



## Structure of the NSF HEP Budget

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# SIGN OF THE TIMES





# Topics

- Issues
- PHY Program Scope
- EPP/PNA/Theory Program Scope
- EPP/PNA Demographics
- Budget and Funding Information
- Planning
- Issues



# ISSUES

- There is evidence that the field has not yet produced a viable plan for the future that is supportable, when compared to other sciences.
- We ask the community to develop a plan centered on a transformative, frontier, scientific program, including a process to craft the resources necessary to carry it out. Meanwhile, other "must do" mid-scale programmatic elements should complement this plan.



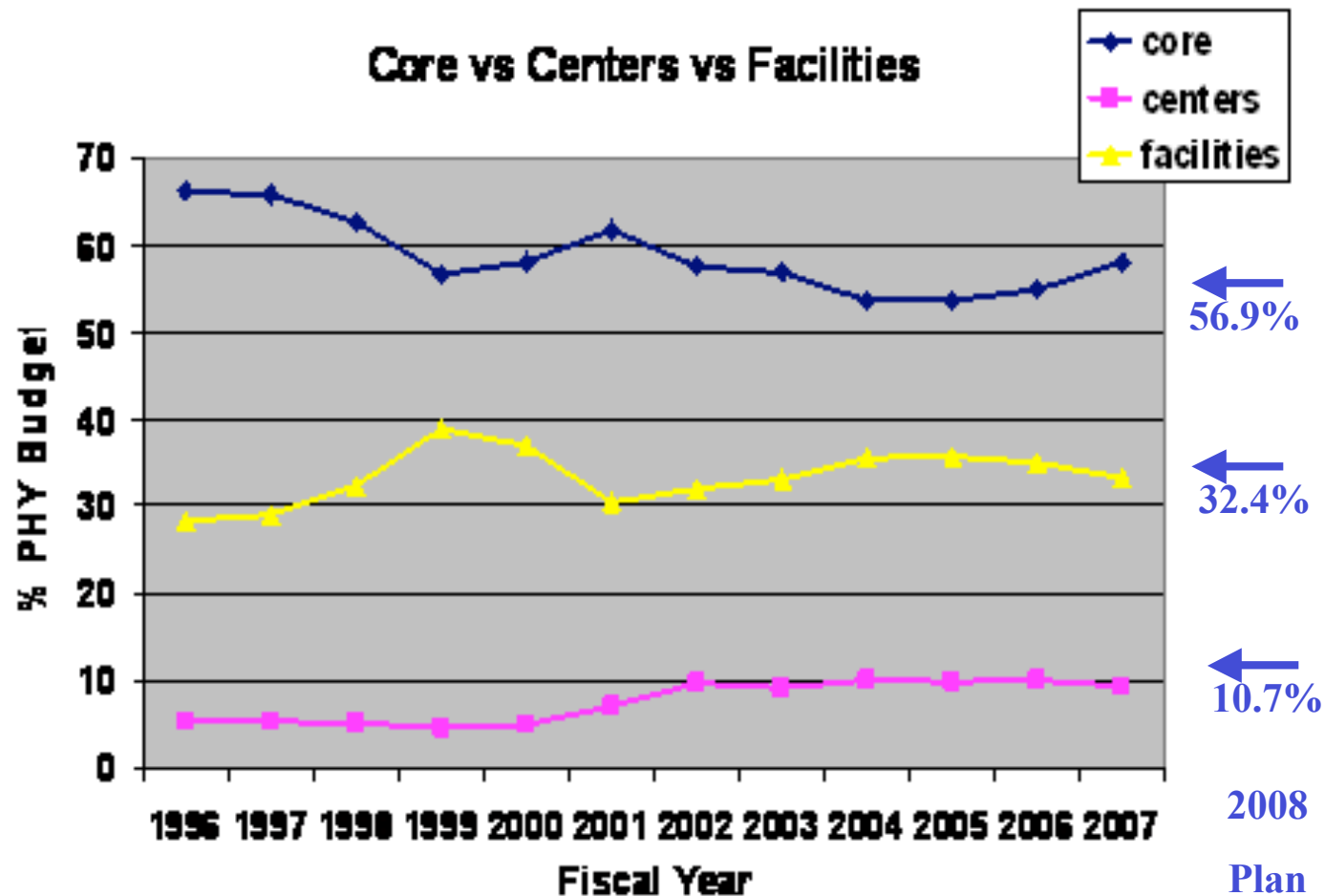
# NSF PHY Strategy

- Short term - Complete programs at FNAL, BaBar, CESR; begin LHC exploration of TeV scale; complete plans for neutrino, astrophysics/cosmology, rare processes program; R&D for DUSEL and all promising energy-frontier accelerator concepts (e.g., CESR-TA); strengthen university program & theory
- **Intermediate term - Exploit discovery potential of LHC; utilize potential of DUSEL; support neutrino, astrophysics/cosmology, rare process approaches to major discoveries; prioritize/select best-value lepton & hadron accelerator concepts; strengthen university experiment program & theory**
- Long term - Prepare to participate in the next energy-frontier collider, from the platform of a broad discovery program.



# Physics Division Budget Sectors

## Budget sectors over time





# Physics Division Funding – \$ M

	FY03 Actual	FY04 Actual	FY05 Actual	FY06 Actual	FY07 Actual	FY08 Plan	FY09 Request
Physics	\$224.92	\$223.65	\$222.23	\$234.36	\$249.06	250.52	297.70
Base Prgm	157.70	146.00	142.95	156.36	164.62	169.31	220.05
Facilities	67.22	77.65	79.28	78.00	84.46	81.21	77.65
