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Encyclopedia micro-array traps for storing electrons or positrons – A first step towards antimatter as a source of energy

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Antimatter is the ideal medium for storing energy per mass. Upon annihilation with matter, 100% of the mass is converted to energy. Positron-electron annihilations result in only energetic photons which could be used for propulsion or conventional energy production. Of the three key challenges: Creation of antimatter, conversion to energy, and confinement of large quantities for long times, the latter is paramount for this idea to work. Squeezing like charged particles to high densities requires forces that exceed technical capabilities. An experiment aimed at alleviation of this space-charge challenge is discussed. Rather than storing all charged particles in a single trap of large magnetic and electric fields, an array of micro-traps is used. It features high length-to-diameter aspect ratios and metallic walls. Image potentials in the walls effectively make charges in one micro-trap invisible to charges in any other trap. The electric potential required for axial confinement can be lowered by many orders of magnitude. Ultimately, it is expected to store on the order of 100 billion positrons in 20000 micro-traps in a 50 mm diameter by 100 mm length cylindrical volume. To date, tests with electrons are performed. Confinement up to 1 second has been achieved for a partial trap. The progress and future direction of the experiment will be discussed along with potential uses other than energy storage.

Biography

Marc H Weber completed his PhD in 1989 on positrons (antiparticles of electrons) interacting with single crystal surfaces from City College of the City University of New York. He is a Research Professor at Washington State University and has worked on positron in atomic physics, high energy physics and materials science.

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