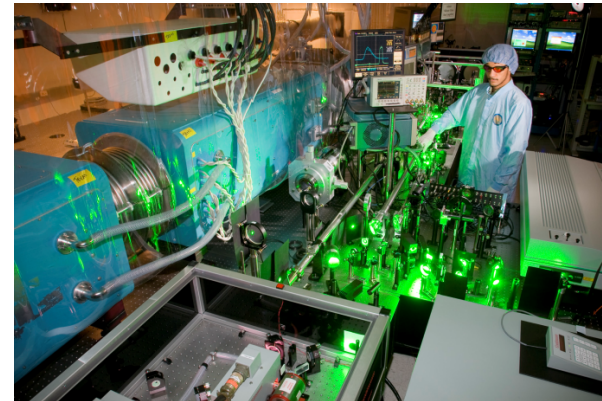
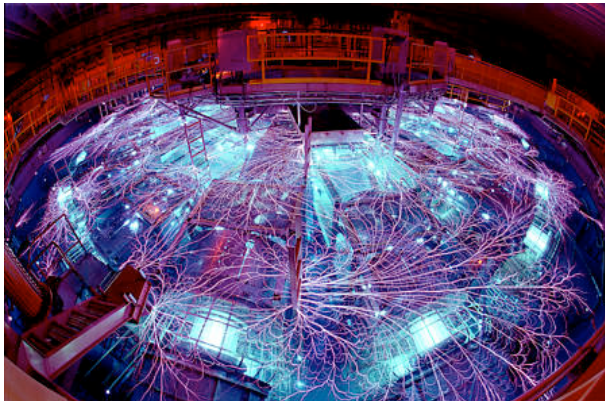


# Workshop on “Science with High-Power Lasers and Pulsed Power (#3) Research Opportunities and User Meeting”



Santa Fe Eldorado Hotel  
July 28-30, 2011

Presented by:

Alan Wootton  
University of Texas

# Introduction

- Purpose, deliverables of this meeting
- Summary of 2009 (inaugural,) 2010 workshops and consequences
  - Status of highlighted concepts
- Agenda
  - User meeting:
    - Ongoing 'user' research at the Z facilities and TX lasers
    - The facilities and their capabilities
  - Research Directions
    - Breakout sessions. Discuss
      - How to maximize the impact of our current research
      - How to grow the community and where appropriate the teams
      - New ideas
      - Infrastructure requests
  - Discussion
- Administrative information

## **The primary purpose of this meeting is to help maximize the impact of our fundamental science program**

---

A workshop to discuss fundamental science experiments that are being or about to be, or could be, undertaken on the pulsed power and laser facilities at Sandia National Laboratories (SNL) and the University of Texas (UT).

A user meeting, in which current and prospective users can present their research, and hear plans for and comment on user access, planned experiments, facility capabilities, and facility schedules.

Up to 15% of the shot time on the Z facilities is now available for fundamental science. The Texas Petawatt laser is operating and accepting ‘collaborative users’.

The workshop is being held under the auspices of the Institute for High Energy Density Science, joint between UTX and SNL.

Maximize the impact of our research, while being realistic in what can be achieved with limited shot time on these unique facilities (‘manage, maintain expectations’)

## The facilities considered are at SNL and UTX

---

At SNL: the Z accelerator with its experimental platforms, and diagnostics (including Z-Beamlet and Z-Petawatt) are available for HED science experiments. Up to 15% of Z shots will be available for fundamental science. The program is now run by Mark Herrmann of SNL.

At UTX (Austin): Texas Petawatt, THOR, GHOST. Mike Donovan is point of contact for the collaborative user program.

Information on diagnostics, facility capabilities, and plasma platforms, will be provided this afternoon.

## There are five deliverables expected from this workshop

---

- 1) A status report for each research project with allocated experimental time (astrophysics, planetary science, magnetized HED science)
- 2) A summary of how each individual research proposal will maximize the impact of the research while managing expectations (limited shots, diagnostics, etc.)
- 3) Specific ideas on how to grow our community and where appropriate the individual research teams

-----

- 4) New research directions for consideration. However we need our committed-to fundamental research to succeed, so this must have priority
- 5) Infrastructure suggestions (diagnostics, design tools, analysis tools, data access, lab space, ....). However initial focus should be on utilizing existing infrastructure

Each breakout session should prepare an informal report for Saturday morning covering the above, and a more formal report for our web page

# In two years we have progressed from first ideas to initiating experiments and preliminary data



Science with High-Power  
Lasers and Pulsed  
Power:  
Report on the inaugural workshop, Santa Fe,  
July 28 – 30, 2009

Science with High-Power  
Lasers and Pulsed Power (#2),  
Research Opportunities and  
User Meeting

