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## Ponderomotive laser lens for beam phase space control

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Slice and normalized emittances are the critical parameters that dictate the efficiency of SASE FEL mechanism and advanced FEL lasing schemes. The control of the emittance has been notoriously difficult and requires substantial efforts to transport a high-brightness electron beam from the cathode to the undulator. In this communication, we introduce the concept of a ponderomotive laser lens that imprints a time-dependent linear and/or nonlinear correlation into the transverse phase space of the electron beam. The laser lens is based on the ponderomotive force created by the gradient of a laser field. The slice emittance can be reduced by correcting undesired nonlinear correlations in the transverse phase space. Advanced linear emittance compensation can also be implemented using a dedicated temporal profile of the ponderomotive laser lens. The SACLA injector is used as a theoretical study case to demonstrate capabilities of the proposed ponderomotive laser lens.

### Footnotes

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