

## Integrated free-electron laser schemes

Eli Jerby

Faculty of Engineering, Tel Aviv University, Ramat Aviv 69978, Israel

The *integrated-FEL* concept is proposed as an alternative approach for the *discrete* compact-FELs [1]. In the proposed integrated-FEL, the accelerator and the wiggler are integrated for the sake of compaction. Two examples of integrated-FEL schemes are presented here briefly in order to demonstrate the *FEL-integration* concept:

a) A *functional integration* scheme is shown in fig. 1. Two electron beams are sharing the same wiggler in this integrated-FEL scheme. A low-energy electron beam (e.b.1) undergoes a microtron-oscillator interaction and produces high-power microwave radiation. This power is fed to the rf linac which accelerates another electron beam (e.b.2) to a relativistic energy. The high-energy e.b.2 is injected to the same wiggler and interacts with much shorter wavelength than e.b.1, probably in the infrared regime. A considerable overhead reduction in this integrated-FEL system could be the elimination of the external rf-source for the linac.

b) A *volume integration* is demonstrated in fig. 2. This integrated-FEL scheme combines a microtron accelerator and a circular wiggler [2]. The electron beam is accelerated as in a microtron, but in its outer arc it is subjected to a circular wiggler field. The wiggling elec-

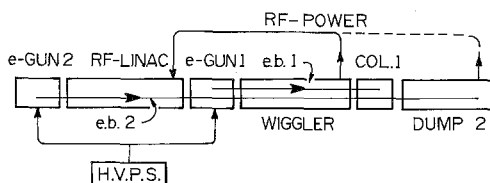


Fig. 1. A linear integrated-FEL scheme.

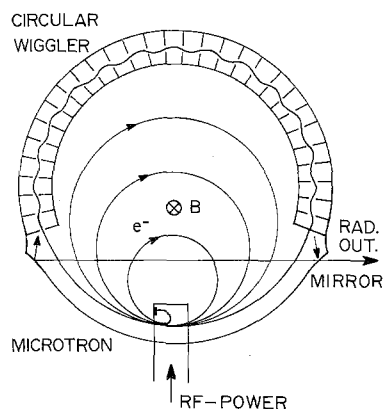


Fig. 2. A circular integrated-FEL scheme.

trons interact with whispering gallery modes supported by the concave wall [3]. If proved, an equilibrium steady-state operation as in the storage-ring FEL could be an interesting feature of this scheme. An advantage of this integrated-FEL could be its relatively small size.

### References

- [1] J.C. Goldstein et al., Nucl. Instr. and Meth. A296 (1990) 282.
- [2] G. Bekefi, Appl. Phys. Lett. 40 (1982) 578; see also T. Mizuno et al., Nucl. Instr. and Meth. A318 (1992) 749, and references therein.
- [3] H. Yamada et al., Photon-storage ring project, Digest 13th Int. Free Electron Laser Conf., Santa-Fe, New Mexico, 1991.