Planning for External Users  
of  
Z, Z-Beamlet, Z-PW,  
and  
Texas Petawatt

Table of Contents	1
1. Introduction	2
2. Objectives	3
3. Scope	4
4. Organization	5
5. Meeting Objectives	6
6. Meeting Agenda	7
7. Meeting Objectives	8
8. Meeting Agenda	9
9. Meeting Objectives	10
10. Meeting Agenda	11
11. Meeting Objectives	12
12. Meeting Agenda	13
13. Meeting Objectives	14
14. Meeting Agenda	15
15. Meeting Objectives	16
16. Meeting Agenda	17
17. Meeting Objectives	18
18. Meeting Agenda	19
19. Meeting Objectives	20
20. Meeting Agenda	21
21. Meeting Objectives	22
22. Meeting Agenda	23
23. Meeting Objectives	24
24. Meeting Agenda	25
25. Meeting Objectives	26
26. Meeting Agenda	27
27. Meeting Objectives	28
28. Meeting Agenda	29
29. Meeting Objectives	30
30. Meeting Agenda	31
31. Meeting Objectives	32
32. Meeting Agenda	33
33. Meeting Objectives	34
34. Meeting Agenda	35
35. Meeting Objectives	36
36. Meeting Agenda	37
37. Meeting Objectives	38
38. Meeting Agenda	39
39. Meeting Objectives	40
40. Meeting Agenda	41
41. Meeting Objectives	42
42. Meeting Agenda	43
43. Meeting Objectives	44
44. Meeting Agenda	45
45. Meeting Objectives	46
46. Meeting Agenda	47
47. Meeting Objectives	48
48. Meeting Agenda	49
49. Meeting Objectives	50
50. Meeting Agenda	51
51. Meeting Objectives	52
52. Meeting Agenda	53
53. Meeting Objectives	54
54. Meeting Agenda	55
55. Meeting Objectives	56
56. Meeting Agenda	57
57. Meeting Objectives	58
58. Meeting Agenda	59
59. Meeting Objectives	60
60. Meeting Agenda	61
61. Meeting Objectives	62
62. Meeting Agenda	63
63. Meeting Objectives	64
64. Meeting Agenda	65
65. Meeting Objectives	66
66. Meeting Agenda	67
67. Meeting Objectives	68
68. Meeting Agenda	69
69. Meeting Objectives	70
70. Meeting Agenda	71
71. Meeting Objectives	72
72. Meeting Agenda	73
73. Meeting Objectives	74
74. Meeting Agenda	75
75. Meeting Objectives	76
76. Meeting Agenda	77
77. Meeting Objectives	78
78. Meeting Agenda	79
79. Meeting Objectives	80
80. Meeting Agenda	81
81. Meeting Objectives	82
82. Meeting Agenda	83
83. Meeting Objectives	84
84. Meeting Agenda	85
85. Meeting Objectives	86
86. Meeting Agenda	87
87. Meeting Objectives	88
88. Meeting Agenda	89
89. Meeting Objectives	90
90. Meeting Agenda	91
91. Meeting Objectives	92
92. Meeting Agenda	93
93. Meeting Objectives	94
94. Meeting Agenda	95
95. Meeting Objectives	96
96. Meeting Agenda	97
97. Meeting Objectives	98
98. Meeting Agenda	99
99. Meeting Objectives	100



Call for Proposals Package for the T1 Facility  
Fundamental Science Experiments for the Petawatt  
August 1, 2011 - December 31, 2011

Submission Deadline: September 15, 2011  
Review Period: January 10, 2012

Point of Contact: Dr. Robert W. Eason  
Address: T1 Science Directorate  
Sandia National Laboratories  
PO Box 5800  
Livermore, CA 94550-5800  
Phone: (925) 286-1234  
Email: rweason@sandia.gov



**2009:** The first workshop considered research directions, defined four research areas (astro, planetary, magnetized HED, particles and beams) with 10 ideas.

**2010:** The second workshop was both a research directions and a user meeting. Within the four areas, eight specific research proposals were initiated. Additional diagnostics, capabilities and infrastructure were suggested.

Proposals were submitted to the HEDLP Joint program.

A draft document planning for users was developed.

At SNL: A call for proposals to utilize the Z facilities for fundamental science was published.

**2011:** At SNL, received proposals were reviewed, and time has been allocated.

At UTX: Collaborative user experiments allocated time on the TX PW laser.

We plan to continue the research directions and user meeting, and calls for proposals, with staggered project starts to maintain continuity

# Agenda, Thursday July 28

---

- Session 1a: User experiments: status at Z. Chaired by Alan Wootton (UTX)
  - White dwarf work status: Don Winget (UTX)
  - Opacity work: Anil Pradham (Ohio St)
  - Solar opacity work status: Jim Bailey (SNL)
  - Photo-ionized plasma work status: Roberto Mancini (UNR)
  - Black hole accretion disk status: Duane Liedahl (SNL)
  - Giant Planets: far out, close in, and deep inside: Nadine Nettelmann (U. Rostock)
  - Earth core work status: Stein Jacobsen (Harvard)
- Session 1b: User experiments: status at UT. Chaired by Mike Donovan (UTX)
  - Solid Target Experiments on the Texas Laser Facilities: Kramer Akli and Mike Storm (Ohio St)
  - Cluster fusion work status: Gilliss Dyer (UTX)
  - Wakefield acceleration work status: Xiaoming Wang (UTX)
  - Antimatter work status: Edison Liang (Rice)
- Session 2: Facility access, facility status. Chaired by Briggs Atherton (SNL)
  - Z diagnostics and plasma platforms: Greg Rochau (SNL)
  - UT user capabilities: Mike Donovan (UTX)

