**Particle Beam Weapon**

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A particle beam is a stream of [charged](http://en.wikipedia.org/wiki/Charged_particle) or [neutral particles](http://en.wikipedia.org/wiki/Neutral_particle) (often moving at very near the [speed of light](http://en.wikipedia.org/wiki/Speed_of_light)) which may be directed by [magnets](http://en.wikipedia.org/wiki/Magnets) and focused by [electrostatic lenses](http://en.wikipedia.org/wiki/Electrostatic_lens), although they may also be self-focusing (see [Pinch](http://en.wikipedia.org/wiki/Pinch_(plasma_physics))).

Subatomic particles such as [electrons](http://en.wikipedia.org/wiki/Electron), [positrons](http://en.wikipedia.org/wiki/Positron), and [protons](http://en.wikipedia.org/wiki/Proton) can be accelerated to high velocities and energies, usually expressed in terms of [center-of-mass energy](http://en.wikipedia.org/w/index.php?title=Center-of-mass_energy&action=edit&redlink=1), by machines that impart energy to the particles in small stages, ultimately achieving very high energy particle beams, measured in terms of billions and even trillions of [electron volts](http://en.wikipedia.org/wiki/Electronvolt). Thus, in terms of their scale, particles can be made to perform as powerful missiles for bombarding other particles in a target substance or for colliding with each other as they assume intersecting orbits.

High energy beams are created in [particle accelerators](http://en.wikipedia.org/wiki/Particle_accelerator), in which a charged particle is drawn forward by an electrostatic (not magnetic) field with a charge opposite to the particle (like charges repel one another, opposites attract); as the particle passes the source of each field, the charge of the field is reversed so that the particle is now pushed on to another field source. Through a series of fields in sequence, the particle accelerates until it is moving at a high speed. A natural analogy to particle beams is [lightning](http://en.wikipedia.org/wiki/Lightning), where electrons flow from negatively charged clouds to positively charged clouds or the earth.

Low and medium energy beams are quite common. Traditional [cathode-ray tube](http://en.wikipedia.org/wiki/Cathode-ray_tube) televisions and computer displays use them to scan out each image, and some [radiation therapy](http://en.wikipedia.org/wiki/Radiation_therapy) methods use them to treat cancer.

**Particle beams as weapons**

Though particle beams are perhaps most famously employed as weapon systems in [science fiction](http://en.wikipedia.org/wiki/Science_fiction), the U.S. [Advanced Research Projects Agency](http://en.wikipedia.org/wiki/Defense_Advanced_Research_Projects_Agency) started work on [particle beam weapons](http://en.wikipedia.org/wiki/Particle_beam_weapon) as early as 1958[[1]](http://en.wikipedia.org/wiki/Particle_beam#cite_note-roberds84-0#cite_note-roberds84-0) , two years before the first scientific demonstration of [lasers](http://en.wikipedia.org/wiki/Laser). The general idea of particle-beam weaponry is to hit a target object with a stream of accelerated particles moving at near the speed of light and therefore carrying tremendous [kinetic energy](http://en.wikipedia.org/wiki/Kinetic_energy); the particles transfer their kinetic energy to the atoms in the molecules of the target upon striking, much as a cue ball transfers its energy to the racked balls in [billiards](http://en.wikipedia.org/wiki/Billiards), thus exciting the target's atoms and superheating the target object in a short time, leading to explosion either of the surface layer or the interior of the target. Currently, the materials for such weapons are "high-risk" and may not be developed for some time.

The power needed to project a high-powered beam of this kind surpasses the production capabilities of any standard battlefield powerplant, thus such weapons are not anticipated to be produced in the foreseeable future. Particle beams could possibly be used from fixed locations, or in space, for example as part of the [Strategic Defense Initiative](http://en.wikipedia.org/wiki/Strategic_Defense_Initiative) (dubbed "Star Wars") or similar initiatives, but the problems related to power source still stand at present, pending future development in that field.

**See also**

* [Beamline](http://en.wikipedia.org/wiki/Beamline)
* [Charged particle beam](http://en.wikipedia.org/wiki/Charged_particle_beam)
* [Electron beam](http://en.wikipedia.org/wiki/Electron_beam)
* [Ion beam](http://en.wikipedia.org/wiki/Ion_beam)
* [Linear particle accelerator](http://en.wikipedia.org/wiki/Linear_particle_accelerator)
* [Microbeam](http://en.wikipedia.org/wiki/Microbeam)
* [Particle accelerator](http://en.wikipedia.org/wiki/Particle_accelerator)
* [Directed-energy weapon](http://en.wikipedia.org/wiki/Directed-energy_weapon)
* [Large Hadron Collider](http://en.wikipedia.org/wiki/Large_Hadron_Collider)

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This page was last modified on 20 November 2010 at 18:39.