POTENTIAL FOR COLLABORATION*
ON THE SUPERCONDUCTING SUPER COLLIDER

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ABSTRACT

The viewgraphs on the following pages comprise a presentation to the L₃/L* collaboration as a basis for Livermore's participation. First we give an overview of the Laboratory mission, budget, and staff. Next, some illustrative examples of laser fusion, laser isotope, and beam research/magnetic fusion are shown. Finally, we show a few cases of current research that is relevant to high energy physics.

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MASTER

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Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory

- **Founded in 1952 by E. O. Lawrence**
- **Run by the University of California for the Department of Energy**
- **Mission is large scale applied science focused on defense, energy, and environment**
- **Current approximate Lab employment level of 8300 full time equivalents**
- **Operating budget \$1.0 billion in FY 1990**

Laboratory costs by major program

(\$ in millions)

	FY 1989 Actual	FY 1990 Estimate
Nuclear Weapons RD&T	\$315.6	\$304.8
Inertial Confinement Fusion	64.6	70.0
Verification & Control	24.1	25.5
Other DOE Defense	6.4	9.1
Special Isotope Separation	68.5	59.4
Advanced Isotope Separation	94.9	101.5
Magnetic Fusion	29.4	25.3
National MFE Computer Center	31.9	34.0
Energy Research	29.0	25.2
Biomedical & Environmental	12.2	13.1
Basic Energy Science	9.6	10.8
Environmental Restoration	11.3	17.3
Total DOE Direct	697.5	696.0
Other DOE Organizations	41.9	42.4
Total DOE Operating	739.4	738.4
Non - DOE [FEL]	213.9 [39.5]	216.3 [15.0]
Total Laboratory Operating	953.3	954.7
Construction/Equipment	102.3	125.1
Total Laboratory	\$1,055.6	\$1,079.8

LLNL manpower history

Lawrence Livermore National Laboratory

Date: September 22, 1980
 Contributor: Regents of the University of California
 Contract: No. W-7400-eng-48
 Type of Contract: Research

John H. Nuckolls
 John H. Nuckolls, Director

LLNL staff profile

Staff/Education	MS			Total
	PhD	BS/AA	None	
Scientists and Engineers	1250	1810	59	3119
Physicists	686	214	4	904
Chemists and Material Scientists	181	125	4	310
Biomed and Environmental Scientists	49	67	1	117
Mathematicians/Computer Scientists	65	504	16	585
Engineers	269	900	34	1203
Technical and Crafts	2	1210	2033	3245
Administrative and Clerical	33	716	1379	2128
Total Laboratory	1285	3736	3471	8492

Excludes: Part-time, summer hires and temporary program participants.

Joint US/USSR verification test

Nova System

Laser isotope separation is building toward plant-scale demonstrations

Uranium AVLIS

- Enrichment demonstration planned for FY91/92
- Plant deployment 1995-97
- Teamed with Martin Marietta Energy Systems

Special isotope separation

- Performance verification series planned for FY89
- Plant operations start scheduled for 1994
- Teamed with Westinghouse

- B-490 laboratory addition planned for FY89 start
- B-332/335 installation nearing completion

FEL Program has demonstrated high gain at 10 μ m in the PALADIN wiggler

PALADIN wiggler

10- μ m laser beam profiles

Microwave Tokamak Experiment (MTX)

Experimental Test Accelerator II

We are developing innovative technology for space systems; commercial applications will result

Wide angle
satellite tracker

Laser pantography;
3D circuit fabrication
& integration

Very high speed integrated circuits
Laser pantographically hybridized
and space qualified

Miniature star tracker

LLNL Activities with Relevance to L*

- Nuclear and particle physics
- Neutrino mass from tritium β decay
- Pegasys - quark propagation in nuclei
- RHIC - relativistic heavy ion collisions and the quark gluon plasma
- ITER - international cooperation on a thermonuclear experimental reactor
- MFTF - basis for an interesting L* prototype testing facility?
- Innovative technology for space systems
- Computing at LLNL

TRITIUM β -DECAY NEUTRINO MASS

EXPERIMENT USING A FROZEN TRITIUM SOURCE

Investigators:

Brian Balke

Lawrence Cox

Orrin Fackler

Marshall Mugge

Objective:

To determine the electron neutrino mass to within a few electron volts by measuring the shape of the tritium β -decay spectrum near the end-point using a high-resolution electrostatic spectrometer. Employing a frozen tritium source reduces molecular and solid-state effects on the measured neutrino mass to less than 1 eV.

Tritium beta decay spectrometer for neutrino mass experiment

(Angle view)

(End view)

(In situ)

(In situ)

Magnet shield surrounding vacuum vessel

End view

Grid fabrication

Toroidal - field spectrometer

PEGASYS

(PEP GASjet-Spectrometer SYStem)

Collaborating Institutions

American University

CERN

Jagellonian University (Cracow)

Florida State University

Georgetown University

Lawrence Livermore National Laboratory

University of Maryland

University of Massachusetts

Ohio University

University of Pennsylvania

Purdue University

Rensselaer Polytechnic Institute

University of Rochester

SLAC

Stanford University

Tel Aviv University

University of Virginia

University of Washington

Schematic of the PEGASYS internal target proposed for Stanford's PEP electron ring

Top view

International Thermonuclear Experimental Reactor

ITER International Design Team

LLNL computational capacity

← LCC six supercomputers

Four Cray 1's
One Cray X-MP/48
One Cray X-MP/416
(2500 users)
One Cray Y-MP/832
(Feb. 1989)

NMFECC four supercomputers →

One Cray 1
One Cray X-MP/22
Two Cray 2's
(4000 users)

Plans at LLNL

- LCC plans to acquire a Y/MP in 1988 and a Cray 3 as soon as they are available. The Cray 3 decision is driven primarily by price-performance and size of memory. LCC will also release two 1 MWord Cray-i's.
- NMFEC also plans to get a Cray 3, but will acquire an interim Cray 2 this year. We plan to release the two Cray-1's and hope to end up with an all Cray-2,3 center by 1991. Large memory is a major decision issue.
- LANL will acquire two Y/MP machines later this year and then release four Cray-1's and two X/MP's. They are interested in a Cray 3 in 1990.

Center \ Year	84	85	86	87	88	89	90	Capacity
LCC	8	10	10	15	15	28	61	in
NMFEC	5	10	10	10	15	15	50	
LANL	13	18	22	27	26	39	80	C1E's

Energy Sciences Network 1990

SERVICE AVAILABLE 1990

LLNL Massively Parallel Computing Initiative

- **Three-year project from Physics Department funded from Director's IRD**
- **Test applicability of this approach for a broad spectrum of LLNL activities**
- **Hardware - 128 processors each with ~ Cray-1S equivalence with adequate communications**
- **Staff - approximately 11 FTE's from LLNL and visiting university participants**
- **L* - possible testing of new generation of simulation techniques (built on GEANT and maybe try to couple to engineering CAD/CAM capabilities)**

- END -

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