HEPAP 18 November 2010 MG

EPP PROGRAM OFFICERS
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Program Officer Applications Will Be Sought Soon

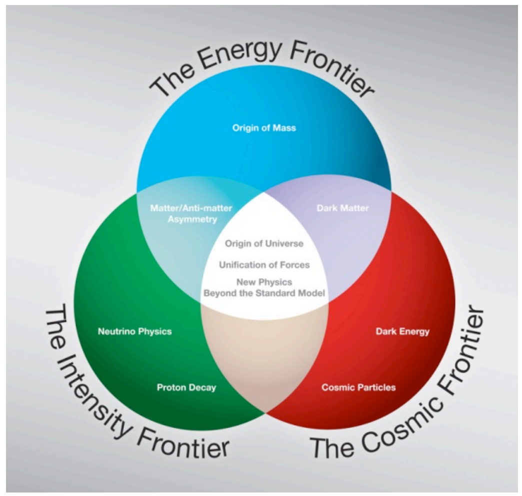
Typical Recommendation:
"You write to ask me for my opinion of X, who has applied for a position in your NSF program.

I cannot recommend him too highly nor say enough good things about him. There is no other with whom I can adequately compare him.

His performance was the sort of work you don't expect to see nowadays and there he has clearly demonstrated his complete capabilities.

The amount of material he knows will surprise you. You will indeed be fortunate if you can get him to work for you.“

In a time of tight budgets, EPP PO's believe that partnerships and synergies with PHY and NSF programs will significantly enhance our EPP program scope .



Physics Program Partners	NSF Partnerships
MRI	OPP
Career	OCI
PIF	EHR
PFC	OISE
EIR	AST
AMOP	
APPI?	And of Course OHEP &ONP /DOE

PROGRAM HIGHLIGHTS SELECTED BY PO'S

You can peruse budget details and statistics further below.
Here we emphasize timely program actions
and the larger picture.

DUSEL DISCUSSED TOMORROW?

SUMMARY OF EPP/PNA/THY BASE & ALLIED FUNDING ($M)

	FY07	FY08	FY09	FY10
Base				
EPP Accel Based (D0, CDF, LHC, Neutrinos, Lepton Collider R&D)	18.91	20.45	18.794	25.792
PNA+IceCube Ops	16.33	17.33	18.08	20.02
CESR	14.71	13.71	8.50	0
LHC OPS	18.00	18.00	18.00	18.00
Accel + ILC Det R&D	2.16	4.00	0.30	0.30
DUSEL, R&D	6.00	6.96	4.00	4.09
EPP+Astro/Cosmo Thy	11.82	11.68	12.03	13.20
Total Base	87.94	92.13	79.67	81.40
Allied Funding				
MRI	1.76	2.06	2.76	8.93
PFC	5.93	6.26	7.09	7.11
OCI/CISE	1.61	1.30	0.75	0.13
PIF/OMA/ESIE/OISE	4.45	4.41	2.75	2.75
PIRE	0.50	0.50	0.57	1.50
Total Allied	13.55	13.91	13.92	19.81
Overall Total	**101.49**	**106.04**	**93.59**	**101.21**

Highlights: NSF Particle and Nuclear Astrophysics Program (PNA 1)

PASAG (Oct 23, 2009):

<u>Dark Matter</u>

The liquid argon technique may be especially promising with the use of depleted argon and should also be explored in any of the funding scenarios. (p.22)

The NSF-PNA Program is funding DarkSide-50 in the Borexino CTF (LNGS) with a start in FY10.

R&D should be conducted on all techniques with potential for scalability and/or background control (such as true directionality). (p.24) All scenarios support the continued R&D into detectors with directional sensitivity. (p.26)

The NSF-PNA Program is continuing to support DRIFT-II (Boulby mine) and made a new award in FY10 to DMTPC.