LIGO	29.00	31.00	32.00	31.68	33.00	29.50	28.50
NSCL	15.65	15.65	17.50	17.34	18.50	18.50	20.50
LHC	3.08	7.00	10.51	13.37	18.00	18.00	18.00
Cornell Facility	19.49	18.00	16.62	14.62	14.71	13.71	8.50
RSVP	--	6.00	2.65	0.99	--	--	--
IceCube	--	--	--	--	0.25	1.50	2.15



## Some EPP/PNA/THY Developments

- DUSEL Site Selection (Homestake) done - \$15M/3yr to UC-Berkeley coop agreement (see T. Chan's talk)
- DUSEL R&D is underway (with DOE)
- Solicitation for proposals for initial suite of DUSEL experiments anticipated in Spring 08 - \$15M/3yr total (see T. Chan's talk)
- The Cornell Facility is planned to close in FY09
- The R&D CESR-TA (ILC Damping Ring) Project, funded by NSF/DOE, is planned through FY10
- Planned funding goals for LHC operations have been reached
- LHC Reverse Site Visits established to aid in effective NSF funding for university groups
- **FY08: EPP down 5%; Theory down 4%; PNA down 2%**





# EPP + PNA Portfolio

- **University Program**
  - **EPP Accelerator based physics**
    - Hadron Colliders: CDF, DØ, CMS, ATLAS, LHCb
    - Electron Positron Colliders: CLEO-c, BaBar,...
    - Neutrinos: MINOS, NOvA, MINERvA, MiniBooNE
  - **Particle and Nuclear Astrophysics**
    - Dark Matter: CDMS, COUPP, XENON10, DRIFT-II, ZEPLIN-II, WARP
    - UltraHigh Energy Universe: HiRes/TA, Pierre Auger, VERITAS, MILAGRO
    - Neutrinos: Double Chooz, Super-K, Borexino, CUORE
  - **Theory (EPP, Astrophysics and Cosmology)**
  - **Computational physics (OSG, Tier2 Centers, DISUN)**
- **LHC Experiments: Maintenance and Operations**
- **DUSEL**
- **CESR/CLEO-c (ending 2/29/08)**
- **Accelerator R&D**
  - CESR-TA (with DOE/OHEP)
  - MICE
  - Advanced Technologies
- **Detector R&D**
  - SLHC, ILC, generic
  - DUSEL (with DOE/OHEP, NP)
- **Partnerships & Broader Impacts**

