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**Direct ion acceleration with variable-frequency lasers** FABIO PEANO, JORGE VIEIRA, RICARDO FONSECA, LUIS SILVA, GoLP/CFP, Instituto Superior Tecnico, Lisboa, Portugal, GIANNI COPPA, ROBERTA MULAS, Politecnico di Torino, Italy — Laser-based ion acceleration commonly relies on indirect schemes, in which the ions are accelerated by the space-charge field in laser-irradiated solid targets, either via plasma-expansion processes [1], or resorting to electrostatic shock structures [2]. Here, we propose the production of monoergetic ion beams via direct acceleration by the laser field (in vacuum or in tenuous plasmas) [3]. The method exploits two counterpropagating lasers with variable frequency to drive a beat-wave structure with variable phase velocity: the ions are trapped in the beat wave and accelerated to high energies. The physical mechanism is described with a 1D theory, providing the general conditions for trapping and scaling laws for the relevant ion-beam features. The validity and the robustness of the method are confirmed by 2D PIC simulations with OSIRIS [4].

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