



# FUNDAMENTAL PHYSICS AT THE INTENSITY FRONTIER

HEPAP  
October 27-28, 2011  
Status & Update

*J.Hewett & H.Weerts  
SLAC & Argonne*

*Workshop co-chairs*



To: J. Hewett & H. Weerts

August 8, 2011

Particle physics is frequently characterized as addressing three frontiers in fundamental science; the energy, intensity, and cosmic frontiers. Intensity frontier experiments are those that search for new phenomena by probing rare processes or performing extremely precise measurements of known processes. The facilities that enable this program often require intense particle beams and precision detectors. Searches at the intensity frontier are complimentary to those of the other two frontiers and are part of a three-pronged experimental program that is needed to explore the quantum universe.

The Office of High Energy Physics wishes to identify the most exciting opportunities to carry out experiments on the intensity frontier for our future planning. I request that you organize a workshop to:

- identify these opportunities,
- explain what can be learned from such experiments,
- determine which experiments can be done with current facilities and technology,
- determine which experiments require new facilities or new technology to reach their full potential, and
- produce a final report documenting the results of the workshop

The workshop will be inclusive and open to as wide as possible representation from the entire field of particle physics as well as closely related fields, so that the best ideas can be identified and evaluated by a broad cross-section of the community.

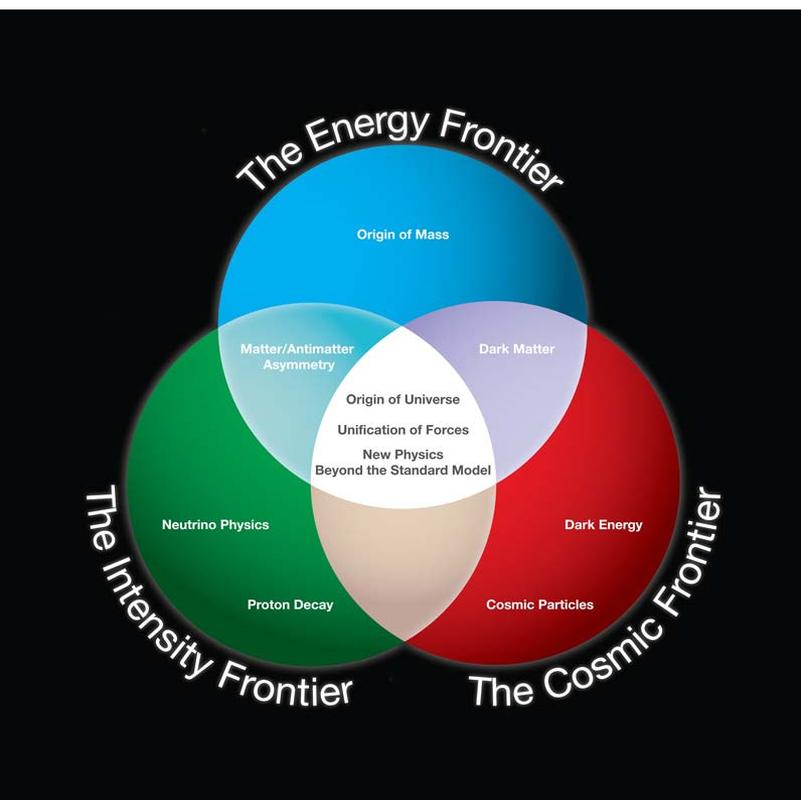
We expect the workshop to be held in the Washington, DC area later this year. We would like to receive the workshop report within 2 months of the close of the workshop. This report will be a valuable document to assist our office in developing an implementation plan that addresses the compelling science of the Intensity Frontier, and hopefully will also serve as a valuable resource and reference for the community.

## Simple goals:

1. Document ( in one coherent document) the physics /science opportunities at the Intensity Frontier.
2. Identify experiments and facilities needed for components of program
3. Demonstrate that community is interested/wants to do the Intensity Frontier physics