HIGHLIGHTS (PNA 2)

PASAG (Oct 23, 2009)

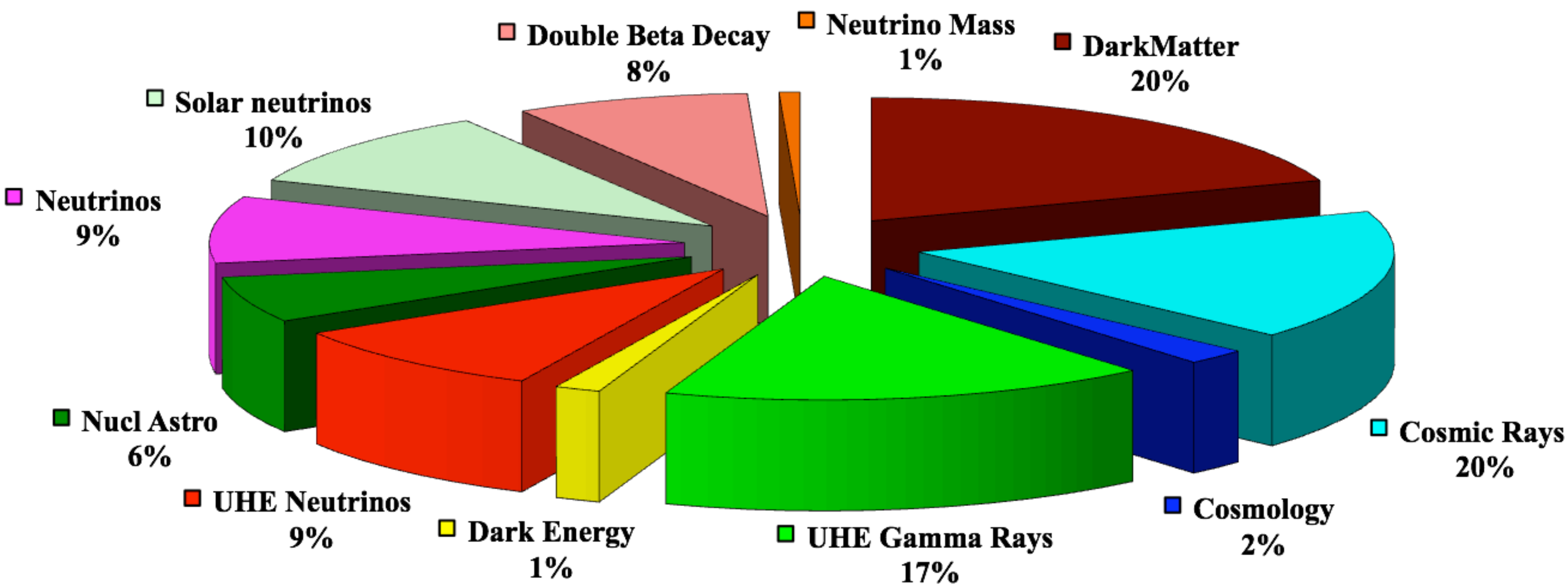
Summary of opportunities in Cosmic Rays and Gamma Rays:

PASAG recommends the construction of HAWC and the funding of the VERITAS upgrade in all four budget scenarios. HAWC is a moderate-priced initiative that will carry out excellent astrophysics using a novel technique; there is also the possibility of surprising results of relevance for particle physics. The upgrade of VERITAS is a relatively low-cost way to improve the performance of an existing instrument to allow it to remain world-leading during the upcoming five to six years.

With DOE-OHEP, we have made a decision to fund the HAWC project, starting with FY11 funding; and
NSF has funded the VERITAS upgrade with an MRI award (Kieda) for $1.63M.