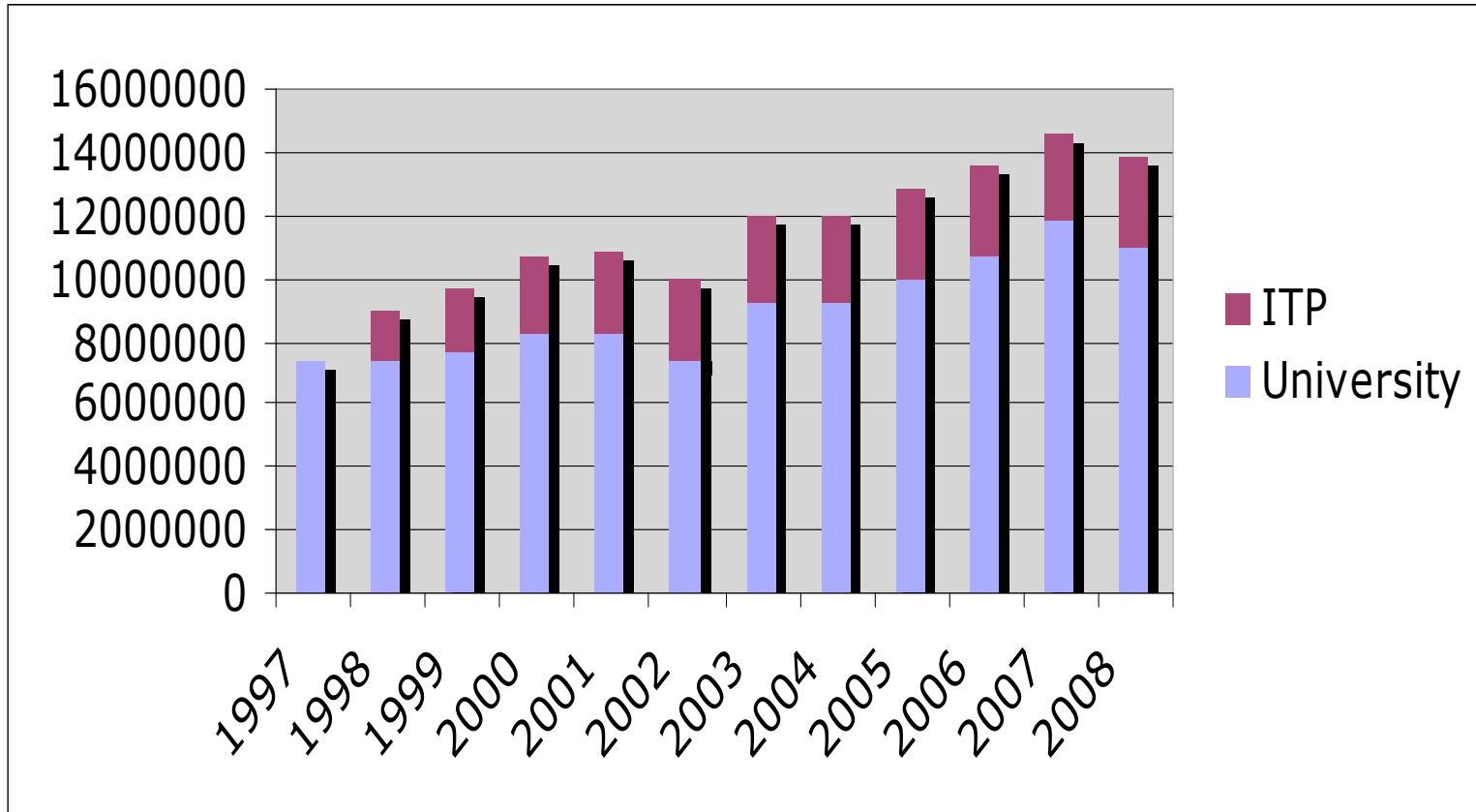


## Scope of Theory Program

- 13 University Groups
- 66 Individual PI proposals
- This include 9 PI's at Undergraduate Institutions and 6 Career Proposals+ 3 this year!
- Two Centers for Collaborative Research—  
Aspen Center and KITP at UCSB—
- Possible LHC Center—PFC competition
- TASI Boulder Summer School (with DOE)



