

Out of the groove

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One of the promises of the emerging field of plasmonics is to be able to manipulate signals of light through their interaction with the collective electronic excitations present at the surface of all metals, known as surface plasmons. Good progress has been made in controlling this interaction, and in manipulating surface plasmons, but few studies have demonstrated active control over an optical beam.

Filling the gap, Domenico Pacifici and colleagues demonstrate an all-optical plasmonic modulator in which the intensity of a beam of light at one wavelength is controlled by that of a second beam at a different wavelength.

The device consists of a parallel groove and slit patterned into a silver film and coated with CdSe nanoparticles. The amount of light transmitted through the slit is controlled by the interference between the surface plasmons launched from the groove and the incident optical field.

Back of the envelope

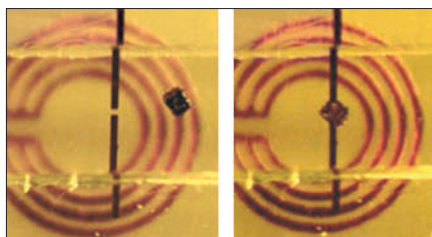
Stud. Hist. Philos. Mod. Phys.

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When thinking about the Einstein–Podolsky–Rosen (EPR) incompleteness argument, most physicists probably imagine two initially entangled spins flying apart. The formulation of the EPR paradox in terms of spin variables was first published by David Bohm in 1951, whereas the original EPR paper of 1935 (the authorship of which was attributed to Boris Podolsky) used position and momentum variables — as do all four later publications authored by Albert Einstein alone that discuss the EPR argument.

Tilman Sauer now reports his finding of a note that Einstein made on the back of a sheet of calculations, in which the incompleteness argument is formulated in terms of spin variables. The manuscript is not dated, but Sauer — who found the note among 1,800 pages of calculations in the Albert Einstein Archives in Jerusalem — estimates that it was written in late 1954 or early 1955. That makes it Einstein's latest version of the incompleteness argument, and one of Einstein's last statements on quantum mechanics in general.

Loaded dice



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That small magnetic structures can be moved around using magnetic fields is as little of a surprise as the fact that metals heat up when irradiated with a radiofrequency field. But Hongke Ye and colleagues have combined these basic ingredients to create a remotely controlled delivery system for nanolitre amounts of chemicals.

They load microfabricated magnetic containers — gold-coated nickel cubes whose sides are 200 μm long — with a gel that has been soaked in a chemical reagent. The container can be moved to a target location using a magnetic stylus. Once in place, it is exposed to radiofrequency irradiation, leading to eddy currents. The associated heating softens the encapsulated gel and releases the chemical.

To demonstrate the potential of the method — in particular the good spatial control provided by the approach — Ye *et al.* used two containers to sequentially deliver a sensitizer and an

activator to a gap in a thin wire (pictured, the radiofrequency coil can be seen below the wire), thus repairing the break.

Not in technicolor

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The black-and-white standard model still stands — the latest results from the DØ experiment at Fermilab show no evidence of ‘technicolor’. Technicolor is a hypothesis that goes beyond the standard model, modelled along the lines of quantum chromodynamics (the successful description of the dynamics of the strong force) to explain electroweak symmetry-breaking and the observed masses of the *W* and *Z* bosons — without invoking a scalar Higgs field. If the theory is correct, there should be a new, strong interaction acting between a new set of fermions, called ‘technifermions’.

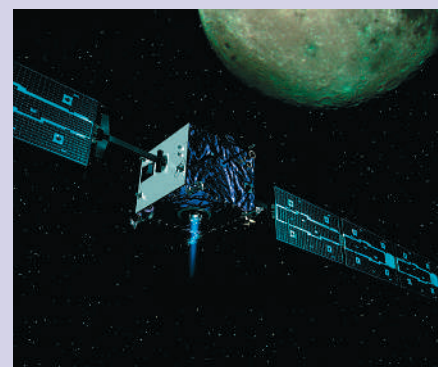
Using data on high-energy proton–antiproton collisions, V. M. Abazov *et al.* have searched for evidence of ‘technipions’ — the technicolor equivalent of the more mundane pions of the standard model. Technipions are predicted to decay into charm and bottom quarks, each of which leave distinctive signatures in the DØ detector. But Abazov *et al.* see nothing beyond what can be explained by the existing standard model. Although their results don't rule out technicolor entirely, it seems that there's still all to play for in the hunt for the Higgs.

Dust thrust

Phys. Plasma **14**, 053507 (2007)

Rocket fuel is great for propelling a spacecraft into orbit around the Earth. But if there is to be enough left over to make adjustments to the trajectory of a craft over long periods of time, the weight of the fuel is too much. The solution is to use a solar-powered electrical propulsion system, such as the ion thruster on Europe's SMART-1 satellite (pictured).

Ion thrusters accelerate ions, under a large electric field, out of the back of the craft, gently propelling it to speeds of hundreds of kilometres a second. But the complexity, lack of precision and expense of thrusters makes them impractical for many civilian satellite applications. Now, K. Avinash and G. P. Zank suggest a simpler alternative. They propose that if dust is injected into hot plasma, thermal



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energy would ionize the dust particles and generate a potential gradient that could push them out of an exhaust port. The authors' calculations suggest that such a device should achieve thrusts of 10–30 μN with better power efficiency than conventional ion thrusters.