國內教授汪治平（Jyhpyng Wang）尖端課題介紹與腦力激盪時間

Ultrafast Lasers and High-field Physics

超快雷射與強場物理

綱要:

超短脈衝雷射和寬頻雷射放大器的新發展，使得物理學者能夠在實驗室中產生極為強大的電磁脈衝，其瞬間電場強度高達 10^{13} V/m，對應的光壓高達 10^{9} 大氣壓，照度相當於地表日照的 10^{20} 倍。如此強大的電磁脈衝，已將實驗物理推到新的境界。例如將電子在微米的尺度內加速到接近光速，或在小範圍內將質子加速撞擊原子核以產生核融合反應，或產生高熱電漿來製作X光雷射，甚至於以電子所受到的強大加速度（地表的 10^{23} 倍）來模擬黑洞附近的物理。這類實驗需要極為準確的系統控制和精巧的測量技術，深具開創性和挑戰性，不但能影響基礎物理，也有很高的應用價值，是值得年輕學子投入的研究領域。

With the development of ultrashort pulse lasers and broad-band laser amplifiers, now physicists can generate extremely intense optical pulses in the laboratory. The peak electric field in the pulses is as large as 10^{13} V/m, with the corresponding optical pressure as large as 10^{9} atm and the corresponding intensity reaching 10^{20} times of sunlight on the earth surface. Such strong optical pulses have pushed the frontier of experimental physics. For instance, one can accelerate electrons to near the speed of light in the micrometer length scale, or accelerate protons locally to collide with nuclei for fusion, or generate transient high-temperature plasma to make soft X-ray lasers, or even simulate the physics near a black-hole by putting electrons in an accelerated frame with acceleration 10^{22} times larger than the gravity on the earth surface. Such experiments require precision control of the laser waveform as well as ingenious measurement techniques to meet the challenge of exploration. With its high impact in fundamental physics and great promises in application, I think this is an exciting field for the new generation of young physicists.