Induced Compton Scattering in a Laser Produced Plasma

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Induced Compton scattering (ICS) in a plasma is investigated. The ICS may play important roles in the Universe when high power radio emissions of pulsars, quasars and other objects interact with the surrounding tenuous plasmas [1]. When high energy electromagnetic radiations ($h\vartheta \gg m_e c^2$) encounter an electron, which is initially at rest, the electron will acquire energy and scatter electromagnetic radiations with a certain angle [2]. This interaction involves the energy transfer from electromagnetic radiation to the electron [3, 4]. The energy transfer by ICS is more effective for the high brightness temperature as we expect in astrophysical circumstances [4]. As a consequence, the spectrum of the scattered light will change. The ICS in various conditions of radiation and electron have been studied in Refs. [1, 4, 5]. The numerical study showed the evolution of photon spectra by ICS intermittently forms solitary structures moving toward lower frequency [4]. We perform an experiment to study these effects by using 100 TW laser facility of NCU. We model the astrophysical circumstances by replacing electromagnetic radiations with a short-intense laser pulse with a power of $10^{18}\,\mathrm{W/cm^2}$ and pulse duration of 50 fs. We use hydrogen gas jet to provide the plasma. A spectrometer with the detection range of 200-1100 nm is employed to collect the scattered signals of ICS. The spectrum of the scattered light is investigated.

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