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Doppler Effect on Structure Period of Nonlinear Laser Lithography OZGUN YAVUZ, SEMIH KARA, ONUR TOKEL, IHOR PAVLOV, FATIH OMER ILDAY, Bilkent University — Recently, Nonlinear Laser Lithography (NLL) was developed for large-area, nanopatterning of surfaces [1]. In NLL, nanopatterns emerge through coherent scattering of the laser from the surface, and its interference with the incident beam. The period of the structures is determined by the laser wavelength. It has been shown by Sipe that the period depends on the laser incidence angle (θ) as $\lambda/(1 \pm sin\theta)$ [2]. Here, we show that the period not only depends on this angle, but also on the polarisation angle. We update the Sipe equation as $\lambda/(1 \pm sin\theta sin\alpha)$, where '$\alpha$' is the angle between scanning direction and polarisation. The physical reason behind this is found through a formal analogy to Doppler effect. In Doppler effect, the measured wavelength of a moving emitter is given as $\lambda/(1 \pm c/vsin\theta)$, where '$\theta$'is the angle between observer and the direction of emitter, 'c' is the speed of observer, 'v' is speed of source. In NLL, velocity of source can be written as $vsin\theta$, and the period equation can be shown to take its new form. We believe that this is the first application of Doppler effect in laser-processing of solid materials.[1]Nature Photonics,7,897(2013). [2]Physical Review B,27,1141(1982).

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