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Numerical Modeling of Relativistic Harmonic Structure from Plasma Mirrors: Insights into Relativistic Plasma Dynamics[1] NICHOLAS FASANO, JULIA MIKHAILOVA, Princeton University — Specular reflection of intense lasers from relativistic plasma mirrors produces a source of high-power, broad bandwidth radiation which, in addition to being a useful secondary light source for probing electron dynamics, encodes the information of the complex plasma dynamics that takes place during extreme light-matter interactions. The appearance of harmonic peaks in the reflected spectrum can be explained as a result of periodically spaced attosecond pulses emitted once every laser cycle. For multi-cycle laser pulses, cycle-to-cycle emission times of attosecond pulses varies due to evolving laser and plasma parameters. In this work, we use particle-in-cell simulations to relate the temporal spacing of attosecond pulses to different observed harmonic structure, including harmonic broadening, harmonic splitting, and the appearance of integer and half-integer harmonics. We demonstrate how a small amount of temporal chirp applied to the driving laser can compensate for the non-periodic emission time of attosecond pulses which results in narrower, more intense individual harmonics. The results of this work provides insight into the rapidly evolving plasma dynamics of intense laser-solid interactions and how these dynamics are encoded in the reflected radiation.

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