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Laser Radiation Pressure and Shock Acceleration of Quasi-Monoenergetic Protons in Thin Gas Target MIN-QING HE, XI SHAO, CHUAN-SHENG LIU, TUNG-CHANG LIU, JAO-JANG SU, GALINA DUDNIKOVA, ROALD SAGDEEV, University of Maryland, College Park, Maryland,USA, ZHENG-MING SHENG, Shanghai Jiao Tong University, Shanghai, PRC
— Recently, there have been increased interests in CO2 laser acceleration of hydrogen gas target for energetic proton generation. We present a scheme of laser thin gas target acceleration for quasi-monoenergetic proton generation. The scheme uses gas target of thickness about several laser wavelengths with spatial density distribution of square-sine shape. In the simulation, a compressed electron/ion layer is formed with enhanced density peak within a region of sub-wavelength scale. The acceleration of proton is a combination of radiation pressure and shock acceleration. During the radiation pressure acceleration of the compressed layer, the protons behind the shock front are also accelerated by the shock electric field. With normalized laser amplitude ~ 5, target thickness $= 2.5\lambda$ and peak density $20\mathrm{n}_c$, the proton energy reaches $\sim$15 MeV. We also analyzed the dependence of laser gas target acceleration on the target thickness, density profile and the incident laser energy.

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