# Funding Profile - Theory





## Critical Issues - Theory Program

- Need to involve more young people in LHC related physics
- Need new hires in Phenomenology
- Traditional funding source for theory students (being TA's) is becoming problematic. (need more funding for students).



# EPP/PNA Underlying Themes

- Empowering University-Based Investigators
- Adding Value
  - Partnerships
    - Building Interdisciplinary Collaboration
  - Broadening Participation
    - Single Investigators
    - Non-traditional/Underrepresented participants
    - Research at Undergraduate Institutions
  - Education, Outreach and Broader Impacts



# Partnerships

- **Cyberscience**
  - Tier 2c - with OCI
  - UltraLight - with OCI
  - OSG - with OCI and DOE
- **Education with research**
  - QuarkNet - with OMA, EHR and DOE/HEP
  - CHEPREO - with OMA, OCI, EHR, OISE
  - I2U2 - with OMA, EHR, PHY
  - Mariachi - OCI funded
  - CyberBridges - OCI funded
  - PIRE (UK, KSU, UNL, UIC, UPRM) - with OISE
  - ILC Outreach - with OISE

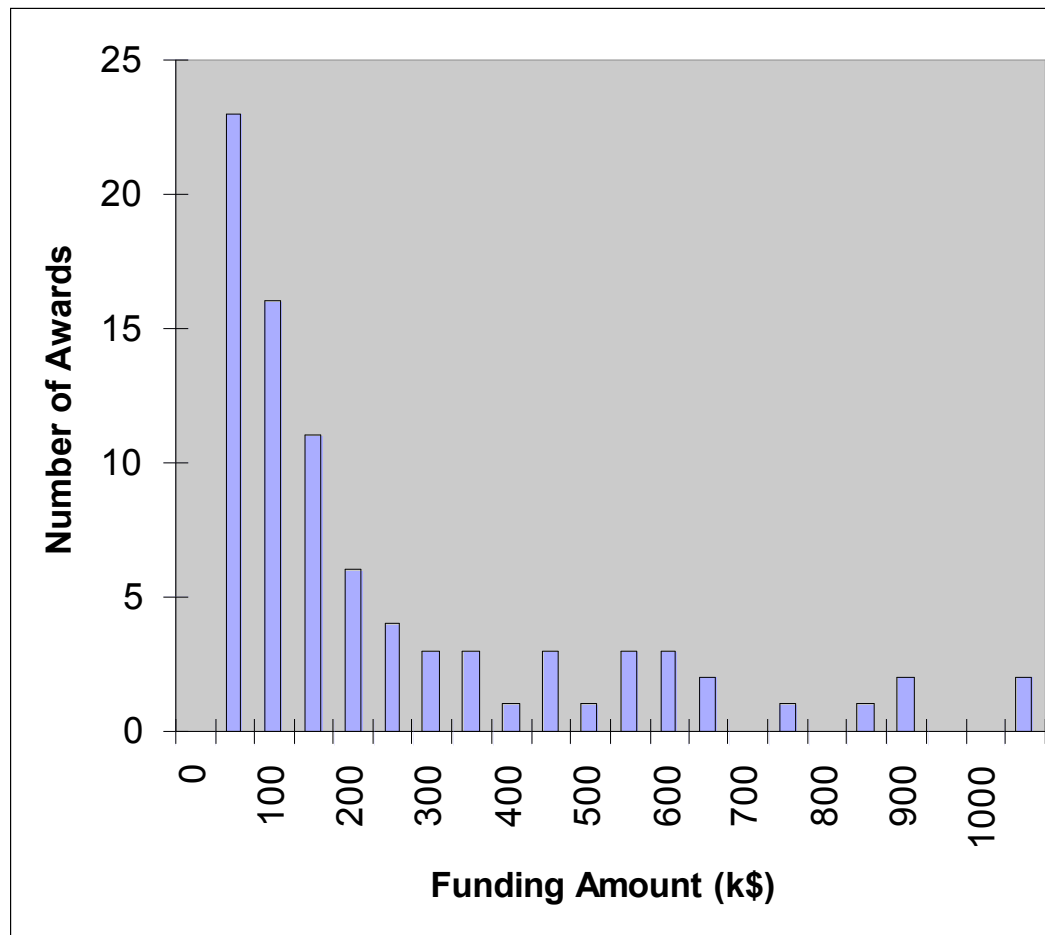


# EPP Demographic

EPP (NSF/EIS system listing)	2004	2005	2006	2007
1. Senior Personnel	101	97	107	119
2. Postdoctoral Associates	71	69	76	75
3. Other Professionals	29	27	28	19
4. Graduate Students	99	98	102	107
5. Undergraduate Students	28	26	23	26
6. Secretarial - Clerical	10	8	7	10
7. Other Personnel	16	8	7	5
Research funding	\$19.13M	\$17.35M	\$20.03M	\$19.29M
Grant Funding/Sr Personnel	\$189.4K	\$178.9K	\$187.2K	\$162.1K



# EPP FY07 Funding Actions



- **85 Total Funding Actions**
- **Mean of \$237K based on 70 actions**
- **2 Actions > \$1M**
- **13 small awards for conferences and workshops.**





