Towards Table-top Particle Accelerators

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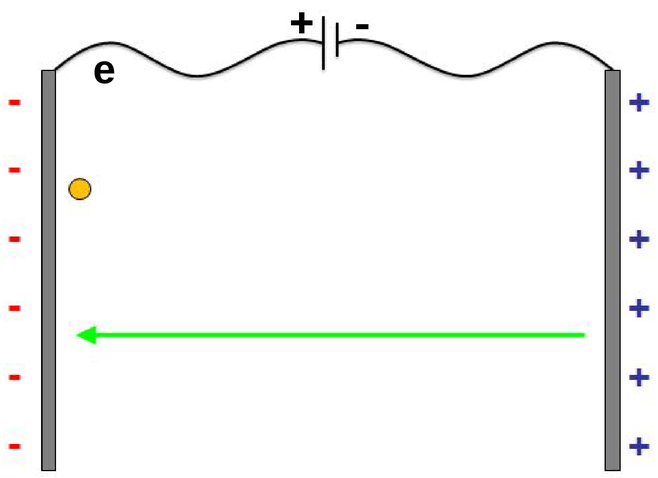
Motivation

- Modern particle accelerators measure up to several kilometres in size and cost billions of euros. The limitations of modern particle accelerators are set by the metal which can be damaged if the electric field is too strong;
- Dielectric material can withstand electric fields that are one hundred times stronger than those found in metals, together with the large optical field strength achievable with short laser pulse, so the accelerating force can be increased a hundredfold, which reduces the size of particle accelerator to several meters long;
- Dielectric laser accelerators (DLA s) are strong potential candidates for future table-top particle accelerators, which are much cheaper and smaller.

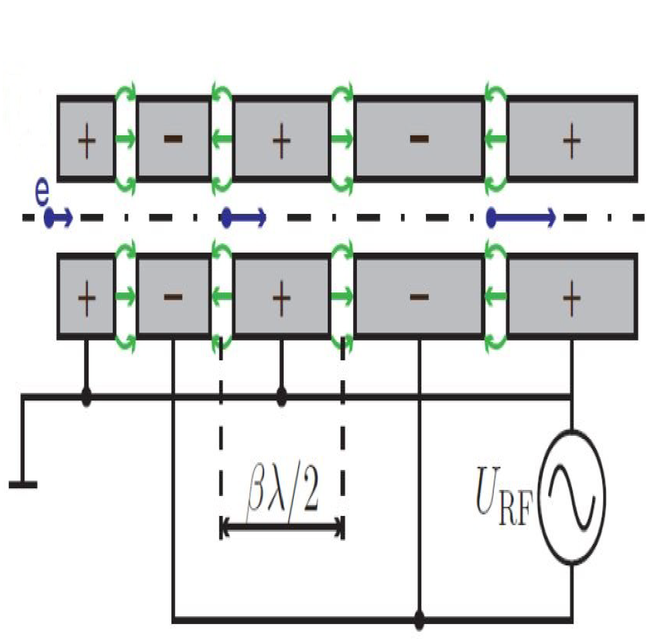
❖ Conventional particle accelerator

Electrostatic Accelerator



The energy gain is limited by achievable high voltage.

