### Lasery na swobodnych elektronach

**Otwiera się nowe źródło ultrakrótkich impulsów laserowych w Hamburgu** (

### Europe’s X-ray laser fires up, Nature 2017):

### The European XFEL fires powerful X-rays in bursts of a few hundred femtoseconds: so short that, like strobe lights, they can capture snapshots of jittery molecules frozen in time, and with a wavelength small enough to provide pictures at atomic resolution. The Hamburg machine is one of a few such X-ray lasers worldwide, but boasts a unique rapid-fire feature: it can rattle off 27,000 pulses every second, a firing rate more than 200 times greater than the next-fastest facility, the $420-million Linac Coherent Light Source (LCLS) at the SLAC National Accelerator Laboratory in Menlo Park, California.

Należy najpierw przeczytac przeglądowy artykuł Philip H. Bucksbaum and Nora Berrah, Brighter and faster: The promise and challenge of the x-ray free-electron laser, Phys. Today 68, 7, 26 (2015). I opisac zasade dzialania XFEL. Potem mozna zobaczyc jak wiązke laserowa mozna poprawic: A stable narrow-band X-ray laser, Nature 2015, J. Amann, Demonstration of self-seeding in a hard-X-ray free-electron laser, NATURE PHOTONICS, VOL 6 (2012) p.693