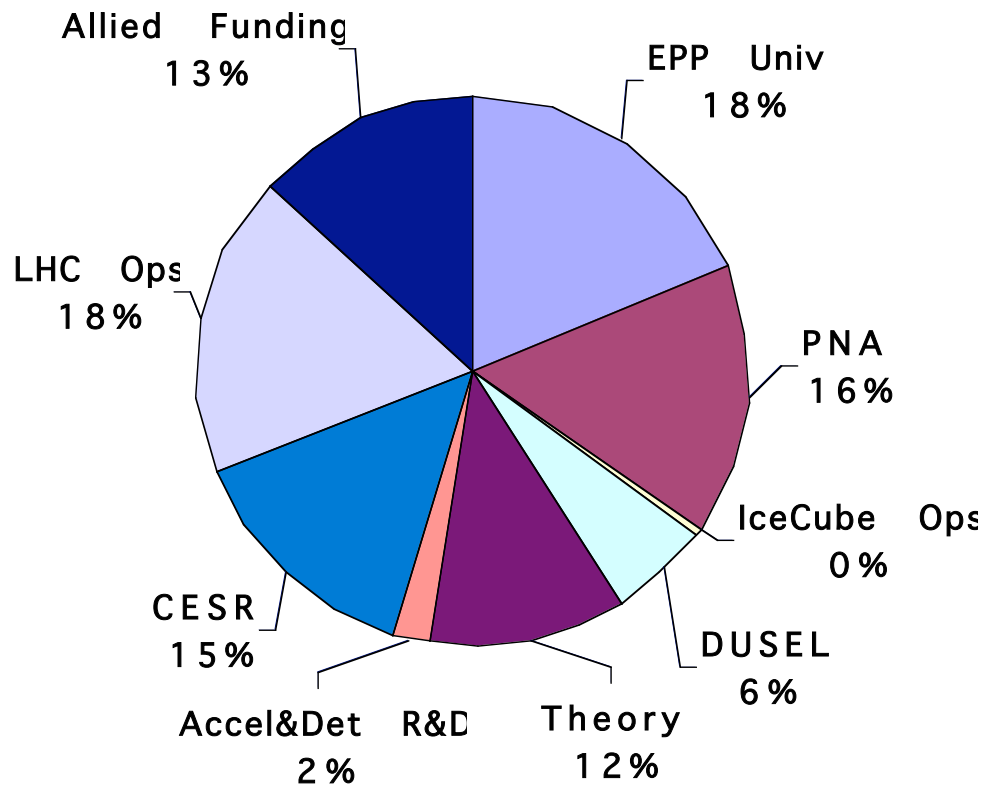
## PNA Demographic - FY07

- 40 Universities
- 73 Principal Investigators (43 FTE)
- 12 Under-represented PIs
- 7 FTE Research Scientists
- 40 FTE Postdocs
- 77 Graduate Students
- 63 Undergraduates
- Total Support = \$ 13,379,953
- \$ per PI = \$182,040; \$ per PI(FTE) = \$307,939



# EPP/PNA/Thy Funding Distribution FY07

	\$M
EPP	18.91
PNA	16.08
IceCube Ops	0.25
DUSEL	6.00
Theory	11.82
Accel & Det R&D	2.16
CESR	14.71
LHC Ops	18.00
Allied Funding	13.05
<hr/>	
<b>Total</b>	<b>100.99</b>





# Base + Allied Funding – \$ M

	FY03	FY04	FY05	FY06	FY07	FY08	FY09
<b>Base</b>							
<b>EPP</b>	25.31	19.75	18.19	19.03	18.91	20.06; Distribution To Be Determined	
<b>Accel + ILC Det R&amp;D</b>	0.29	0.34	0.78	1.55	2.16		
<b>PNA</b>	11.70	12.68	14.69	15.85	16.08	15.78	
<b>Cornell Facility</b>	19.49	18.00	16.62	14.62	14.71	13.71	8.5
<b>IceCube OPS</b>					0.25	1.50	2.15
<b>LHC OPS</b>	3.08	7.00	10.51	13.65	18.00	18.00	18.00
<b>(RSVP)/DUSEL, R&amp;D</b>	0	(6.00)	(2.65)	(0.99)	3.10	6.96	
<b>EPP+Astro/Cosmo Thy</b>	12.07	9.23	10.05	10.82	11.82	11.40	
<b>Total Base</b>	<b>71.93</b>	<b>73.00</b>	<b>73.50</b>	<b>76.24</b>	<b>85.03</b>	<b>87.40</b>	
<b>EPP Allied Funding</b>							
<b>MRI</b>	1.70	0.00	0.75	1.66	1.05		
<b>PFC</b>	4.00	5.02	5.56	5.77	5.93		
<b>OCI/CISE</b>	6.30	6.50	5.65	3.63	1.61		
<b>PIF/OMA/ESIE/OISE</b>	0.70	0.29	0.55	3.72	4.45		
<b>Total Allied</b>	<b>12.70</b>	<b>11.81</b>	<b>12.51</b>	<b>14.78</b>	<b>13.05</b>		
