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Type: talk

Light Sail Acceleration of Ultra-Thin Foils

Wednesday, 27 September 2017 16:20 (20 minutes)

The talk will present results of recent experiments using the GEMINI laser at the Rutherford Appleton Laboratory investigating the acceleration of ions from ultrathin carbon foils (2-100nm). The laser delivered ~8J (after two plasma mirrors) on target in a 30fs ($\lambda = 800\text{nm}$) pulse providing an intensity of approximately $6 \times 10^{20} \text{Wcm}^{-2}$.

In this interaction regime, it is known that laser polarization can play an important role in determining the dynamics of the laser-target coupling and of the ion acceleration process. In particular, the use of circular polarization (controlled by a quarter-wave plate) can significantly reduce electron heating, helping to preserve the opacity of the foils during the irradiation. This is key to accessing acceleration regimes where the laser radiation pressure is the dominant mechanism, such as the so-called Light Sail process.

Our results highlight a strong dependence of the maximum ion energies on laser polarization, with circular polarisation leading to the highest values ($>25\text{MeV/nucleon}$) for carbon and contaminant protons. For targets thinner than 20nm, circular polarisation produced energies over double that of linear polarisation. This is consistent with the onset of Light Sail acceleration, also indicated by Particle in Cell simulations.

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