Particle and Nuclear Astrophysics Program **PNA 2**

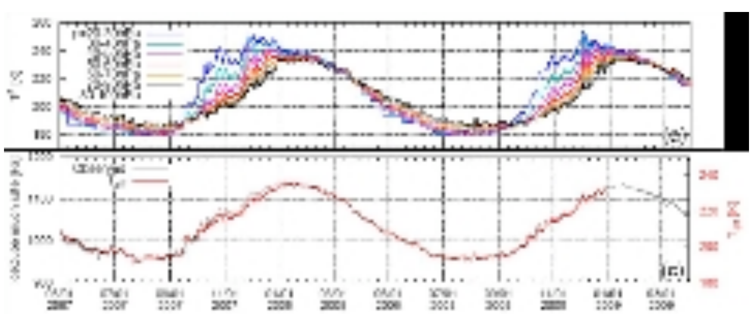
PNA funding by topic for FY2010



HIGHLIGHTS (PNA 3)

IceCube measures temperature changes in the Antarctic ozone layer

From measurements of the correlation of observed muon rates in IceCube with long and short term variations in the South Pole atmosphere, the IceCube Neutrino Observatory has demonstrated that it closely probes the time dependence of the stratospheric temperatures in the Antarctic ozone layer and the ozone hole dynamics. The results were presented in a paper at the International Cosmic Ray Conference (ICRC 2009) (arXiv:1001.0776v2 7 Jan, 2010).



The temporal behavior of the South Pole stratosphere from May 2007 to April 2009 is compared to the high energy muon rate in the deep ice. **(top) The temperature profiles of the stratosphere at pressure layers from 20 hPa to 100 hPa where the first cosmic ray interactions happen. (bottom) The IceCube muon trigger rate.**

HIGHLIGHTS (PNA 4)

Geoneutrinos from Borexino

BOREXINO was designed to measure in real time, and separately, the different components of the solar-ν spectrum via their elastic scattering off of electrons in a volume of highly purified liquid scintillator.

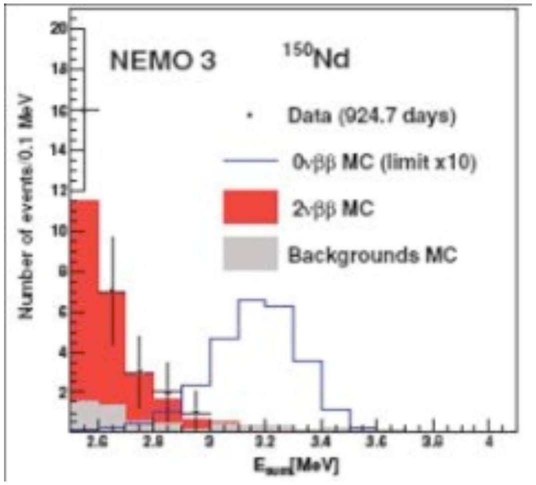
Geo-neutrinos are anti-neutrinos produced in the radioactive decays of uranium, thorium, potassium and rubidium found in ancient rocks deep within our planet. These decays are believed to contribute a significant but unknown fraction of the heat generated inside Earth, where this heat influences volcanic activity and tectonic plate movements, for example. Borexino, the large neutrino detector, serves as a window to look deep into the Earth's core and report on the planet's structure. A measurement of geoneutrinos will provide data on the composition and history of the earth.

The recent BOREXINO measurement of the geo–neutrinos rate is $3.9^{+1.6}_{-1.3}$ ($^{+5.8}_{-3.2}$) events/(100 ton·yr). This measurement rejects the hypothesis of an active geo-reactor in the Earth's core with a power above 3 TW at 95% C.L. The observed prompt positron spectrum above 2.6 MeV is compatible with that expected from European nuclear reactors (mean base line of approximately 1000 km). Their measurement of reactor anti–neutrinos excludes the non-oscillation hypothesis at 99.6% C.L.

