

# Report on the JSA Initiatives Fund Program Project Workshop on Science at Jefferson Lab's Low Energy Recirculator Facility (LERF)

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## Introduction

The Low Energy Recirculator Facility (LERF) at Jefferson Lab, which houses an Energy Recovery Linac and 7 User Labs, provides excellent opportunities for fundamental and applied science research as well as education and training. The equipment at LERF falls into two broad categories: the accelerator in a radiation shielded vault, and well-equipped User Labs which can be employed independently of the accelerator. The User Labs house state-of-the-art equipment for Pulsed Laser Deposition, Micro-Machining, XHV vacuum work, laser-generated TeraHertz with associated instrumentation, and pulsed fiber laser development.

The goal of this workshop was to inform researchers and educators of opportunities at the LERF facility, and explore its research and educational potential. The workshop was expected to indicate a path to continued realization of LERF's potential.

The Workshop summary, including links to the participant list and program, was published at <https://www.jlab.org/conferences/LERF-march17/>

## Workshop Organization

The one day "Workshop on Science at LERF" took place at Jefferson Lab on March 17, 2017. The workshop was organized into several topical sessions dealing with science using the LERF beam, and science possible with the LERF lab equipment. A tour of the ODU ARC and LERF labs was organized for workshop participants, and a panel discussion concluded the workshop proceedings. There were 11 formal invited presentations. The workshop scientific program and presentations are available at (<https://www.jlab.org/indico/event/199/>).

The organizing committee consisted of:

- C. Sukenik (ODU)
- M. Kelley (W&M and Jefferson Lab)
- G. Krafft (Jefferson Lab and ODU)
- S. Benson (Jefferson Lab)
- H. Areti (Jefferson Lab)
- H. El-sayed Ali (ODU)
- D. Wells (NMT)
- R. Milner (MIT)

The workshop attracted 51 registered participants from Jefferson Lab, NASA, and nearby universities. This attendance considerably exceeded initial expectations. The workshop was moved to a larger room in order to accommodate the meeting.

## Budget

Allocated funds from the JSA Initiatives Fund Program (\$1900 granted) were used as follows:

1. Partially support the travel expenses of one invited speaker:  
BREYERTON, Eric, Virginia Diodes, Inc., Charlottesville, VA: Hotel Charge of \$138.94
2. Break Period Refreshments: \$470.45
3. Funded the Bus transportation for the ODU/ARC and LERF Tour: \$583.00

Only \$1192.39 of the JSA Initiatives grant was needed because the number of claims for travel expenses was much smaller than expectations. Several of the workshop participants, and one invited talk presenter attended the following DARKLIGHT collaboration workshop on their university travel funding.

The workshop organizers are thankful to Bob McKeown for the Jefferson Lab directorate support of the workshop used for the workshop working lunch.

## Workshop Summary

The workshop started off with presentations from Bob McKeown, the deputy director of Jefferson Lab and the Lead Physicist of the lab, describing the lab and how outside projects are carried out at Jefferson Lab. The details for a Work for Others program will be slightly different and some of the procedures will have to be developed, but the safety and resources management for the experiments must be done the same as all other experiments. George Neil next gave a historical perspective of the LERF with a quick description of how the User Labs are managed.

We then had several talks about potential uses of the LERF for nuclear physics, isotope production, and positron production. All these applications would use the accelerator downstairs in the facility. The LERF compliments CEBAF as a nuclear physics accelerator by providing low energy beam at high current. With an internal target one can, in principle, preserve the beam quality well enough to allow energy recovery. When operated as a single pass device for isotope or positron production, the accelerator can provide over 100 kW of beam power to a target. Since the beam is also very bright and has a very small energy spread it can be used for a very bright positron source.

In the second session of the workshop Steve Benson presented a description of the research equipment available in the user labs and a description of how they might be used by outside researchers, including contact information for each of the user labs. This was followed by tours of the User Labs, the vault (by those who were interested in only using the accelerator), and the ODU research labs at the ARC building. Some of the ODU inventory is state-of-the-art-level equipment.

The third session concentrated on user experiments in the User Labs that did not necessarily use the FEL. Eric Bryerton described potential uses of THz radiation. And Michael Kelley and Kevin Jordan gave nice summaries of how they used the LERF User Labs to carry out user programs in nanotubes and Materials Research. Finally, Hani Elsayed-Ali followed up Steve Benson's talk with a description of equipment available in the ODU labs at the ARC and how they might be used. The session was closed out by Shukui Zhang's presentation of possible laser applications that might be developed in the LERF. They range from THz production, to production of electron beams with angular momentum, to next-generation photocathode drive lasers.

The last and most important session was the Panel Discussion on science at LERF User Labs and ODU facilities. The panel members were: Michael Kelly (College of W&M/JLAB , Branslav Vlahovic (North Carolina Central University), Lawrence Forsley(NASA-Glenn Research Center). The session started with some of the problems with getting funding for the facility. It was pointed out that many groups used the LERF as a place to test out ideas. Once the ideas were tested out the groups left and developed the applications elsewhere. One good suggestion was that NIST might be a good source for nuclear data experiments, especially those requiring great precision or luminosity. An unexpected addition was from Virginia Diodes, who expressed an interest in using the Laser MicroEngineering Station (LMES) to develop very tiny but precise waveguides for THz devices. We will follow up on this with Virginia Diodes. Bratislav Vlahovic from NCCU pointed out that there is a very strong need for bright low energy positron sources and it would not be hard to get them to buy time at a positron use facility. When the NCCU positron proposal was discussed previously it was pointed out that the science case was weak but that, otherwise, it was a reasonable proposal. With a good science case, the proposal might be funded. Dr. Vlahovic agreed to help put together a proposal for a Scientific users of low energy positrons to make the science case for the facility. This would be submitted to DOE NP to see if the idea is reasonable. It was also pointed out that there is a positron workshop at Jefferson Lab this September at which low energy positron use will be discussed (among many other topics).



## Workshop on Science at LERF

Friday, March 17, 2017

Jefferson Lab • Newport News, VA