

Current Status and Future Prospects of High-Power Free Electron Lasers

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Free electron lasers (FEL) have, at least, the following advantages in comparison to conventional lasers:

- FEL can be designed for any arbitrary given emission wavelength.
- It is continuously tunable within wide band.
- Easy to get single-mode emission.
- Easily controlled emission structure (pulse duration, repetition rate, and pulse energy).
- Possible to obtain extremely high average power (> 1 MW).

On the other hand, their drawbacks are:

- They are extremely complicated and expensive machines.
- Comparably low pulse energy.
- Difficult to get high monochromaticity.
- Almost impossible to get extremely short (femtosecond duration) pulses.

Thus one can conclude that only high-power FEL can be competitive in comparison to conventional lasers, as its drawbacks are not so significant in this case, while the advantages remain. Basic principles, existing projects (especially high-power ones), technical problems, and possible applications of FEL are presented.