HIGHLIGHTS (PNA 5)

Searching for very rare events in an underground laboratory

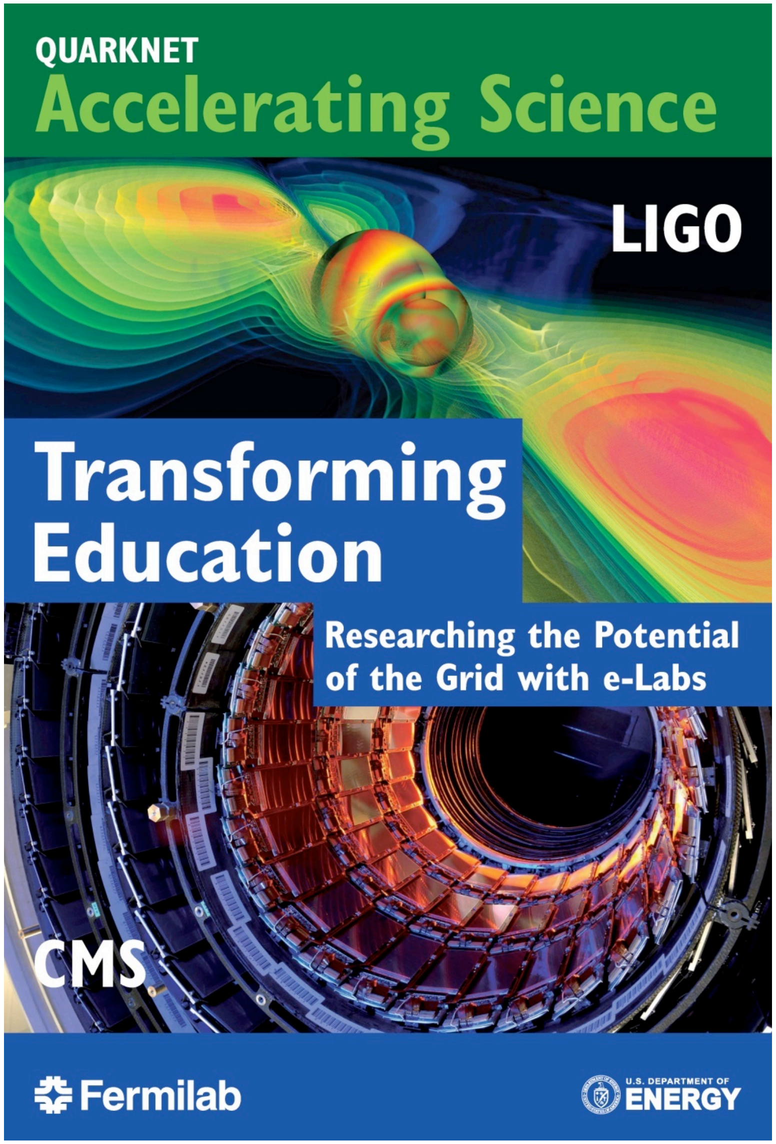
The observation of neutrino oscillations indicates that neutrinos must have mass. However, to date we only have upper limits on the values of the neutrino masses. The NEMO (Neutrino Ettore Majorana Observatory) experiment set up in the Modane Underground Laboratory, Savoie, France, has recently set new upper limits on the mass of this particle by searching for examples of a rare process called "Neutrino-less Double Beta Decay."



Distribution of the energy sum of the two electrons for E_{sum} > 2.5 MeV. The data are compared with the total background, consisting of internal and external background and the 2-neutrino expectation. A MC simulation of a neutrino-less double beta decay signal corresponding to ten times the number of events expected for the observed 90% C.L. limit is also shown (in blue).

The data are in good agreement with the sum of the background and the 2-neutrino double beta decay signal distributions. Since no significant excess at 3.368 MeV is observed in the energy sum distribution, a lower limit is set on the half-life for neutrino-less double beta decay. This, in turn, sets an upper limit on the neutrino mass of 4.0 - 6.8 eV, where the range covers the uncertainty in a nuclear matrix element calculation.

