# Project XFEL

2010 marked the 50th anniversary of the laser, which was invented to emit visible light at a wavelength of 694.3 nm. An interesting coincidence is that 2010 should also be remembered for the inauguration of user operations of LCLS, the first hard X-ray laser (at around 0.15 nm wavelength), at the SLAC national laboratory in the US. The X-ray lasers do not use any laser materials to amplify the X-rays, but use only free electrons with relativistic energy in a vacuum as radiating materials. Thus, these lasers are called X-ray Free Electron Lasers (XFELs). The scientific impact of the XFEL is so great that the supply of the beam time at the LCLS is far less than the demand from scientists around the world. It is now widely recognized that the few existing XFELs around the world are not enough to fulfill the demands of the frontier sciences and technologies. Scientists all over the world are waiting for the debut of our XFEL.

Another interesting coincidence is that 2010 is the final year of our XFEL construction project. We saw the completion of the Experimental Building in May, followed by the construction of radiation shields for end-stations as well as the assembly of X-ray optics including total reflection mirrors and a double-crystal monochromator. A building where both XFEL and SPring-8 beams intersect at the sample position will be completed by the end of March 2010. The intersection of the two beams enables both XFEL pump and SPring-8 probe type measurements, which enhances the synergy between XFEL and SPring-8. We started the RF aging process in October and finally started electron beam commissioning in February 2011. We are certain that we will observe lasing in the near future.

The concept of 'Compact SASE Source' originated by us is now widely recognized. This basically combines a high-gradient linac and a shorter period undulator. Several new XFEL projects have been proposed following our scheme, including initiatives in Switzerland, Korea and China.

The prototype EUV-FEL, known as SCSS, has been operated for users at around 60 nm wavelength. Several interesting and important experiments using the SCSS have already been carried out. In particular, we have achieved, for the first time in the world, the seeding operation with higher harmonics of the conventional laser. By seeding, temporal coherence of the FEL is greatly improved as compared with the SASE method. We are designing seeding schemes for shorter wavelength FELs.

Last but not least, we again encourage and invite completely new ideas for using the unique capabilities of our XFEL, which is located adjacent to the world's brightest synchrotron radiation source, SPring-8.

We are pleased to announce our XFEL, named SACLA, has reached SASE lasing in June, 2011.

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SPRING-8 COMPACT SASE SOURCE PROJECT
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