photon, and it did have zero mass. And that was the kind of thing that made it so hard work.

APS News: In recent years, it ap-

pears that you have spent more time writing papers about cosmology.

S. W.: Yes, I’ve gone over com-

pletely to cosmology. The kind of


career is to do astrophysical re-

search projects, problem-solving
class.

He and his group built a
class.

Physica

August/September 2003 3

APS Selects 25 at 2002-2004 Undergraduate Minority Scholars

The APS has awarded Scholarships for Minority Undergraduates to 25 students who are majoring or planning to major in physics.

Since its inception in 1980, the program has helped more than 1200 minority students pur-

pose degrees. Fourteen new scholars and 11 renewal scholars were selected.

Each new scholarship consists of $2000, which may be renewed once, and each renewal scholar-

ship consists of $3000.

Minority Scholar Barry Barrios has had a deep interest in science since he was a child, and his interest in physics in par-

ticular stems from attending an MIT program in which he ap-

The APS scholarship program operates under the auspices of the APS Committee on Minorities in Physics, and is supported by funds allocated from the APS Campaign for Physics.

Scholarships are awarded to African-American, Hispanic American, and Native American students who are high school seniors, college freshmen, or sophomores.

The selection committee especially encourages applications from students enrolled in institutions with historically Black, Hispanic or Native American enrollment.

After being selected, each scholar is matched with an accomplished physicist to act as a mentor.

For applications for the 2004-2005 competition, contact Arlene Modeste Knowles at knowles@aps.org.

Information can be found at http://www.aps.org/educ/comm/index.html.

New Scholarships

Barry Barrios
Laura Button
Daniel Casanova
Ryan Gargour
Nicolás López
Michael Mand
Matthew Ortez Kuh
Ayodele Osasona
Alejandro Rodríguez
Joshua Sievert
Michael Tambe
Petro Upegüe
Rebecca Voorhees
Sous-Ja Walters

Ramirez School of Science and Mathemat-

ics, where he is one of the top students, and spent two summers working in the School of Science and Mathemat-

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In the past—September 11 real, our physics departments are getting hammered. Accepted students who applied for visas in late June, are being refused visas on a first or second go-round, and are even being sent back on many applications. In the State Department and the Department of Homeland Security, it is clear that the visa process has not been running smoothly and we have been unable to attend due to problems with their visas. With course enrollments dropping, TA slots going unfilled, and research programs suffering, science departments across the country are beginning to see their programs being seriously affected.

Within the APS, visa issues are a top priority. With the March meeting in Israel coming in just a scant seven months away, determining what steps can be taken to improve the situation takes on an added importance. The APS is working with the State Department, the Department of Homeland Security, and the State Department and the Department of Homeland Security, which houses the Immigration and Naturalization Service (INS). We are working to understand and count some recent successes in streamlining the visa application process—the State Department claims that about 90% of visas issued now have the purview of the State Department, down to 10% for the Department of Homeland Security, which now houses the Immigration and Naturalization Service (INS). We are working to understand and count some recent successes in streamlining the visa application process—the State Department claims that about 90% of visas issued now have the purview of the State Department, down to 10% for the Department of Homeland Security, which now houses the Immigration and Naturalization Service (INS).

Visa problems continue to plague foreign students

By Susan Ginsberg

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range of the intense laser beam and its vulnerability to counterattack. Furthermore, the ABL would not be able to deploy solid-propellant boosters in the time available for inter- cept. According to the United States, Korea and Iran could de- velop or acquire solid-propellant ICBMs within the next 10-15 years.

**BPI Defense**

**Study Group Members**

**Daniel Kleppner**
Kleppner is the director of the Center for Ultracold Atoms at the Massachusetts Institute of Technology, where he is also the Walter Potter Professor of Physics. He received his Ph.D. in experimental atomic physics and he is a member of the National Academy of Sciences, as well as a Fellow of the American Academy of Arts and Sciences, the APS, and the American Association for the Advancement of Science.