HIGHLIGHTS NSF EPP ACCELERATOR BASED PARTNERHIPS (EPP 1)



EHR, EIR, OCI
OHEP
PARTNERSHIPS
AND
SYNERGIES
All add value to our Science

OISE (Office of International Science and Engineering) PARTNERSHIP (EPP 2)

PIRE (PARNERSHIPS FOR RESEARCH AND EDUCATION): Advanced Pixel Silicon Detectors for the CMS detector

2007-11; $2,177K to date.

A collaboration on the US side between the University of Kansas, the University of Illinois-Chicago, the University of Nebraska, and the University of Puerto Rico-Mayaguez with the Paul Scherrer Institute and Eidgenoessiche Technische Hochschule (ETH) in Zurich, Switzerland.

The project will contribute to a globally engaged and internationally trained workforce, increase minority participation in science and engineering, and develop lasting connections between the participants and their counterparts at foreign institutions. The ability to involve undergraduates is innovative, because in contrast to most high energy physics collaborations, these exchanges will occur with foreign collaborators at the universities, rather than in the laboratory.

OISE (Office of International Science and Engineering) PARTNERSHIP (EPP 3)

OISE PIRE: In Partnership also with OCI (Office of Cyberinfrastructure)

2010; $892,233 to date

Training and Workshops in Data Intensive Computing Using The Open Science Data Cloud U Illinois Chicago/ Florida Int'l U (CHEPREO) / Johns Hopkins/ U Chicago, Brazil, China, Japan, Korea, Netherlands, UK

This PIRE team intends to help develop large-scale distributed computing capabilities - the Open Science Data Cloud (OSDC) - to provide long term persistent storage for scientific data and state-of-the-art services for integrating, analyzing, sharing and archiving scientific data. The group proposes to study and strengthen storage systems that integrate specialized network protocols and support data transport over wide-area, high-performance networks.

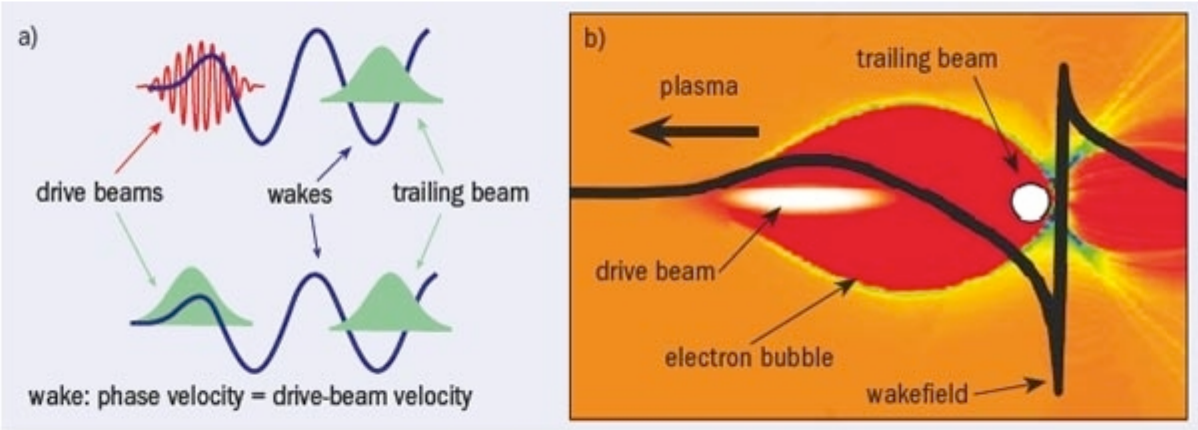
POTENTIAL PHY **APPI PROGRAM** PARTNERSHIP CAN SUPPORT ACCELERATOR R&D AT UNIVERSITIES **(EPP 4)**

*EPP now possesses no accelerator laboratory facilities, but supports accelerator research at Universities: Project X; Colliders; SRF

CORNELL
COLLIDER
& SRF R&D

AMOP PHY PROGRAM PARTNERSHIP (EPP 5)