<b>Overall Total</b>	<b>84.63</b>	<b>84.81</b>	<b>86.01</b>	<b>91.02</b>	<b>98.07</b>		
<b>MREFC</b>							
<b>LHC construction</b>	9.69						
<b>IceCube</b>	24.54	41.75	47.62	49.85	24.38	25.91	11.33



# Planning FY09 and Beyond-1

- Continue to support university groups participating in a compelling experimental program at Fermilab.
- Strengthen University Experiment Program and Theory
  - Regional Infrastructure (UGPS Recommendation)
  - Support for small experiments (UGPS Recommendation)
- Continue a successful history of partnerships with DOE/OHEP
  - LHC: Detector Construction and LHC Operations
  - Pierre Auger, CDMS, Veritas,...
  - QuarkNet, OSG
  - CESR-TA, SRF
  - DUSEL R&D
- Continue a successful history of partnerships with DOE/NP
  - DUSEL R&D
  - CUORE



# Planning FY09 and Beyond-2

- **Possible Future Major Facilities**
  - **High Energy/Intensity Accelerator: DOE/HEP lead; PHY supporting**
    - Fermilab
    - ILC
  - **DUSEL: PHY lead; DOE/OHEP and NP supporting**
    - Long baseline neutrino experiment
    - Proton decay
    - Double beta decay



# ISSUES

- There is evidence that the field has not yet produced a viable plan for the future that is supportable, when compared to other sciences.
- We ask the community to develop a plan centered on a transformative, frontier, scientific program, including a process to craft the resources necessary to carry it out. Meanwhile, other "must do" mid-scale programmatic elements should complement this plan.



