Stable, polarized betatron radiation and applications

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Betatron oscillations in laser-plasma accelerators lead to the emission of synchrotron-like X-rays with femtosecond duration. While the sources' properties are potentially interesting for many applications, the important shot-to-shot fluctuations of flux, beam-profile and energy have hindered its success.

In this talk, we present recent results on the reliable production of betatron radiation with tunable polarization. Using ionization-induced injection in a gas mixture, the orbits of the relativistic electrons emitting the radiation are reproducible and controlled. We observe that both the signal and beam profile fluctuations are significantly reduced and that the beam pointing varies by less than a tenth of the beam divergence. The polarization ratio reaches 80 percent, and the polarization axis can be easily rotated. Using the source, we present first applications in ultrafast X-ray absorption spectroscopy and give an outlook on other potential applications.

References

[1] A. Döpp et al. Stable femtosecond X-rays with tunable polarization from a laser-driven accelerator. *Light: Science & Applications* accepted article preview 12 May 2017; doi:10.1038/lsa.2017.86