

PLASMA AS A UNIQUE MEDIUM
FOR THE PERSPECTIVE HIGH-GRADIENT
ACCELERATION OF CHARGED PARTICLES

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S u m m a r y

The recent results in the worldwide development of advanced methods of acceleration of charged particles, in which plasma plays the unique role as a high-gradient accelerating medium, are presented. The wakefield intensity of about 100 GeV/m excited in plasma by a ultrashort terawatt-petawatt laser pulse or a high-charge relativistic electron bunch has been experimentally achieved. A laser-driven wakefield accelerator of an energy of above 1 GeV at centimeter-lengths and a beam-driven wakefield accelerator doubling the energy of a 42-GeV electron bunch at a meter-length have been demonstrated. Such new facet of plasma as an accelerator structure illuminates prospects of building the colliders in the TeV-energy range with acceptable size and cost for high-energy physics and compact advanced tabletop accelerators based on T^3 lasers for the creation of bright sources of light and γ -ray radiation and applications in nano-material science, chemistry, biology, medicine, and industry.