# Agenda, Friday July 29 (breakout groups) and Saturday July 30

---

## Friday July 29:

3.1) Magnetized HED Science, chaired by Dan Sinars (SNL,) in Pinon Room (2<sup>nd</sup> floor)

3.2) Planetary Science, chaired by Thomas Mattsson (SNL), in Chaparral Room (3<sup>rd</sup> floor)

3.3) Astrophysics, chaired by Don Winget (UTX) and Jim Bailey (SNL), in Sunset Room (here)

Spare room for any other group that self-organizes: Turquoise Room (4<sup>th</sup> floor)

**Sat July 30:** Sunset room (here)

Out-brief from panel chairs (Dan Sinars, Thomas Mattsson, Jim Bailey)

General discussion



## Administrative Details

---

Meeting Room Assignments (also listed on your printed materials):

Plenary Sessions: Sunset

Parallel Breakouts Sessions (Friday all day):

Astrophysics: Sunset (here)

Planetary: Chaparral Room, third floor

Magnetized HED: Pinon room, second floor

Spare: Turquoise, fourth floor

**(You cannot work in the break-out rooms past 6 pm)**

Note start times: Thursday & Friday breakfast 7:30 – 8:30, start time 8:30; Saturday breakfast 8:00 – 9:00 am, start time 9:00 am

Schedule changes:

Today: Please hand in presentations to me at the break before your presentation  
We will ask for cc of the presentations, to post on the web page

Maria: [maria.aguirre@mail.utexas.edu](mailto:maria.aguirre@mail.utexas.edu)

Cari: [cagerlo@sandia.gov](mailto:cagerlo@sandia.gov) (505) 417-2398

# Back up slides

# Research areas and topics from workshops #1 and #2

Science area	research topic	Ongoing research	New idea	Community
Radiative astrophysics	White dwarf photospheres	Lab (Z) spectral properties in H	Study (in Z) He, C. Add B fields. Lower temperatures	Add: postdoc at Z, spectroscopist, line theorist
	Accretion-powered objects	Test spectral models used to infer driving radiation and absorption in active galactic nuclei	Test and improve spectral synthesis models associated with accretion disks around black holes	Need PI. Add: postdoc, student at Z; improve links to astro community
	Stellar opacities	Fe opacity in sun's convection zone	Mid-Z opacities	Add: postdoc at Z; additional theoretical effort
Particles and beams	Proton beams	Deflectometry diagnostic development	Distinguish roles of different electron acceleration models, including multi-pass through target	Add: more theoretical effort
	Electron beams	Wakefield acceleration		
Magnetized high energy density science	Hydrodynamic, magnetized jets	At MAGPIE, GenASIS, x-pinch	Z -> higher dimensionless numbers (Reynolds), resolution, density (all for turbulence studies). X-pinch-> B -> pulsars?	Consider possibility of LANL National High Field Lab, others
	Boundary effects	x-pinch	Higher current at Z; two-fluid modeling	
	Cluster fusion	no B field	With 100 T (energy transport)	
	Kelvin-Helmholtz instability			
	Reconnection		In non-ideal warm dense matter -> better diagnostics	
Planetary science	Earths and super-earths		EOS up to 400 GPa and 5000 K in Fe and alloys with impurities -> a) Earth now, understanding dynamo generation, b) Earth then, understanding moon formation	Grow teams, embrace geographic diversity
	gas and ice giants here and out there		High-precision EOS and density for H, H <sub>2</sub> O above 100 GPa and 5000 K. Study mixtures and phase stability	

Table 1. The topics discussed at breakout sessions

# Diagnostic and capability suggestions from workshops #1 and #2

	radiative astrophysics	particles and beams	magnetized high energy density	planetary science
DIAGNOSTICS				
optical Thomson scattering (n, T)	x		x	
x-ray Thomson scattering (n, T)	x		x	x
laser interferometer (n)	x	x		
high sensitivity spectroscopy (emission spectra)	x			
proton beam deflectometry (B)		x	x	
pyrometry				x
proton radiography (n)	x			
high intensity backlighters spectrometer 0.5-1 keV	x			
improved single-shot laser characterization		x		
laser Compton scattering		x		
Stark shift (B)		x		
CAPABILITIES				
filled gas cells on top of x-ray source (higher photoionization parameter)	x			
cells with hazardous gasses	x			
thinner windows on cells	x			
longer duration x-ray drives (for equilibrium conditions)	x			
x-pinch geometry			x	

Table 2. Diagnostic and other capabilities requested

## Infrastructure suggestions from workshops #1 and #2

1) Providing better infrastructure for visitors (offices, network, computing, 'phone, project meeting rooms/collaborative environment)
2) Developing a well-defined process for machine-time application
3) List of diagnostics: past, present and future
4) A Calculator” for simulating existing diagnostics and predicting experiment outcomes – similar to what is available for space and ground based observatory instruments
5) A POC, but from a hardware perspective: – someone who knows all the hardware, what is available and where it is and who to talk to