Ann. Phys. (Berlin) **528**, No. 5, 340–343 (2016) / DOI 10.1002/andp.201670028

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COVER PICTURE

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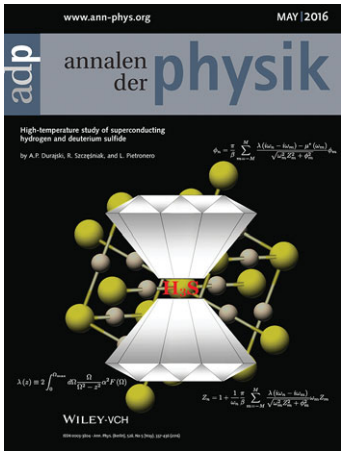
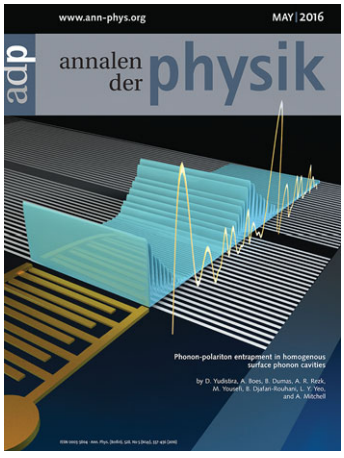


Hydrogen-rich compounds are extensively explored as candidates for high-temperature superconductors. Recently, hydrogen sulfide (H_3S), compressed in a diamond anvil cell, was experimentally found to show the loss of resistance at the critical temperature of 203 K. It opens the door to achieving room-temperature superconductivity in these types of materials.

This paper investigates the thermodynamic properties of superconducting hydrogen and deuterium sulfide at 150 GPa. In particular, the energy gap, specific heat jump, thermodynamic critical field and London penetration depth were calculated within the framework of the Eliashberg formalism. Then, these parameters were used to estimate the dimensionless ratios which exceed the predictions of the Bardeen-Cooper-Schrieffer theory. These discrepancies arise from the existence of the strong-coupling and retardation effects in the systems investigated. The Eliashberg theory goes beyond the BCS theory to include these effects.

The results presented in this paper are expected to stimulate experimental and theoretical exploration and discovery of new superconducting hydrogen-containing materials like H_3S.



Surface phonon cavities that are homogenous in both mechanical and dielectric properties are reported. The cavities are formed by the placement of a defect of a single domain within periodic domain inversion of single crystal piezoelectric lithium niobate that exhibits a surface phononic bandgap through the phonon-polariton coupling. Surface cavity resonances are observed within the bandgap, which correspond to entrapment of the phonon-polariton within the defect. In addition to demonstrating that the observed resonances are non-radiative and decoupled from bulk radiation, which is critical for high Q cavities, the possibility to tune the surface cavity resonance spectra simply by varying the defect width is also shown. Such an ability to excite a surface cavity resonance that is non-radiative with simultaneous localization of the electric field, together with the advantage of a cavity that is physically formed from a completely monolithic and uniform material, offers unique opportunities.

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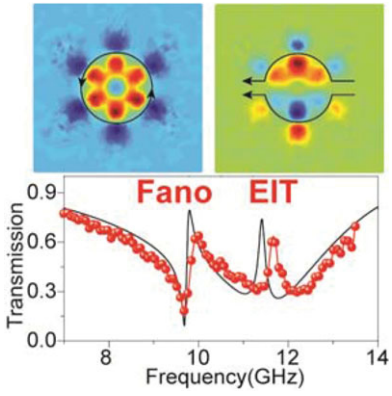
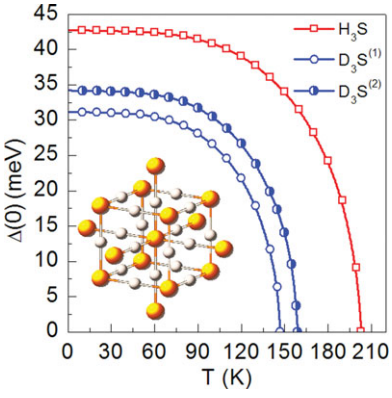
THEN & NOW

RAPID RESEARCH LETTER



This work experimentally and numerically presents a 3D toroidal metamaterial with two different toroidal dipoles along orthogonal directions. The chosen toroidal metamaterial also supports Fano resonance and electromagnetically induced transparency (EIT) phenomena in the transmission spectra. The radiation pattern of the multipole and the destructive interference between electric–toroidal and electric–magnetic dipoles are clearly illustrated to understand the unerlying physics of the proposed 3D toroidal metamaterial.

EDITOR'S CHOICE



Hydrogen-rich compounds are extensively explored as candidates for a high-temperature superconductors. Currently, the measured critical temperature of 203 K on H_3S is among the highest over all-known superconductors. This paper investigates the thermodynamic properties of superconducting hydrogen and deuterium sulfide at high pressure. In particular, the energy gap, the specific heat, the thermodynamic critical field and the London penetration depth were calculated within the framework of the Eliashberg formalism.