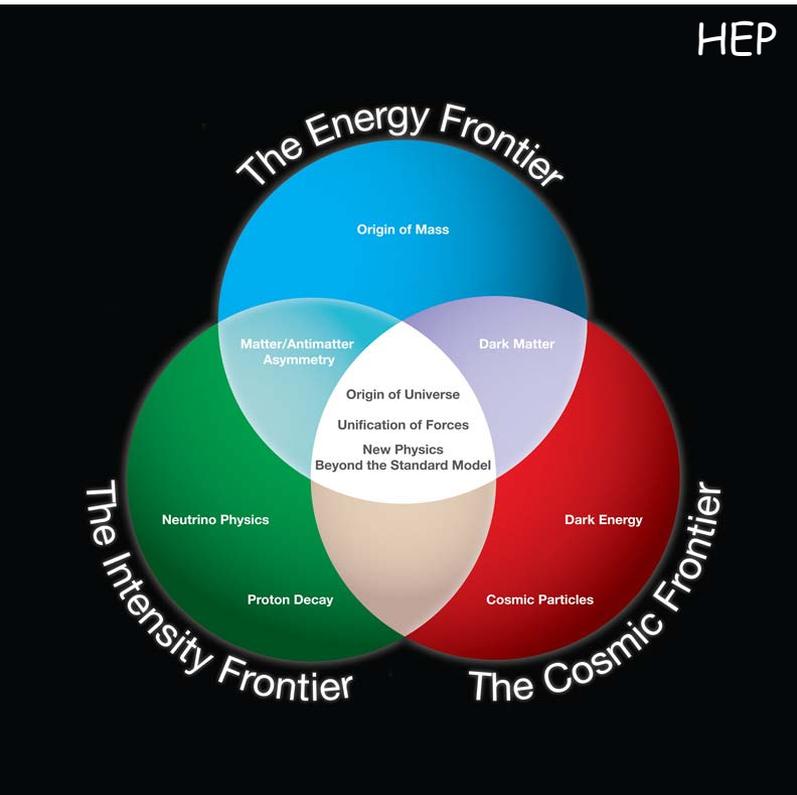
Good representation of HEP



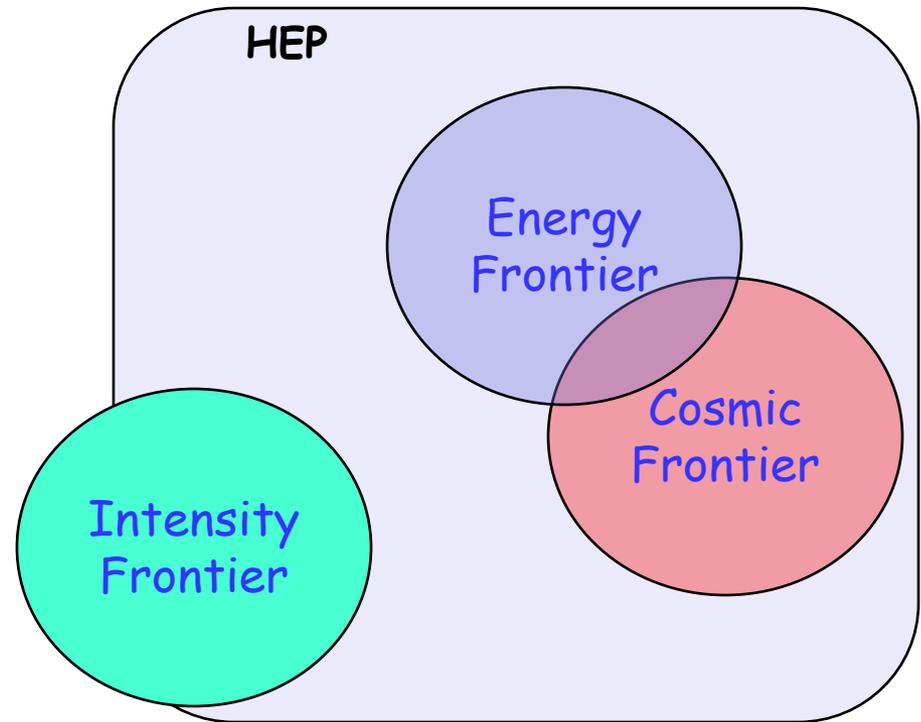
as long as they are all together



Good representation of HEP



Struggled with definition of Intensity Frontier & still are somewhat



as long as they are all together

This exercise separates Intensity Frontier, trying to define its "science"---- there are no clear boundaries in science. Also bring in Nuclear Physics.



In line with the 2008 P5 report which coined the term, we came up with the following definition for the scope of Intensity Frontier for this workshop:

"The Intensity Frontier are those experiments/facilities that measure properties of leptons and quarks with a precision that allows probing contributions from fields not present in the Standard Model .

Since nucleons, nuclei, atoms consist of leptons/quarks and if you have Standard Model predictions for them, they are automatically included. "

# Items considered & not part of workshop ( people have asked)



The SM Higgs once discovered ( or something at LHC )

Precision studies of Z boson

Studies of nucleon/nuclei structure

Example: spin structure of nucleon

Exception:  $\nu$  cross sections , A dependence etc  
Needed to study neutrinos

“Other” science & technology enabled by a facility  
that is part of the Intensity Frontier

Example: Accelerator Driven Systems (ADS)

# "The Intensity Frontier Workshop" exercise



Really:

Through working groups, meetings, workshops over October & November 2011 identify physics opportunities & needed facilities at the Intensity Frontier

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Heavy Quarks	Joel Butler, Jack Ritchie	Zoltan Ligeti	Ritchie Patterson
Charged leptons	Brendan Casey	Yuval Grossman	Aaron Roodman
Neutrinos	Sam Zeller, Kate Scholberg	Andre deGouvea	Kevin Pitts
Hidden Sector Photons & Axions	John Jaros	Rouven Essig	Juan Collar
Proton decay	Chang-Kee Jung	Carlos Wagner	Chip Brock
Nucleons /Nuclei/Atoms	Zheng-Tian Lu	Michael Ramsey- Musolf	Wick Haxton
Topic	Experiment	Theory	Observer

B-physics, with all experiments  
 Kaon physics:  $s, c$  &  $b$  quarks

Muons, taus

All experiments for properties of neutrinos. Accelerator & non-accel.