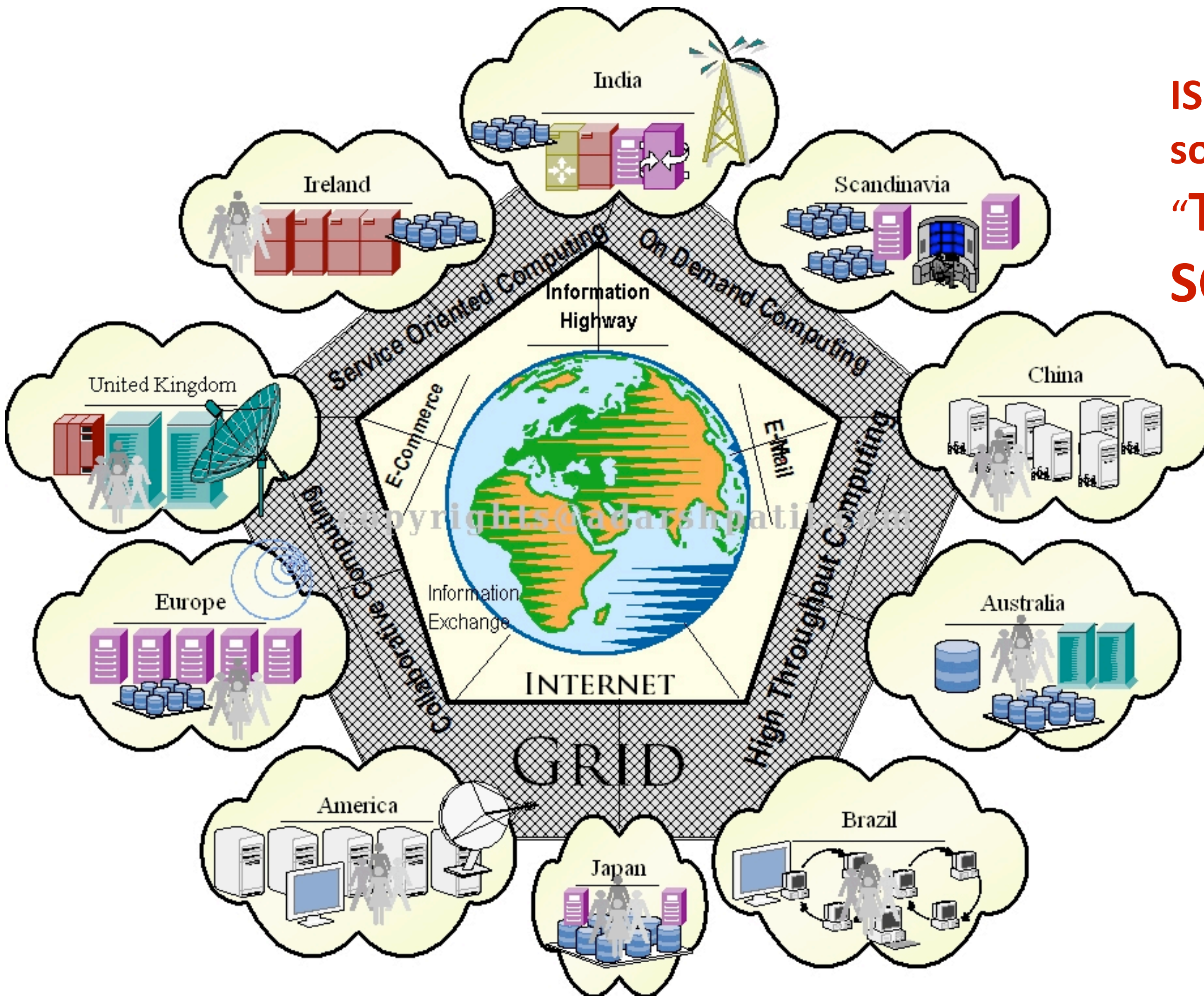
The mixture of physics disciplines involved meant that even proof-of-concept experiments on plasma accelerators required an expertise in plasma physics, lasers and beam physics.



