High field ultrafast laser driven electron accelerator and novel radiation light source

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High field ultrafast laser pulse can instantaneously generate intense electromagnetic fields at a very small scale of focus, in which microscale region it is expected to generate compact electron accelerators and new radiation sources. Here we present a principle of quasi particle coherent radiation amplification using a free electron pumping. When an ultrafast laser focus on a metal wire waveguide, the excited electron pulse pumps surface plasmon polaritons and achieves coherent amplification, which is observed by the ultrafast optical pump-probe method. Using this quasiparticle source with natural surface modes, we have demonstrated a new method of waveguide-coupled terahertz electron acceleration with electron energy gain exceeding MeV at an acceleration distance of 5 mm within the waveguide. The electrons locked phase with laser are crucial for the direct acceleration and pulse control of electrons. We propose a scheme to generate attosecond electron pulse (~260 as) from solid surface under relativistic laser field.

Short Bio:

Ye Tian is Professor of Chinese Academy of Sciences, Shanghai Institute of Optics and Fine Mechanics. His research interests include high field laser and plasmas interaction, ultrafast phenomenon, terahertz generation and acceleration, compact electron and quasiparticle radiation source.