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Stimulation of Nonlinear Optical Effects in Vacuum by Increasing Lorentz Invariants[1] YUICHIRO MONDEN, RYOSUKE KODAMA, Graduate School of Engineering, Osaka University — In a regime of nonlinear quantum electrodynamics, vacuum becomes a nonlinear optical medium in strong electromagnetic fields due to the polarization generated by virtual electron-positron pairs. We have investigated nonlinear optical effects in vacuum induced by ultra-intense laser beam theoretically. Nonlinear polarization in vacuum is calculated by the use of the effective Lagrangian density presented by Heisenberg, Euler and Schwinger, and the representation of polarization contains Lorentz Invariants. As a result of calculations, it is found that lower f-number focusing optics enhances nonlinear polarization and the photon number generated by the interaction between vacuum and laser field. This result shows that fast focusing optics dramatically decreases the laser intensity to detect the nonlinear optical properties of vacuum.

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