Advancing Pulse Compression beyond Exawatts by Plasma Photonics

MinSup Hur
Physics Dept. UNIST

Abstract

If you are riding on a bike basking in the gentle September sunlight, it's worth acknowledging the role of plasma in providing such a delightful moment. When you find yourself reading a book under the soft glow of a fluorescent lamp, you are benefiting from the principles of plasma physics. Surprisingly, many of our sources of light stem from plasmas—exotic but violent states of matter comprised of randomly moving ionized particles, that is, electrons, and ions. But can you believe that such a spoiled state of matter can be surprisingly useful as an optical device? When we think of optics or photonics, our minds often draw the images of mirrors and lenses constructed from solid matter. It might seem counterintuitive that something as chaotic and elusive as broken-down gas can be remarkably useful in manipulation of intense light, especially laser beams. In this presentation, I will introduce several intriguing techniques of plasma photonics for harnessing ultraintense light using the plasma. The paramount of the plasma photonics is the pulse compression. Commencing with the briefing of chirped-pulse-amplification (CPA) technique for which the 2018 Nobel Physics Prize was awarded to G. Mourou, I will present the vision and advantages of utilizing plasma to push the boundaries of the conventional CPA technique and its potential use for advanced study.