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Some personal perspectives on future directions for short wavelength FELs

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Free-electron lasers have left their childhood and now entered their second quarter century of life. With the outstanding successes of FLASH, LCLS, SACLA, and the promising initial results of FERMI here in Trieste, it is appropriate to look forward to the next decade of free-electron laser progress. While much of the activities in the past decade have concentrated on making short duration (e.g. 10-200 fs pulses), high peak power (1-20 GW) pulses in the XUV to hard x-ray regime, I believe it likely that FEL and their accelerator colleagues will be able to control in much finer detail the longitudinal phase spaces (i.e., wavelength and time dimensions) of coherent FEL emission. Trains of phase-locked pulses down to the sub-fs regime, time-dependent spectral and polarization manipulation, multi-discrete wavelength output (e.g., temporally synchronized THz and soft x-ray pulses), and the use of undulator tapering to increase the peak power are some of the many distinct possibilities that may come to pass in the not so distant future. This talk will take a brief look at many of these areas and some of the necessary developments in accelerator, external seed laser, and FEL technology to bring them to fruition.