STUDENT ORIENTED

Wide Ranging OCI and PIF (Physics at the Information Frontier) PARTNERSHIP (EPP 6)

DATA INTENSIVE EXPERIMENTS REQUIRE ADVANCED (Post Tier 2) CYBERINFRASTRUCTURE -OSG example also with OHEP



ISGTW- with OCI, soon to be "THE DIGITAL SCIENTIST"?

LHC (PARTNERSHIP with OHEP) (EPP 7)

*NSF SUPPORT FOR LHC **OPERATIONS** PROGRAM AND **DETECTOR** UPGRADES: A SUMMARY*

- ❑ **Purpose:** *Support is for university groups operations activities in U.S. ATLAS and CMS Collaborations (following detector construction for **$81M**)*
- [NSF also provides core program support for LHCb (Syracuse) and TOTEM initial phase (Penn State/Case Western)]
- ❑ **Operations Funding Profile (equally divided for ATLAS & CMS)**

FY	03	04	05	06	07	08	09	10	11
$M	5.0	7.0	10.5	13.6	18.0	18.0	18.0	18.0	18.0

- ❑ **Ops support coordinated with that of DOE**
- ❑ **Includes support for Tier- 2 computing facilities ($2.4M/Yr for ATLAS, $2.7M/Yr for CMS)**

Budgets for FY 12-16 depend on the development of new 5-year cooperative agreement proposals for approval by the National Science Board. The process is to begin shortly.

NSF LHC support (cont'd) -- II

- **Note that Base Support for Universities from EPP Program ~$14M/yr**
- **PARTNERSHIP Funding from other NSF-wide sources**
  - LHC Major Research Instrumentation (MRI):

    FY09: $500K for LHCb

    FY 10: $1.7M for US CMS, $4.1for US ATLAS, $0.8M for US LHCb computing with LIGO
  - Partnerships for International Research and Education (PIRE): US CMS- $2.5 M over 5 years
- **Funding from other Physics Division sources and partnerships with other NSF Offices :**
  - Open Science Grid (OSG), with DOE, OCI, $13.9 M over 5 years (NSF part)
  - ATLAS/CMS graduate student awards at CERN (e.g., $365K in FY 10)
  - Education with research (e.g., QuarkNet [with DOE], CHEPREO, I2U2,..)

- **Upgrade R&D Strategy:**
  - decision reaffirmed to keep the R&D funding support in the Ops program to stimulate a focused R&D effort by a closer coupling between actual operating experience and perceived upgrade goals ;
  - possible other support from NSF-wide programs such as MRI.
- **Upgrade Construction Strategy:**
  - totally changed because of the change and remaining uncertainty in the LHC run plan and upgrade schedule. Now focused only on the "initial" upgrades. ***Possible funding support no sooner than FY 2013***. Meanwhile, possible earlier (but limited) support from other sources may be from the MRI program.

EPP Theory and Cosmology are intense, vibrant disciplines where many people are exploring new ideas at the intersections of particle physics, astrophysics, and cosmology!

•FY10 initiated the era of the LHC! Data from LHC will be truly *transformational.*

•But the LHC is not all there is.

.Increasing emphasis on interdisciplinary connections to

•Astro/Cosmo … dark matter, dark energy

•Nuclear physics … strong interactions, heavy ions, RHIC

•Consequently, HEP theory spans many orders of magnitude in energy, and runs the gamut from hard-core data-driven collider phenomenology to abstract model-building and considerations of the “ultimate theory”.

