note that the energy mismatch between atom-pair states near $n = 70$ can be very close to zero, enabling the scheme to benefit from a Förster resonance. *DP*

PHOTODETECTORS

Room temperature promise

Appl. Phys. Lett. **105,** 023512 (2014)

Detectors for mid-wavelength infrared (MWIR) radiation are typically based on semiconductor devices that require cryogenic cooling to achieve desirable operational parameters. Now, Alexander Soibel and co-workers from the California Institute of Technology in the USA have investigated the high-temperature performance of MWIR detectors composed of an n-doped InAsSb top contact, an AlAsSb barrier, and a lightly n-doped InAsSb absorber region. The team found that the quantum efficiency of the detectors is 35% without anti-reflection coating and does not change with temperature in the 77–325 K range, indicating the potential for room temperature operation. The detectors have a cut-off wavelength near 4.5 μm and exhibit a detectivity of 1×10^9 cm $Hz^{1/2}$ W^{-1} at 300 K, and 5×10^9 cm $Hz^{1/2}$ W^{-1} at 250 K, which is easily achievable with single-stage thermoelectric coolers. The scientists further investigated the bias voltage and dark current density as a function of temperature to understand the electronic characteristics of the devices. *NH*

QUANTUM INFORMATION

Crystal solitons

Phys. Rev. Lett. **113,** 053001 (2014)

At sufficiently low temperatures, systems of laser-cooled and trapped ions can arrange themselves into Coulomb crystal structures that feature soliton-like properties that could prove useful for storing and manipulating quantum information, including the task of generating entanglement. One of the main challenges in the field is how to approach scaling from one-dimensional ion chains to two-dimensional, planar ion crystals. Now, Haggai Landa and co-workers from Israel, France and Germany have studied the interaction of periodically driven two-dimensional ion crystals with optical forces. The international team considered a system composed of $^{40}Ca^+$ and $^{43}Ca^+$ ions, which can form in a quadrupole trap with a ring geometry. In this work, $^{40}Ca^+$ ions, with a dipole-forbidden transition at 729 nm, serve as bits of quantum information (qubits). Their proposed technique requires Doppler cooling of the crystal and sideband cooling of the soliton's localized mode. Analysis reveals the effects of micromotion of ions in radiofrequency traps inherent to such structures. *NH*

BIOPHOTONICS

Intracellular tracking

Adv. Funct. Mater. **24,** 4796–4803 (2014)

Fluorescent semiconductor quantum dots are potentially useful as labelling and tracking agents within cells due to the broad range of available emission colours, their photostability and high photoluminescence efficiency. However, the temporal 'blinking' of their emission limits the duration of the tracking. Now, Aaron Keller and co-workers from Los Alamos National Laboratory, the US Naval Research Laboratory and the University of New Mexico Health Services Center have used giant non-blinking dots to get around the problem. The team used thick-shell dots made from a 4 nm core of CdSe surrounded by a shell of 16 monolayers of CdS. The resulting giant quantum dots were approximately 15 nm in size. The dots were then used as an optical label for three-dimensional tracking of single proteins in live cells, in particular the IgE-FcεRI receptor. Results showed a sevenfold increase in the probability of observing IgE-FcεRI for longer than one minute when using the giant dots rather than their conventional counterparts. *OG*

QUANTUM INFORMATION

Spin-wave memory upgrade

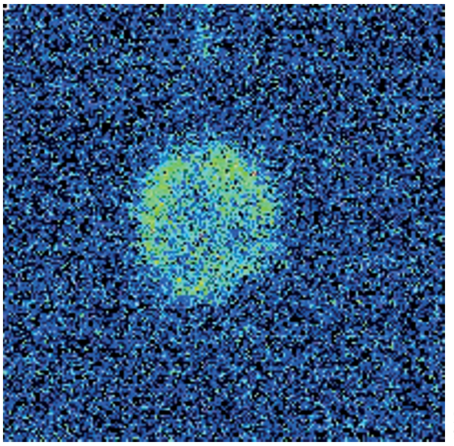
New J. Phys. **16,** 083005 (2014)

An optical spin-wave memory that has a storage efficiency strongly enhanced by an optical cavity has been demonstrated by scientists at the University of Geneva in Switzerland. The memory is based on the atomic frequency comb method with a crystal of Eu^{3+}-doped Y_2SiO_5 being placed inside an impendence-matched cavity to increase the absorption probability of an incident pulse. The researchers report that the efficiency of their memory is 12%, the highest value reported so far and an important development for intrinsically low-absorbing materials like europium-doped crystal. In the future, the European team believes that the efficiency could be further improved by the use of optics with lower losses and control over cavity modes. Once realized, efficient and long-lived quantum memories based on spin waves would prove valuable for applications involving quantum repeaters and quantum networks. *OG*

LIGHT SOURCES

More efficient plasmas

Appl. Phys. Express **7,** 086202 (2014)



JSAP

Although laser-produced plasmas are promising as a new source technology for realizing extreme ultraviolet (EUV) radiation and soft X-rays, the generation process is not yet very efficient. Ideally, improvements are needed for the scheme to become practical for applications such as next generation EUV lithography, which is needed for the fabrication of ever smaller transistors in microelectronics. Kensuke Yoshida and co-workers from Japan, Ireland and China have now achieved one of the highest conversion efficiencies to date by using twelve laser beams to produce spherical plasmas. The team used the powerful GEKKO-XII system in Japan, a giant Nd:glass laser at Osaka University, which has twelve laser beams, each with a pulse energy of 1 joule at a wavelength of 1.053 μm. The total 12 joules of energy, delivered within a 1.3 ns Gaussian pulse, irradiated spherical targets (polystyrene balls coated with a 2-μm-thick metallic layer of Gd, Tb or Mo) almost uniformly by positioning the incident beams at twelve faces of a regular dodecahedron. By adjusting the size of the laser spot diameters from 100 to 1,000 μm, the laser intensity on the target surface could be varied from 3×10^{11} W cm^{-2} to 3×10^{13} W cm^{-2}. The international collaboration of researchers found that an optimum laser intensity of 1×10^{12} W cm^{-2} yielded an electron temperature of around 100 eV and an EUV conversion efficiency of 0.8%. Using plasmas with this spherical geometry is more efficient for light generation as there is significantly reduced kinetic energy loss compared with planar targets. *DP*

Written by Oliver Graydon, Noriaki Horiuchi, Maria Maragkou and David Pile.

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