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Radiation Pressure Acceleration of Ions

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Radiation Pressure Acceleration is a regime of laser-driven ion acceleration in which masses of plasma are accelerated by the photon pressure of the laser pulse. For small areal masses and ultra-high intensities ($> 10^{21}\mathrm{Wcm}^{-2}$) this should permit one to reach ion energies on the order of 100 MeV per nucleon. Since a whole mass of plasma is accelerated as a "light sail" the energy distribution is quasi-monoenergetic. Such an acceleration scheme has very strong prospects for a number of applications. We will briefly review the early theoretical work that we carried out into this scheme, and the modelling of initial experiments, however we will mainly concentrate on new ideas that may achieve much better results without having to resort to much more powerful lasers. Specifically we propose a new way to generate low areal mass targets (including pure hydrogen targets) using existing HEDP techniques. These low areal mass targets may be able to produce 100 MeV proton beams with relatively modest laser parameters.