Compact laser acceleration of particles for oncological applications

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The proton beam therapy of cancer has been practiced to yield good therapeutic results. However, it remains a costly treatment, primarily because of its huge accelerator facility needed to drive proton beams. The introduction of laser acceleration promises to greatly reduce the size and possible cost to accelerate and provide a medically needed system for therapy. Not only its compact acceleration section, but also its compactness of necessary radiation shield and beam handling section (a portion similar to the gantry) contribute to the compactness of the overall therapy machine size. A series of innovations such as the adiabatic acceleration, double-layer target, the optimized target thickness, etc. constitutes to provide a new paradigm of laser-driven compact therapy. We envision that the verification of dosage with the self-auto-activation by PET combined with pencil-beam scanning characteristics amounts to a new feedback therapy of cancer.