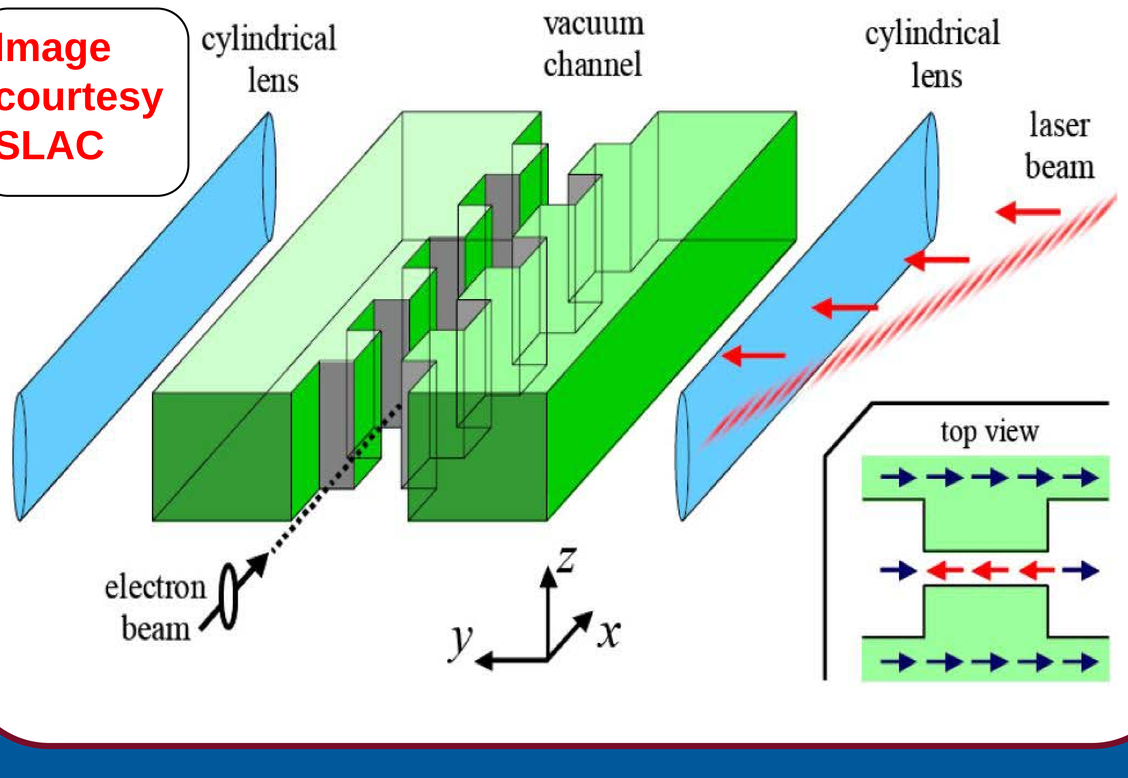
Drift tube Accelerator



- **Gustav Lsing proposed this concept in 1924, then it was demonstrated by Rolf Wideroe in 1928.**
- **It is limited by the drift length or high frequency microwave source at that time.**