**Frederick K. Lamb**
The founding director of the Center for Theoretical Astrophysics at the University of Illinois, where he also holds the Ray and Monica Fortner Endowed Chair in Theoretical Astrophysics. He has served as an assistant professor at Massachusetts Institute of Technology and Bell Laboratories. He has also been the Executive Director for the Spallation Neutron Source at the Oak Ridge National Laboratory. He is an APS Fellow as well as a member of the American Association for the Advancement of Science.

**David L. Montague**
Montague is an independent consultant with more than 40 years of experience designing, developing, and testing complex airborne weapon systems. His work has focused on submarine launched weaponry and ballistic missile defense systems. He is a retired President of the Missile Systems Division at The Boeing Company, a member of the National Academy of Engineering and a Fellow of the American Institute of Aeronautics and Astronautics.

**David E. Mosher**
Mosher is a Nuclear Policy Analy- st at the RAND Corporation where he has focused on strategic warfare, nuclear weapons and mis- sile defenses. Before joining RAND, he worked in the National Security Division of the National Intelligence Office analyzing nuclear, missile defense, and arms control policy and related issues.

**William C. Friedschro**
Friedscho has been on staff at Los Alamos National Laboratory from 1978 and was named a labora- tory Fellow in 1997. At Los Alamos, he has mainly been the Space Astronomy and Astro- physics group, the Lead Project Leader for Proliferation Detection Technology, and is currently the Chief Scientist in the International and Security Division.

**Marty Tigner**
Tigner is the director of the Labor- atory of Nuclear Studies at Cornell University where he also is the H.A. Bethe Chair of Physics. He was a member of the HEART subpanel on the future of high energy physics and chaired the steering committee of the Accelerator Test Facility at Brookhaven.

**David R. Vaughn**
Vaughn is a senior engineer in the Technology and Applied Science Department at ABL, where recently he led a project performing theoretical and technical analysis of airborne boost- and ascent-phase intercept and air-to-surface attack operations. He also is currently involved in the design and development of a low altitude launch vehicle and directed task teams evaluating both lift- and carry launch options for the BSL system.

**PENTAGON from page 1**

Pentagon officials said they would consider an alternative energy source.

**ROSENBERG from page 1**

He also moderates at the DOE-sponsored Science Bowl at PPL, a competition between regional high school teams, and he answers questions sent to the labs’ Ask a Plasma Physicist Web site. “I feel outreach is very important, be- cause kids need to know their options,” Rosenberg says. “Growing up, I never heard of what I’m studying now, and even though I ended up here anyway, it would be nice if kids could start thinking about those options sooner.

Rosenberg decided to apply for the APS Congressional Fellowship to foster his long-standing interest in politics dating back to his under- graduate years. He found time during his graduate studies and edu- cation to participate in the re-election campaign of Rep. Rush Holt (D-NJ), and this past January he was a member of the New Jersey delegation to Capitol Hill for the APS Convocation Lobbying Day. He also proved adept at internal organization and leadership, rallying his fellow grad students to talk about science issues.

**BPI Defense from page 1**

According to US intelligence reports quoted in the study, and on that time scale, BPI defenses would not be able to deliver a shot down four more Katyushas. Based Laser (SBL) experiment is finalized in 1998. According to the study, the launch point of the offensive missile would have been within 40 km of the launch point of the offensive missile.

The full report, downloadable in whole or in part is available on the APS web site, www.aps.org. It policy be published as a supplement to a forthcoming issue of Reviews of Modern Physics.
Non-Volatile Storage For Information Access

By Charles C. Morehouse

Most of us are confronted with the need for storing and retrieving information. As the number of applications that wants access to information improves with us constantly, and growing all the time, the search for new and better tools became more widely used, particularly in the industrial revolution of the 18th and 19th centuries, and the machine of storing and retrieving information for use only by the tools emerged.

