A gravitational shock wave generated by a beam of null matter in quadratic gravity
E. C. de Rey Neto *et al.*
Class. Quantum Grav., 2003, **20**, 1479–1487.

The theory of quadratic gravity is developed by adding the non-linear terms in the curvature to the Einstein–Hilbert action. This paper reports an exact solution for a shock wave metric in the framework of quadratic gravity and Einstein's general relativity. The authors consider an ultra-relativistic jet, assumed to comprise of particles with a velocity equal to that of light, and the jet is then represented by a beam of null particles. The calculations show that the contribution due to higher-curvature gravity term becomes vanishingly small at large distances from the beam axis.

Equilibrium properties of a gravitating dusty plasma
B. P. Pandey *et al.*
Phys. Scr., 2002, **66**, 269–272.

An analysis of the equilibrium properties of gravitating dusty plasmas indicates that the presence of an electric field, arising from charge separation, plays a crucial role in the maintenance of a proper equilibrium.

Influences of process parameters on 111-oriented CVD diamond film growth under two-step method
F. Wang
Czech. J. Phys., 2003, **53**, 163–170.

Chemical Vapour Deposition (CVD) diamond film finds many unique applications in mechanical, electronic and chemical systems. Diamond is usually deposited at sub-atmospheric 20 Torr pressure in a feed gas of H_2 containing a small fraction of hydrocarbon precursor. Simulation of a two-step model for growth of 111-oriented CVD diamond film at atomic scale is carried out at various temperatures and hydrocarbon radical concentrations. The two-step model is in better agreement with experimental observations in comparison with a one-step model. Regulation of the substrate temperature and hydrocarbon concentration is important for making high quality films.

Some remarks on standing gravitational waves
H. Stephani
Gen. Relativ. Gravit., 2003, **35**, 467–474.

Standing waves are subject matter of high school physics textbooks, as occurring in acoustics and electromagnetics. The author attempts an intuitive definition of standing waves in the context of gravitational waves. Several of his searches meet with negative results, except some Einstein–Rosen waves.

Crystal structures and shape-memory behaviour of NiTi
X. Huang, G. J. Ackland and K. M. Rabe
Nat. Mater., 2003, **2**, 307–311.

Nitinol (NiTi) is a common shape memory alloy (SMA) that upon heating can come back to original shape even after a large deformation. While waiting for a better atomic-level understanding of this effect in NiTi, applications are underway in the development of miniaturized devices suitable for micro-electromechanical systems. This work proposes that storage of memory occurs at the micro-structural level.

Designing the refractive indices by using magnetic fluids
H. E. Hong *et al.*
Appl. Phys. Lett., 2003, **82**, 2434–2436.

Tunability and flexibility of optoelectronic devices can be improved by manipulating the refractive indices of material used. Authors describe a magnetic fluid, comprising of magnetic nanoparticles in liquid carriers, which is convenient for modulating the refractive index by varying the composition of carriers and particles. The flexibility is further enhanced by applying an external varying magnetic field. The paper demonstrates the feasibility of developing tunable devices using magnetic fluids.

The onset of matter–wave amplification in a superradiant Bose–Einstein condensate
D. Scheble *et al.*
Science, 2003, **300**, 475–478.

Experimental observation of patterns of recoiling atoms generated by the interaction of short and strong laser pulses with an atomic Bose–Einstein condensate (BEC), that are different from patterns generated by light scattering experiments, calls for clarification of these differences. This work shows that matter–wave amplification in BEC is suppressed at short times, clarifying the nature of bosonic stimulation.

Bose–Einstein condensation of the triplet states in the magnetic insulator $TlCuCl_3$
Ch. Ruegg *et al.*
Nature, 2003, **423**, 62–65.

Integer-spin bosons are not constrained by the Pauli exclusion principle, thereby forming a collection of particles called the Bose–Einstein Condensate (BEC). An experimental investigation, using neutron scattering of $TlCuCl_3$ single crystals excited in a magnetically ordered state, verifies the theoretical predictions arising out of BEC of the triplet states.

Large parity violation effects in heavy metal containing chiral compounds
P. Schwerdtfeger, J. Gierlich and T. Bollwein
Angew. Chem. Int. Ed. Engl., 2003, **42**, 1293–1296.

Parity violation effects introduce a small energy difference between enantiomers of a chiral molecule, usually of the order of few millihertz in magnitude. This work reports relativistic calculations for several chiral molecules containing a heavy-metal center.