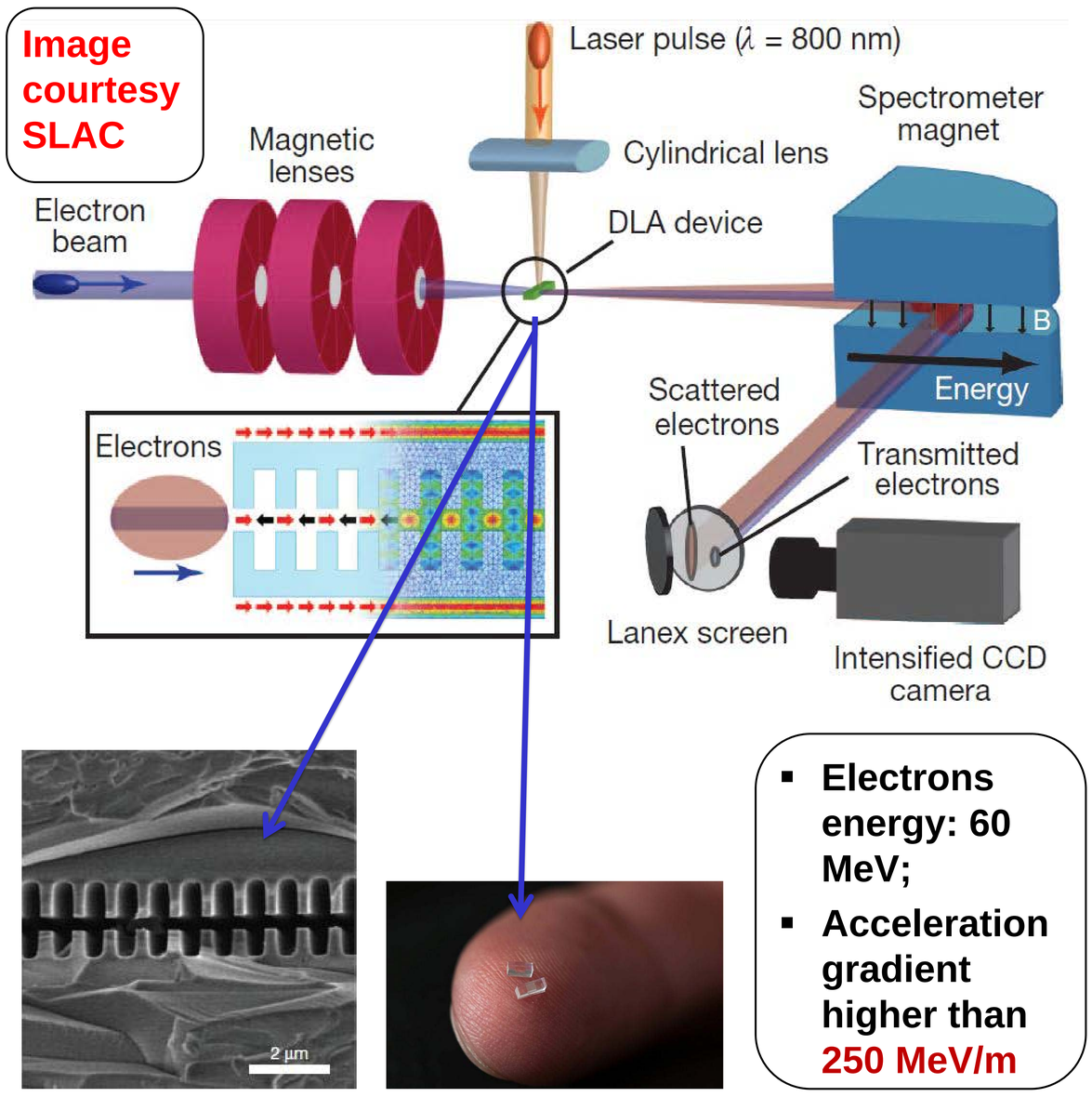
❖ Novel particle accelerator--DLA

Image courtesy SLAC



❖ Demonstration experiment in Stanford University

Image courtesy SLAC

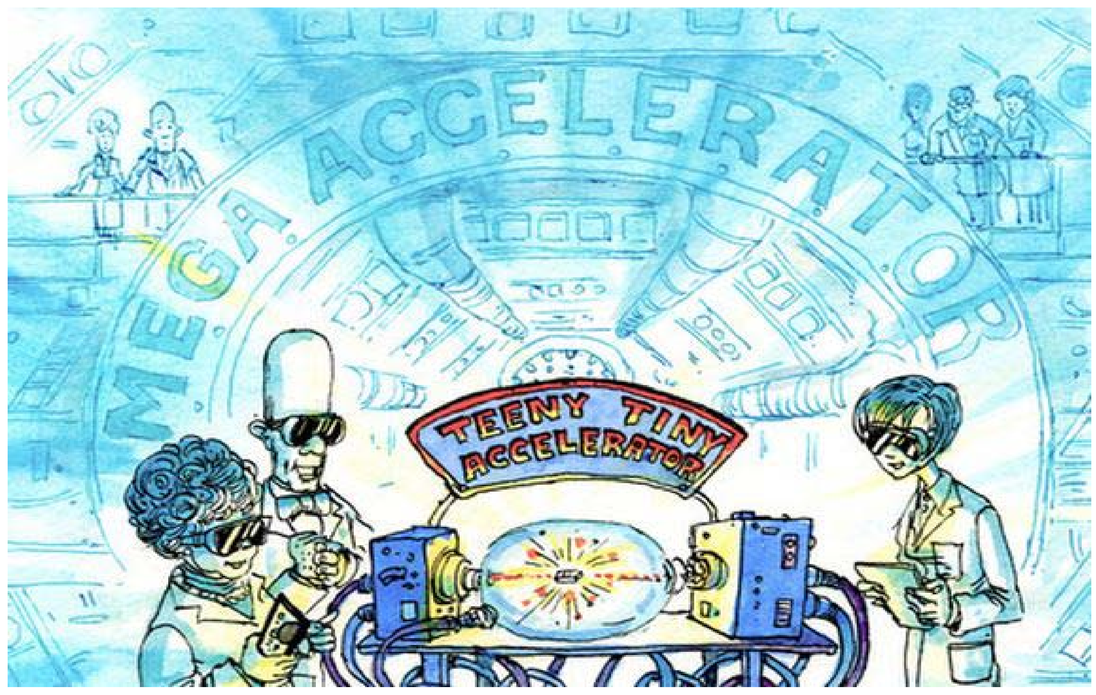


- **Electrons energy: 60 MeV;**
- **Acceleration gradient higher than 250 MeV/m**

❖ Future table-top particle accelerator

- **More compact for smaller accelerator;**
- **Higher accelerating force**
- **Much Lower cost;**

Image courtesy The Economist



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