THEORY PROGRAM: HIGHLIGHTS FOR FY11

1. The LHC Theory Initiative

The LHC Theory Initiative is a fellowship program intended to help the US meet the theoretical needs of the LHC by providing graduate student and postdoctoral fellowships to promising young theorists working on LHC-related physics. The program was created by the U.S. particle theory community in anticipation of the data to come from the Large Hadron Collider. **In 2010, the program funded 6 postdocs and 4 graduate students.**,

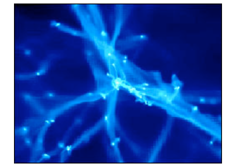
2. Aspen Center for Physics

Started in 1962, The Aspen Center for Physics is a scientific organization which promotes organized research in physics, astrophysics and related fields
through a program of individual and collaborative research, seminars, workshops and conferences and which promotes the education of the general public through public lectures and other activities. NSF provides the major continuing grant for the summer program, and this grant is also coming up for renewal in FY2011.

3. Theoretical Advanced Study Institute (TASI)

TASI is a four-week summer school in high-energy physics or astrophysics held yearly at the University of Colorado at Boulder. The school is meant primarily for advanced graduate students and consists of a series of pedagogical lectures on selected topics given by active researchers in the field. **The purpose of TASI is to introduce graduate students to cutting-edge topics that they may not have access to in their home institutions.** TASI also gives young theoretical physicists a chance to meet and become friends with their fellow students, who will become their future peers. TASI is the most common summer school attended by high-energy physics graduate students in the United States. TASI is supported in part by the NSF Theory program, and this grant is also coming up for renewal in 2011.

Selected Physics Frontiers Centers



Kavli Institute for Cosmological Physics – Chicago - Meyer

Kavli Institute for Theoretical Physics – UCSB – Gross

Budget Details

EPP THEORY AND COSMOLOGY

($M)	FY 07	FY 08	FY 09	FY 10
BASE	11.82	11.68	12.03	13.2

Received 15 CAREER proposals

9 RUI Grants

Received 47-50 regular grant proposals

Supporting 131 senior personnel

81 Different Institutions

RESEARCH PROGRAM –EPP & PNA

	FY	2008	2009	2010	2011
EPP	CAREER proposals submitted	13	8	19	8
	CAREER proposals Funded	1	3	5	
PNA	CAREER proposals submitted	9	10	7	8
	CAREER proposals funded	1	3	1	
EPP	Props submitted	25	29	28	14
	Funded (renewals)	16 (14)	20 (11)	13 (11)	
PNA	Props submitted	45	46	45	46
	Funded (renewals)	21 (15)	33 (20)	32 (18)	

Particle and Nuclear Astrophysics Program ($M) **PNA I**

FY	2007	2008	2009	2010
Total funding (+ARRA) (- stand. awd)	$16,080k	$15,833k	$15,932 + $5,723k	$17,879 +$5,581k -$605k
ARRA total			$15,310k	
No. Universities	39	41	57	62
Underrepresented PIs	13	17	22	31
# PIs PhD <10 yr		11	15	18
# Faculty (FTE)	41.2	42.5	54.9	65.1
Funding to Faculty ($)	13,340K	12,804K	17,994K	19,979K
$/FTE Faculty	$324k	$301k	$328k	$307k
#postdoc/FTE fac	0.98	0.91	0.88	0.80
#grad std/FTE fac	1.93	1.88	1.89	1.81
MRI (PNA)		$605,000	$2,221,969	$1,633,490

NSF-PHY Elementary Particle Physics

FY	2007	2008	2009	2010
Total funding ($K) (+ARRA) (- standard awards)	18,913	20,452	18,794 + 4,614	25,792 +5,275 -1,760
ARRA total			$13,990	
No. Universities	48	50	57	58
Underrepresented PIs		19	26	27
# PIs PhD <10 yr		14	12	19
# Faculty (FTE)	111	108	109	104
Funding to Faculty ($)	18,810K	20,350K	22,900K	21,193K
Avg (Median) $/FTE Faculty	170K	188K	210K	213K (120K)
#postdoc/FTE faculty	0.76	0.67	0.77	0.78
#grad std/FTE faculty	1.09	1.26	1.44	1.17
MRI (EPP) - $	1,762K	1,450K	541K	8,287K

INSTRUCTIONS FOR UPCOMING PANELS

For FY 11 and Beyond, Huge Budget Uncertainties