EVOLUTION OF FELS OVER THE LAST 34 YEARS

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Abstract

The concept of the free electron laser (FEL) started 34 years ago with Madey's 1972 paper. The basic mechanism which employs a beam of free electrons to amplify co-propagating light has remained essentially the same as further developments have demonstrated high peak power, high average power, high gain, optical guiding, continuous tunability and reliability. FELs have operated at wavelengths from the far infrared, infrared, visible and down to the ultraviolet. The realization of high gain has lead to the generation of soft x-rays and soon hard x-rays where there are no mirrors. About a hundred FELs and user facilities are distributed around the world, and in many ways the FEL has become a "perfect" source of coherent electromagnetic radiation. FELs are in encyclopedias, in laser textbooks, with several textbooks specifically on FELs, and have clarified several physical principles for stimulated emission and laser physics. Today a Google search on "free electron lasers" produces nearly 13 million hits. The accomplishments during this time have been many, but none so important as establishing a community. Prospects for future directions are also briefly considered.