This is a wonderfully exciting time in physics research. Recent discoveries have uncovered profound mysteries about the origins and evolution of the universe, and have motivated high energy physics experiments crucial for unraveling these mysteries.

The discoveries (in the general sense of the word) are

- Dark energy
- New dark matter measurements with gravitational lensing
- CMB results of inflation, and the dark and baryonic matter densities of the universe
- Neutrino mixing and the possibility of leptogenesis
- Standard model CP violation, which doesn't explain the matter-antimatter asymmetry
- Higgs mass limits
- The understanding that the familiar neutrinos are not the dark matter
- Although not an experimental discovery, I include here ideas about extra dimensions

The mysteries are

- What is dark energy?
- What caused inflation and is it related to dark energy?
- What is the dark matter particle?
- Is leptogenesis the source of the matter-antimatter asymmetry of the universe?
- With tightened limits on the Higgs mass, is it really the origin of mass?

The HEP experiments this motivates are (I'm excluding astrophysical experiments, since the text refers specifically to HEP experiments):

- Searches for SUSY, with the neutralino as dark matter candidate (Tevatron, LHC)
- Higgs searches (Tevatron, LHC)
- CP violation in neutrino mixing (future neutrino facilities) and measurement of θ_{13}
- Searches for extra dimensions (Tevatron, LHC)
- Searches for non-standard model CP violation (B physics experiments)
- Direct underground (CDMS) and space-based (GLAST) searches for dark matter

(Please note: None of us is expected to be an expert on all of this. If asked something you don't know, say you will find out ad get back to them later)

Understanding the universe is thus intimately linked to the exploration of its smallest components.

It is impossible to answer big questions about the universe without understanding the **particle physics aspects** of

- Dark matter
- Dark energy
- CP violation
- The spectrum of particles that existed at the early universe (SUSY, Higgs, inflaton, etc.)

The high energy physicists we represent, who come from universities and research institutes around the United States and the world, are studying these questions at SLAC and Fermilab.

We do the research needed to answer solve those mysteries. By the way, we're from all over the country, probably your state too.

Federal investment in the physical sciences by the Department of Energy's Office of Science and the National Science Foundation provides the basis for continued scientific discoveries, the advanced technologies needed to make them, and the education of successive generations of scientists and engineers.

This is the 3-pillared justification for discovery science:

- Scientific discoveries, which are worthwhile in their own right, and also ultimately lead to future technologies opened up by these discoveries, for example
  - The electron à modern day electronics
  - Quantum mechanics à the microchip, the laser, perhaps future quantum computing
  - General relativity à GPS (the GR correction is 11 km per day!)
  - Particles discovered (positrons, neutrons) used in medical imaging and radiotherapy
- Advanced technologies developed in order to carry out the science
  - HEP developed advanced computing and the WWW
  - Accelerators as synchrotron light sources, SLAC x-ray laser in 2008
  - Particle detectors for smoke alarms, nuclear security at airports and seaports
- Training of advanced and skilled workforce
  - Here is what the 2006 budget request says specifically about HEP training (page 277): "The R&D workforce developed under this program [HEP] not only provides new scientific talent in areas of fundamental research, but also provides talent for a wide variety of technical, medical, and industrial areas that require the incisive thinking and problem solving abilities and computing and technical skills developed through an education and experience in a fundamental research field. Scientists trained as high energy physicists can be found working in such diverse areas as hospitals (radiation therapy, medical imaging, and medical physics), national security, space exploration, software and computing, telecommunications, finance, and many other fields."

We thank the Congress for its steady support of this investment, and the recognition that physical science is crucial to the prosperity of the nation.

Start by being nice and thankful.

Congress's recognition of physical sciences is embodied in, for example, the "Biggert Bill" of 2002, HR5270, http://thomas.loc.gov/cgi-bin/query/F?c107:1:./temp/~c107c92cyF:e1707: . Here are some quotes from the bill. Square brackets are mine:

- "Fully half the growth of the United States economy in the last 50 years was due to the Federal investment in scientific and technological innovation, much of which flowed from our Nation's research universities and national laboratories. Computers, the Internet, fiber optics, communications equipment and technology, consumer electronics, defense technologies, global positioning systems, and catalytic converters are but a few examples of the contributions of the **physical sciences** [my highlight] to the overall strength of our economy."
- "The inadequacies of our systems of research and education pose a greater threat to U.S. national security over the next quarter century than any potential conventional war that we

might imagine." [The bill quotes this from a report by the United States Commission on National Security in the 21st Century]

- The bill authorized the following budgets for the Office of Science:
  - $3.492B in 2003
  - $4.015B in 2004 ($3.536B was the actual appropriation)
  - $4.618B in 2005 ($3.600B was the actual appropriation)
  - $5.310B in 2006 ($3.463B requested)

The ongoing Federal investment has kept the United States in a position of leadership in high energy physics research.

"Kept" is intentionally past tense here. Without saying it explicitly, we are implying that the US may no longer be in this position of leadership if the Federal investment is allowed to dwindle.

Based on priorities determined by the high energy physics community, the Department of Energy has outlined in the 2006 budget request its plan for maintaining this leadership and taking advantage of the scientific opportunities presented by recent discoveries.

The purpose of this sentence is to say (not all is said explicitly)

- HEP has a plan (deflects past criticism on lack of plan)
- The plan comes from the administration (it's not just what we wish for)
- We've prioritized (made painful sacrifices, most notably the termination of BTeV)
- Conducting the science in plan is necessary for maintaining U.S. leadership in this area

The plan includes capitalizing on past investments through full operation of existing facilities; conducting research using the Large Hadron Collider in Europe; pursuing a mid-term particle astrophysics, cosmology, and neutrino physics program; and taking a major role in a future International Linear Collider.

Near term

- B Factory and Tevatron operations and luminosity increases are well supported, to extract the maximum physics from these facilities, which the plan says will close in 2008-2009

Mid-term

- Support for energy frontier physics research at the LHC
- Fermilab's ongoing particle astrophysics program
- MINOS/NuMI and yet-unapproved projects exploring scientific opportunities in neutrino physics

Long term

- International Linear Collider

We ask for your continued support for high energy physics in this year's budget, and for funding research in the physical sciences at a constant level of effort, which is crucial for maintaining the nation's leadership in science and technology.

- **"your continued support for HEP in this year's budget":**
  - Attempts to prevent a cut in the 2006 HEP budget below the President's request

- **“funding research in the physical sciences at a constant level of effort”:**
  - “Constant level of effort” means an increase in nominal dollars of about 4%. This is because the consumer price index increase is ~2%, and the additional ~2% is due to the faster rise in salaries and energy costs.
  - “Constant level of effort” is the minimum requested by the “Innovations” report at www.futureofinnovation.org, showed to us by Mike Lubell of APS. APS unit heads took the report to 80 Congressional offices in January. See list mailed earlier to see if any of your members was visited by them
  - The “Innovations” report further says that in order to keep up with increased scientific investments by other global competitors, physical science funding as a fraction of GDP needs to be maintained. This is an increase of 6-7% in nominal dollars. We chose not to go that far in the 1-pager, in order to make it palatable to a wide range of audiences. But it can certainly be mentioned verbally.
- **“crucial for maintaining the nation's leadership in science and technology”:**
  - Wrap up with reference to the justification for physical science, elaborated on earlier in the 1-pager.