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Laser Acceleration of Protons Using Multi-Ion Plasma Gaseous Targets and Its Medical Implications[1] XI SHAO, TUNG-CHANG LIU, CHUAN-SHENG LIU, University of Maryland, College Park, BENGT ELIASSON, Strathclyde University, WENDELL HILL, University of Maryland, College Park, JYHPYNG WANG, Academia Sinica, SHIH-HUNG CHEN, National Central University — We present an acceleration scheme by applying a combination of laser radiation pressure and shielded Coulomb repulsion in laser acceleration of protons in multi-species gaseous targets. By using a circularly polarized CO_2 laser pulse with a wavelength of 10 μm, the critical density is significantly reduced, and a high-pressure gaseous target can be used to achieve an overdense plasma. This gives us a larger degree of freedom in selecting the foil compounds or mixtures, as well as their density and thickness profiles. An 80 MeV quasi-monoenergetic proton beam can be generated using a half-sine shaped laser beam with peak power 70 TW and pulse duration of 150 wave periods. We compared the effects of modifying the thickness and density of the gaseous targets and showed that the compression of the gaseous target affects significantly in the quasi-monoenergetic property of the proton beams. To assess the feasibility of laser-proton cancer therapy with such a proton accelerator, simulations are carried out to model the interaction of protons with water and determine the depth and lateral dose distribution for particle beams produced from PIC simulation. Comparison between the dosage maps of the proton beams produced with different foil densities and thicknesses is also presented.

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