"Dark" photons, paraphotons, axions, WISPs

Proton decay

Properties of nucleons, nuclei or atoms (EDM)

fascinating & challenging

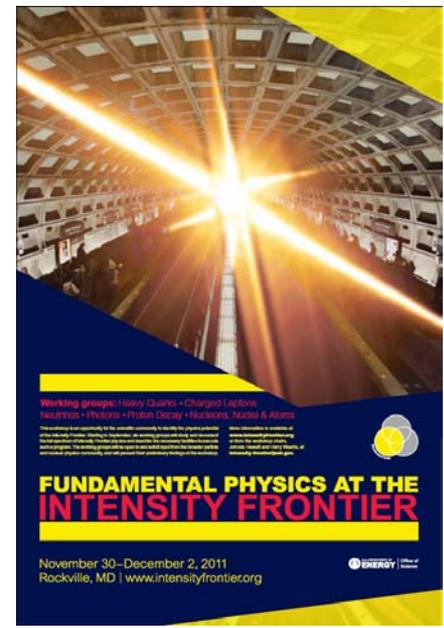
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Summarize findings, more community input & inform community at Intensity Frontier workshop: Nov 30-Dec 2, 2011, Rockville, MD



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+

**Working groups:** Heavy Quarks • Charged Leptons  
 Neutrinos • Photons • Proton Decay • Nucleons, Nuclei & Atoms

**FUNDAMENTAL PHYSICS AT THE INTENSITY FRONTIER**

November 30–December 2, 2011  
 Rockville, MD | [www.intensityfrontier.org](http://www.intensityfrontier.org)

U.S. DEPARTMENT OF ENERGY | Office of Science



Write document based on exercise plus workshop. Deliver end of January 2012.

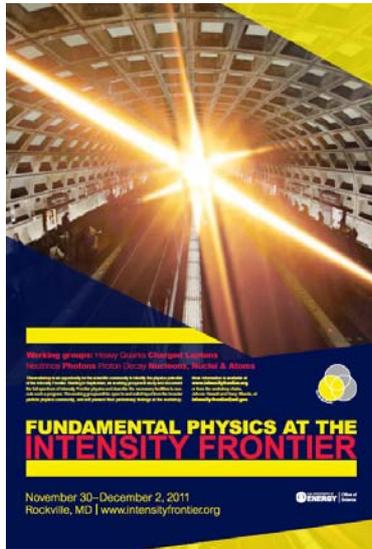
Two documents:  
 1) Technical for HEP & 2) brochure



Date	Action	
Jun 24, 2011	Chairs identified, HEPAP meeting	
July- August	Charge, identify working groups, conveners, posters, web site, etc.	20 conveners
Sept 13, 2011	First conveners meeting, every other week	Working groups start
~Sept 20, 2011	DPF & DNP Announcement out, poster, web site up	Posters sent, WEB site, registration etc.
October 24, 2011	Neutrino working group meeting at FNAL	119 register, ~100 attended
Oct 25, 2011	Meet with ~90 students/postdoc at FNAL	B.Casey & S.Zeller organized
October 26, 2011	In person meeting of conveners	
October 27, 2011	HEPAP	

All working groups are meeting, have invited/inviting speakers for the workshop, have contacted experiments/groups, requesting input, 1-2 pagers

Bi-weekly meetings of all working group conveners  
 Weekly meetings with DOE HEP ( organization, needs)



Date	Agenda	Session
Nov 30, 2011	Intro & working group status	plenary
	Working groups	parallel
Dec 1, 2011	Working groups	parallel
	Working groups	parallel
Dec 2, 2011	Key-note overview talks	plenary
	Working group summaries	plenary

Last day

Expect attendance from DOE Office of Science, not just HEP and NP plus congressional staffers, OSTP and others

Impression left by us( HEP) on that day important.



## Goals one more time:

1. Document ( in one coherent

document) the physics /science opportunities at the Intensity Frontier.

Working groups & workshop

2. Identify experiments and facilities needed for

components of program

3. Demonstrate that community is interested/wants to do the Intensity Frontier physics

Critical for success

## Demonstrate item 3

- Activities during October & November
- Community involvement in them
- Document those activities
- Others ..... suggestions ?
- 
- Registration for workshop
- Attendance at the workshop

Critical...

Today: 175

**Working groups:** Heavy Quarks • Charged Leptons  
 Neutrinos • Photons • Proton Decay • Nucleons, Nuclear & Atoms

This workshop is an opportunity for the scientific community to identify the physics potential of the Intensity Frontier. Ideally, by September, an working group will develop and document the full spectrum of Intensity Frontier physics and describe the necessary facilities to be built to reach this program. The working groups will also coordinate requests for broader particle and nuclear physics community, and will present their preliminary findings at the workshop.

More information is available at [www.intensityfrontier.org](http://www.intensityfrontier.org) or from the workshop chair, Jeffery Howell and Jerry Albert, at [intensity-frontier@slac.stanford.edu](mailto:intensity-frontier@slac.stanford.edu).

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End of presentation

We welcome HEPAP input, suggestions & feedback