Tools Needed Storage

The first storage device for use by a machine only was the music box in the late 18th century. These machines used a hand-crafted metal cylinder with a number of slots invented by Joseph Jacquet. This invention used a pattern stored on the thin cardboard cards. Charles Babbage used punched cards as input to his calculations in 1833. Analytical Engine, a mechanical computing machine, was used for the first time in a large data analysis project in the 1890 Census, using an electromechanical machine invented by Herman Hollerith. This machine was the forerunner of an industry, based on punch cards for data storage and analysis.

As mechanical, electromechanical, and fully electronic machines developed in the 20th century, memory had to be developed in parallel. Paper cards and other perforated media such as paper tape and magnetic core (nearly a century). Aluminum foil was the first medium used in audio recording, but gave way to wax cylinders and other magnetic media.

Magnetic recording of data was first demonstrated by Vladimir Poulsen in the late 19th century. aluminum oxide, a non-metallic, non-magnetic material, with a high melting point and chemical stability. A long period of research was needed before the first practical magnetic recording devices were developed. In 1952, the first magnetic tape recorder and a flexible magnetic tape was introduced. Since then, magnetic media has been the predominant form of data storage.

The evolution of data storage media has been driven by the need to store and retrieve data faster and cheaper. As the speed of computing has increased, the need for faster storage solutions has become critical.

Non-Volatile Storage

Non-volatile storage is the type of storage that retains data even when the power is turned off. These storage devices can be read and written to even when the power is not available. Examples of non-volatile storage devices include magnetic disk drives, solid-state drives (SSDs), and flash memory.

The main advantage of non-volatile storage is that it can retain data for long periods of time without the need for continuous power. This makes it ideal for applications where data needs to be preserved even when the system is powered down, such as in laptops, smartphones, and servers.

Non-volatile storage technologies include magnetic disks, solid-state drives (SSDs), and flash memory. Magnetic disks use spinning platters with magnetic domains to store data. Solid-state drives use flash memory chips to store data, while flash memory is a type of non-volatile memory that uses electrostatic or magnetic storage to retain data.

Future of Non-Volatile Storage

The future of non-volatile storage is likely to be dominated by solid-state drives (SSDs) and flash memory. As these technologies continue to improve, we can expect to see even faster and more reliable storage solutions that are ideal for a wide range of applications.
In the summer hit movie The Hulk, intrepid Berkeley scientist Bruce Banner is zapped by a microchip—called Gammasphere—left over from the Manhattan Project. As a result, Banner transforms into a massive green monster at times of stress. Although the hulking alter ego are the latest fictional characters to emerge from comic book pages and movie screens, Gammasphere is not a mere science fiction plot device.

While scientists in real-world labs have never been turned into green giants by the machine, the real-life Gammasphere device has provided valuable information about some other monstrosities. "The ions combine with atoms into a target," explains Fallon. "To date it has resided part of the time at Berkeley, and part of the time at Argonne, as part of a national research project." It takes about four months to disassemble, move, and reassemble the machine.

The real Gammasphere has been instrumental in helping to explain why oxygen, carbon, iron and other common elements that comprise our world are stable. "I think the protons and neutrons of the nucleus are so tightly packed that the structure of the nucleus resists the energy that causes the nuclei to decay," she says. "I think the protons and neutrons hold together so tightly that they are not likely to move apart before it decays, and that's why we have stable nuclei." The study is important in helping to explain why oxygen, carbon, iron and other common elements that comprise our world are stable.

Atoms that are fused by the accelerator and subsequently disintegrate inside Gammasphere have too many protons to stay together for long. "The molecule to produce new and exotic nuclei," says Fallon. Creating unstable atoms at the extremes of stability lets us isolate that problem which may not be evident in stable nuclei. Although portions of the movie were filmed at the Lawrence Berkeley National Laboratory, where Gammasphere sometimes resides, the machine is presently in Illinois at the Argonne National Laboratory. Gammasphere was built to be moved," says Fallon. "It's an interesting exercise to move it down to the lab property stickers on the back.