# Back Up Slides



# NSF Future Planning

- Mid-Scale Instrumentation
  - Intermediate between MRI and MREFC
  - 5 year time frame
  - Various possibilities
    - An experiment
    - Upgrades
    - Accelerator, Detector R&D, ...
    - Equipment





# Acronyms – I

AP Physics	Advanced Placement Physics (for High School Students)					
APPI	Accelerator Physics and Physics Instrumentation					
AST	Astronomy Division					
CHE	Chemistry Division					
CHEPREO	Center for High Energy Physics Research and Education Outreach					
CI-TEAM	CyberInfrastructure Training Education Advancement and Mentoring					
COV	Committee of Visitors					
CyberBridges	Grid Computing and Science Disciplines Interdisciplinary Research and Education					
DDDAS	Dynamically Data Driven Applications Systems					
DISUN	Data Intensive Science University Network (CMS Tier-2c)					
DMR	Division of Materials Research					
DMS	Division of Mathematical Sciences					
DUSEL	Deep Underground Scientific Laboratory					
EHR	Education and Human Resources Directorate					
EPP	Elementary Particle Physics					
ESIE	Elementary, Secondary and Informal Education					
GK12	Graduate Teaching Fellows in K12 Education					
GOALI	Grant Opportunities for Academic Liaison with Industry					
I2U2	Interactions in Understanding the Universe (Research and Formal and Informal Education Program)					
IPSE	Internships in Public Science Education					
Mariachi	Mixed Apparatus for Radar Investigation of Cosmic-rays of High Ionization					
MPS	Mathematical and Physical Sciences Directorate					
MREFC	Major Research Equipment and Facilities Construction					



# Acronyms – II

NA	Nuclear Astrophysics
OCI	Office of CyberInfrastructure
OISE	Office of International Science and Engineering
OMA	Office of Multidisciplinary Activities
OSG	Open Science Grid (Funded Jointly by DOE and NSF)
PA	Particle Astrophysics
PFC	Physics Frontier Centers
PHY	Physics Division
PhysTEC	Physics Teacher Education Coalition
PIF	Physics at the Information Frontier
PIRE	Partnerships for International Research and Education
PNA	Particle and Nuclear Astrophysics
QuarkNet	National Education and Outreach in Particle Physics (Funded Jointly by DOE and NSF)
R&RA	Research and Related Activities
RET	Research Experiences for Teachers
REU	Research Experiences for Undergraduates
SBE	Social, Behavioral and Economic Sciences Directorate
SBIR	Small Business Innovation Research
SGER	Small Grant for Exploratory Research
Tier 2c	Tier 2 Computing Center - DISUN (Data Intensive Science University Network)
Trillium	The trio of SCIDAC (DOE), GriPhyN (NSF/OCI), and iVDGL (NSF/PHY)
UltraLight	High Bandwidth Networking



# Programs of Interest

- MREFC: Major Research Equipment & Facilities Construction
- MRI: Major Research Instrumentation
- CI-TEAM: Cyberinfrastructure and Education
- PIF: Physics at the Information Frontier
- PIRE: Partnerships for International Research and Education
- SBIR: Small Business Innovation Research
- GOALI: Grant Opportunities for Academic Liaison with Industry
- GK12: Graduate Teaching Fellowships in K12 Education
- IPSE: Internships in Public Science Education
  
- See NSF website for opportunities
  - [www.nsf.gov](http://www.nsf.gov)