A PROPOSAL FOR A LINAC BASED SASE-FEL SOURCE OPERATING IN THE VUV-X REGION

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Linac based FREE Electron Laser (FEL) sources seem to be ideally suited candidates as fourth generation sources of synchrotron radiation. They are indeed able of providing a dramatic increase in brightness (10 orders of magnitude) with respect to the third generation sources. The reasons of such an enhancement are due to the improvements of electron beam quality and associated brightness and to the intrinsic FEL mechanism ensuring amplification of the background (spontaneous) radiation of 8 orders of magnitude.

The electron beam quality improvements are essentially associated with the possibility of exploiting photocathode injectors yielding normalized emittances on the order of 1-2 mm.mrad, values unconceivable for Storage Ring accelerators.

We shortly review the existing and proposed sources and discuss how the obtained experimental results confirm the expected design and theoretical predictions.

Within such a context we discuss in detail the SPARX FEL project, which is aimed at realizing a FEL based synchrotron radiation source in Italy as a joint effort of CNR, ENEA, INFN and second university of Rome at Tor Vergata.

The final goal of the project is that of providing a coherent source operating up to Å region, with peak brightness of the order of 10^{31} standard units.

The project is conceived as evolutive and will exploit a Linac capable of providing a relative energy spread below 0,1%, an emittance of the order of 0,1 mm.mrad, a peak current of the order of 1-2 kA and e-beam bunch duration of ps.

The first part of the project envisages the construction of the Linac with $E_{MAX} \sim$ 2 GeV, with phocathode injector and bunch compressor systems, to obtain the e-beam brightness necessary for the operation of the laser and two undulators to have radiation in the region of 13 nm and 1 nm. Extended tunability is guaranteed by the possibility of exploiting the higher harmonics coherent emission mechanism.

We discuss different technical solutions associated with the demands from the users with particular reference to the technological solutions for the Linac realization (super or normal conducting).

We present some considerations on the time table of the project and discuss the conditions under which the final part of the project (upgrade of the Linac up to 10 GeV and operation in the Å region) can be realized.