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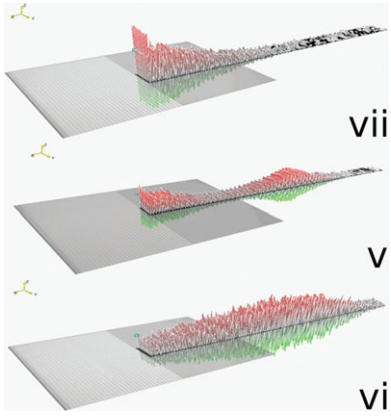
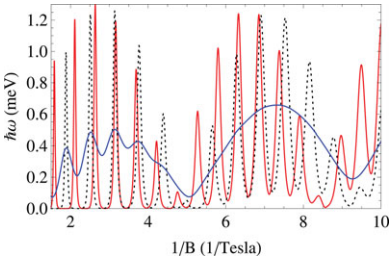
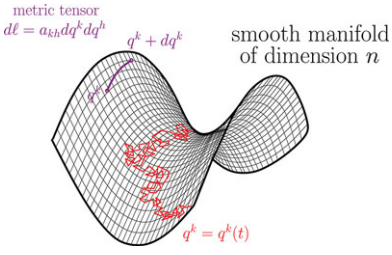
ORIGINAL PAPERS



Surface phonon cavity formed by the placement of a defect of a single domain within periodic domain inversion of single crystal piezoelectric lithium niobate exhibiting surface phononic bandgap through the phonon-polariton coupling is introduced. It is shown that the proposed cavity can exhibit entrapment of phonon-polariton, indicated by the simultaneous localization of both surface phonons and the electric within the defect.



We study the inter and intra Landau band magnetoplasmons in gapped graphene by the self-consistent field approach. Long-lived magnetoplasmons are important in graphene due to the large carrier mobility and doping tunability. They facilitate a strong spatial confinement of light and the terahertz frequencies are promising for next generation optoelectronics.



The formulation of statistical mechanics based on Langevin and Fokker-Planck equations is typically developed for particles without mechanical constraints. However, the constrained statistical mechanics is indispensable to study several statistical properties of molecular assemblies of interest in chemistry, physics and biology. Therefore, in this paper we analyze arbitrary holonomic scleronomous systems by specializing the Lagrange and Hamilton equations of motion to those of the Langevin dynamics on a smooth manifold.

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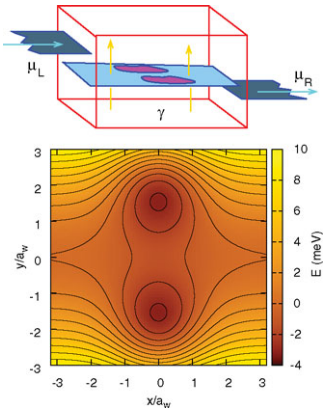
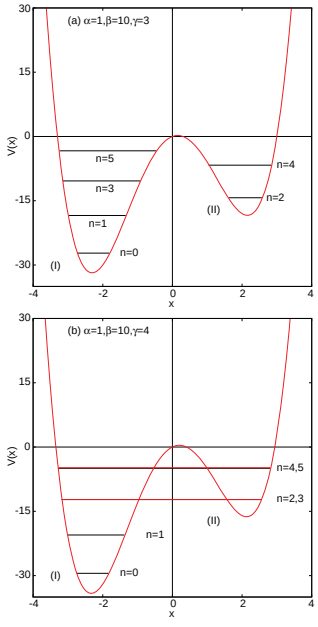


The authors explore theoretically through several measurable quantities how cavity photons can enhance or reduce the interaction of two electrons in parallel quantum dots embedded in a photon cavity.

$$S = 2\int d^{2N}x\sqrt{\mathrm{Det}\left[\mathscr{R}_{ij}\right]}$$

In affine variational principle, a symmetric linear connection is taken as a fundamental field. The metric tensor is generated dynamically, and it appears as a canonically conjugate to the connection. From this picture, Einstein's gravity with a cosmological constant can be obtained by a covariant Legendre transformation of the affine Lagrangian. In the present paper, this formalism is applied to product spaces and the cosmological constant problem.



Some simple rules are proposed to analyze the distribution of a particle in an asymmetric double-well potential given by,

$$V(x) = \alpha x^4 - \beta x^2 + \gamma x.$$

Straightforward modification of the same rule also enables one to explain energy distribution. Energy states become quasi-degenerate *only* at certain characteristic values of the asymmetry parameter, γ. For remaining values of γ, the two wells may be treated as two different single-well potentials. Information-based uncertainty relations like Fisher information, Shannon entropy, Onicescu energy andOnicescu Shannon entropy, as well as conventional uncertainty product and phase space calculations also consolidate the above-mentioned rules in such potentials.