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Hot Electron Jets from a Relativistic Laser Interaction with Wavelength-Scale Rods

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Over the past decade, many experiments showed that interactions of relativistic laser pulses with targets whose geometrical features are comparable to the laser wavelength can result in increased energy coupling between the laser field and the target electrons.

Several different models were suggested to explain this phenomenon. However, unveiling the details of these interactions through parametric studies was so-far hindered by stringent requirements on laser contrast, the need for sophisticated targets, and the realization of an efficient way to deliver targets to the focus of the laser.

I will present our results on the interaction of relativistic laser pulses with free-standing micrometric gold rods varying from smaller- to larger-than the laser wavelength. Hot electrons were found to be emitted in two jets of MeV electrons with an opening angle of a few degrees that depends on the rod's lateral extent. Particle-in-cell simulations show that hot electrons are generated via a 3 step process that extends the well-established Brunel model for vacuum acceleration.

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