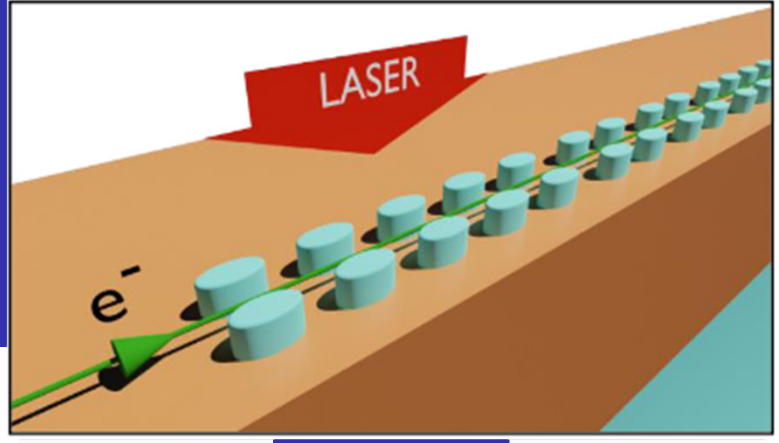
Acceleration and Focusing of Electrons on a Microchip

A novel focusing scheme allows any length (energy) on electron accelerator microchips



STATUS QUO

Electrons can be accelerated with very high gradients (energy gain per length) on microchips using shortpulse lasers. To increase the final energy, the the length has to be increased, which requires a focusing scheme (APF) fulfils this requirement. However, the technical implementation is difficult because symmetrical laser fields have to be generated in the nanostructures, which originate from purely two-dimensional lithography.

OUR TECHNOLOGY

Three-dimensional focusing fields can be generated in the device layer of commercially available SOI (Silicon-On-Insulator) wafers. Only a single laser beam is required for this.

BENEFITS

- ▶ Any high energy (limited by laser)
- ▶ Sub-femtosecond electron pulses with low energy spread
- ▶ Can be fabricated with standard processes of noano-electronics and -photonics

APPLICATION POSSIBILITIES

- Higher energy electron microscopes and electron diffraction instruments
- Electron pulses shorter than the laser period for high-precision time-resolved measurements
- Applications in large and small particle accelerator centers

COMMERCIALIZATION OPPORTUNITIES

There are various possibilities for cooperation between the industrial partner and TU Darmstadt: from an exchange with the know-how carriers of the technology up to a close cooperation in case of further development needs. The technology is protected by intellectual property rights and can be used by the industry partner after a sale or licensing agreement.

CURRENT STAGE OF DEVELOPMENT TECHNOLOGY READINESS LEVEL (TRL)

9	Product ready to launch
8	
7	Prototype
6	
5	
4	
3	Proof of Concept
2	
1	Idea

The development is on level 2-3: Currently it could be shown that the structures work as designed in the computer simulation. The production of prototypes is already in progress, but we are looking for further commercial "silicon foundries" that can produce prototypes for us.

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