Operational results of 'seeded' free-electron laser facility highlighted in study

September 25 2012

Two Colorado State University faculty members are featured in this month's *Nature Photonics* journal for their role in helping to create a really stable and short-wavelength light source with laser-like properties that will help improve everything from medical equipment to the environment.

Sandra Biedron and Stephen Milton, both in CSU's Department of Electrical and Computer Engineering, are co-authors of a paper detailing the first operational results of the world's first soft X-ray, fully coherent and stable free-electron laser (FEL) user facility produced by using electrons near the speed of light. The FERMI@Elettra FEL is located at the Sincrotrone Trieste laboratory in Basovizza, Italy.

This next-generation synchrotron light source, a "seeded" free-electron laser, produces very clean - coherent in both the transverse and longitudinal planes - and stable - minimal intensity fluctuations - light.

In a recent article also in Nature Photonics, colleagues Z. Huang and I. Lindau from the Department of Energy Laboratory, SLAC National Accelerator Laboratory, described the FERMI@Elettra FEL in the following way, "This year, the FERMI FEL in Trieste, Italy, will open up for user operation…FERMI is the first short-wavelength FEL facility to employ seeding to overcome the large bandwidth and spiky spectrum of self-amplified spontaneous emission. Seeding to even shorter wavelengths becomes increasingly challenging and is one of the most active areas of research and development in the field…."

Biedron and Milton have spent the last 12 years collaborating with the FERMI@Elettra team to help make the facility a success at Sincrotrone Trieste. They first became involved with the project while they worked at Argonne National Laboratory and in early 2007, they joined the project more formally – Milton served as the project director of the $200 million endeavor and Biedron served as a key technology and management consultant for the project.

Now, from Colorado State, they work as collaborators with their colleague at the University of Twente in the Netherlands on the next seeding schemes for the FERMI@Elettra FEL. This new scheme should enable the FEL to reach even shorter wavelengths. They also continue with their collaboration with the FERMI@elettra team on RF devices for diagnostics and other coherent light source schemes.

"I am thrilled to see the FERMI@Elettra facility in operation for users after our dedicated team carefully designed, planned, built, and commissioned this extraordinary device over the last years," Milton said. "It is a true feat."

Added Biedron, who also helped coordinate and lead the technical collaborations between the many contributors to the project, "It is amazing to see the efforts of the dedicated Sincrotrone Trieste team and its collaborators from Italy, the EU, North America, and Australia result in such a stable, right, and useful light source – it is just beautiful seeing the machine perform."

More information: The details on the Elettra third-generation light source and the newest source – FERMI@Elettra can be found at www.elettra.trieste.it/
Details on the paper (PDF) can be found at: www.nature.com/nphoton/index.html

Provided by Colorado State University