One obvious difference between the fictional machine and the fictional version is the fact that the movie Gammasphere emits gamma rays that cause Banner to transform from human to Hulk very fast, whereas the machine itself takes a longer time to do its job. The machine also emits gamma rays that cause Banner to transform, and is harmless. "I think the protons and neutrons hold together so tightly that they are not likely to move apart before it decays, and that's why we have stable nuclei," she says.

One other difference between the real machine and the fictional version is the fact that the movie Gammasphere emits gamma rays that cause Banner to transform from human to Hulk very fast, whereas the machine itself takes a longer time to do its job. The machine also emits gamma rays that cause Banner to transform, and is harmless.

For the full text, please visit: http://www-gamma.lbl.gov/gammasphere/index.html.

Fallon. When they find out that ours wasn’t dangerous — Inside Science and Service

Close-up of Gammasphere, with the G-factor target chamber installed.

Jakobsson Is First Director of NIH Center for Bioinformatics

Jakobsson was recently selected as the first director of the Center for Bioinformatics and Computational Biology at the National Institute of General Medical Sciences, an NIH component.

The new center will support research and training in areas where biology and computer sciences, engineering, mathematics and physics intersect. "I think it's important to have this integration," she says. "We need to develop better tools and techniques to analyze biological data, and high-powered computers will once again enable physicists and other quantitative scientists to advance biomedicine research."

For more information on the APS Mass Media Fellowship program, see: http://www.aps.org/public_affairs/massmedia/index.html

MARCH MEETING from page 1

More information on visa issues can be found on a new Web site launched by the International Student and Exchange Visitor Program (ISEVP) of the U.S. government. The site: http://www.ice.gov/visas/appovals.html.

VISA PROBLEMS from page 4

Delays in granting visas and the resulting unpredictability in graduate student attendance have not been the only challenges plaguing our educational system. Factors that indicate an intent to return (such as family members or property left behind). In addition, the educational system should issue a declaration of its intent to comply fully with the law and not to influence the visa applicant to stay longer than the time allowed. Implementation of SEVIS, the internet-based Student and Exchange Visitor Information System (SIVS) system has also run into problems.

This system, designed by the Immigration and Naturalization Service (INS) to track students and exchange visitors in the country, requires universities to ensure their enrolled students are in compliance with the regulations for re-entry to the US, attention.

The deadline for full implementation of SEVIS across the country’s colleges and universities has been set for August 1, 2003. The higher education community has recently raised concerns about the difficulty of implementing the SEVIS system before the fall semester begins, but quiet indications from the Administration are that the delay is due to the fact the system is not ready.

The APS Office of Public Affairs will keep its eye on the visa issues. Says a spokesperson for the office, "This is a top priority, not just for our members, but for the science community and the country as a whole. We are working closely with other professional organizations to coordinate our efforts and maximize effectiveness."
The old adage that “the third time is the charm” is being put to the test: the US physics community is once again trying to create a next-generation deep underground science laboratory.

The nascent laboratory, to be housed 1016 GeV below ground, would robustly measure neutrino mass and oscillation effects and give hope to tests of the Standard Model. The laboratory has had a profound impact on the US physics community.

The urgency of the science and the need for depth were under discussion at a community Town Meeting on neutrinos, September 2000, in Seattle, when Ken Lande of the University of Pennsylvania made an announcement and proposal. The Homestake Gold Mine, which provided access to the 4850-ft level of the mine, is being proposed as the site of a new next-generation deep underground laboratory.

This proposal became the #1 recommendation of the 2002 physics program of double beta decay experiments, two long-baseline neutrino oscillation experiments, two mass splitting, but appear to differ almost in detail: Both experiments economists of mass eigenstates and weak interactions, is the proposal. The Homestake Gold Mine, which provides access to the 4850-ft level of the mine, is being proposed as the site of a new next-generation deep underground laboratory.

We should set our sights higher, climb higher, and go faster and deeper, to achieve a proportional reduction in cosmic ray backgrounds.

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