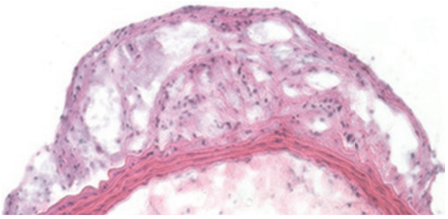
LASER ABLATION
Unblocking arteries
Biomed. Opt. Express **6,** 2552–2561 (2015)


OSA

Ultrashort near-infrared laser pulses can ablate subsurface plaque from the walls of arteries without causing surface damage, report scientists in Switzerland. Thomas Lanvin and co-workers from École Polytechnique de Lausanne and the University of Fribourg used optical coherence tomography (OCT) to study the effect of laser pulse energy on the ablation of plaque in mouse aortas. The laser pulses remove the plaque by vaporization. A 20 W, 1,030 nm wavelength fibre laser with tunable pulse duration, energy and repetition rate was used in the experiments. The team selected pulses with a duration of 1.5 ps and a repetition rate of 1 kHz to mitigate nonlinear self-focusing effects and reduce heat accumulation in the sample, while still being sufficient to perform ablation. The team concluded that pulse energies of 4 μJ or less were able to provide the required ablation without inducing surface damage to the blood vessel. *OG*

LIGHT SOURCES
Exploiting electrons
New J. Phys. **17,** 063036 (2015)

Optical power can be used to drive electron motion — as in inverse free-electron lasers, which do so via undulator magnets. Researchers from the University of California Los Angeles and Radiabeam Technologies, Santa Monica, now show that by reversing this process and decelerating an electron beam it is in principle possible to extract 50% of the electron beam power into coherent radiation with a wavelength of 13.5 nm using a 23-m-long tapered undulator. The team call their scheme TESSA (tapering-enhanced superradiant amplification) due to the use of a strongly tapered undulator; the deceleration is optimized by balancing the tapering with pondermotive gradients. The authors of the study believe that it should be possible (assuming 1 GeV electron energy, 20 kHz repetition rate, 4 kA peak current and 500 fs root-mean-square bunch length) to achieve 20 kW average power at 13.5 nm wavelength, which could be useful for extreme-ultraviolet lithography. In another example the team highlight the possibility of using TESSA to generate hard X-rays with ~6 TW output, only limited by sideband instability in their analysis. *DP*

OPTICAL MANIPULATION
Temporal tweezers
Nature Commun. **6,** 7370 (2015)

Manipulating the temporal position of light pulses can be attractive for optical information processing, allowing pulses to be temporarily stored and reconfigured on the fly without the need for optoelectronic conversion. Jae Jang and colleagues from the University of Auckland in New Zealand experimentally demonstrate how the temporal separation of picosecond pulses of light can be arbitrarily controlled all-optically. In their work, cavity solitons exist as picosecond pulses of light recirculating in a loop of optical fibre. The dispersive temporal spreading of the pulses is controlled by the material nonlinearity and thus related to the power of a continuous-wave 'holding' beam. A gradient in the cavity holding beam will cause an overlapping cavity soliton to move towards, and be trapped at, a point where the gradient vanishes. The team expose the cavity solitons to temporal control gradients in the form of a gigahertz phase modulation imposed on the cavity holding beam. By dynamically changing the phase pattern — translating to a blue shift or red shift and therefore a change in group velocity — they are able to control the movement of the cavity solitons in time. Temporal shifts much larger than the cavity soliton duration are demonstrated both in continuous and discrete manipulations. The approach enables the realization of a fully reconfigurable all-optical buffer and engineered pulse sequences with arbitrary pulse-to-pulse separations. *RW*

LIGHT SOURCES
Solid-state EUV source
Nature **521,** 498–502 (2015)

The generation of extreme ultraviolet (EUV) radiation is often achieved via the interaction of ultrashort light pulses with a jet of gas but now researchers from the Max-Planck-Institut für Quantenoptik, Garching, Germany, have demonstrated generation of broadband EUV radiation from a solid sample of SiO_2. Illumination of 120-nm-thick polycrystalline SiO_2 films with tailored ultrafast optical waveforms yielded an emission spectrum extending from 15 to 35 eV in photon energy. By increasing the strength of the applied fields to ~1.36 V Å^{-1}, photon energies up to 40 eV were possible, but beyond this the samples experience melting. However, preliminary tests indicate that thicker samples may enable extension of the approach towards soft X-ray emission. The team explored the EUV spectra generated by different waveforms including those with super and sub-cycle pulse lengths and from a theoretical point of view the results are confirmed via both semiclassical and quantum mechanical simulations. Comparison of the emission yield of SiO_2 to Kr and Ar — two commonly used gas-phase media for EUV emissions — found it to be in the same class as the gases. *DP*

LASERS
Interband cascade lasers
Appl. Phys. Lett. **106,** 251102 (2015)

Interband cascade lasers (ICL) — devices in which injected electrons are reused in serially-cascaded active regions to generate multiple photons via interband transitions — are promising sources of mid-infrared light. An attraction of the design is that its efficiency and low drive current potentially make it suitable for battery-operated applications such as a chemical detector of methane. Lu Li and co-workers from University of Oklahoma have now demonstrated InAs-based ICLs at room temperature with record-breaking performance. To enhance the confinement factor of the generated light in the central GaInSb/InAs active cascade region, InAs/AlSb intermediate cladding layers with a smaller refractive index than that of the active cascade region were introduced to replace a portion of the undoped InAs space-confinement layers. The 10-μm-wide, 3.5-mm-long device lased in continuous-wave mode at temperatures up to 308 K near 4.85 μm. The lasing threshold current density was below 1 kA cm^{-2}. By introducing the intermediate cladding layer, the lasing performance in pulsed mode was also improved. The 2.0-mm-long device exhibited a threshold current density of 247 A cm^{-2} at 300 K for emission near 4.6 μm, the lowest ever reported among mid-infrared semiconductor lasers at similar wavelengths. Another device lased in pulse mode at temperatures up to 377 K near 5.1 μm, the highest operating temperature reported for electrically pumped ICLs at this wavelength. *NH*

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