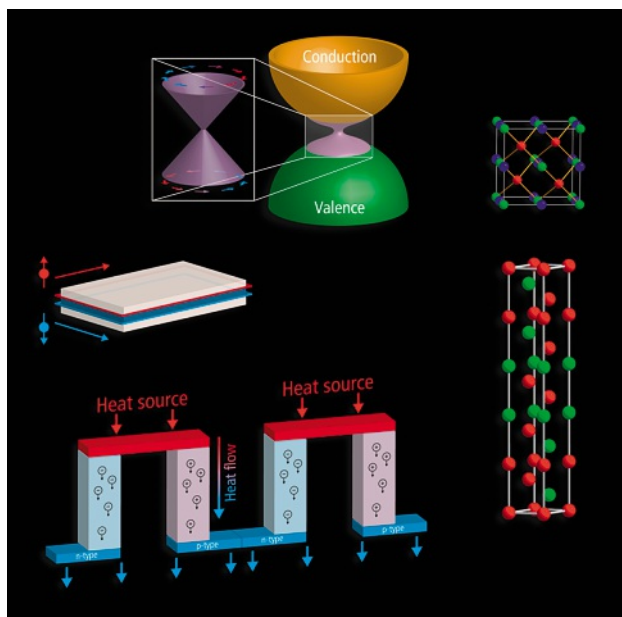


FRONT COVER

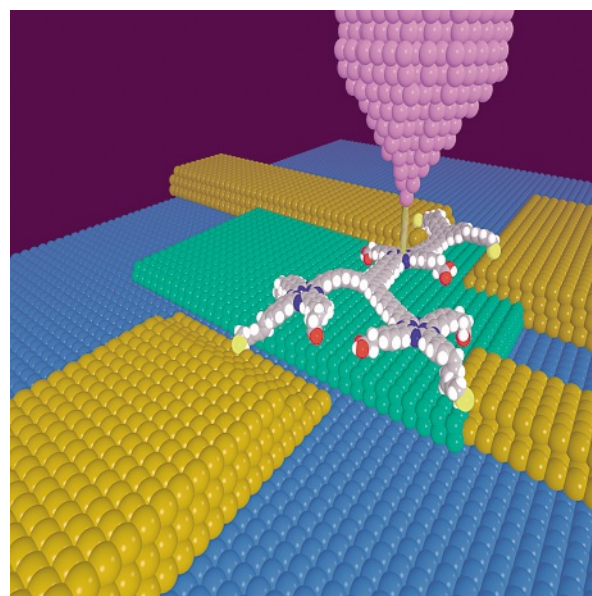


Topological insulators (TIs) are a recently discovered new quantum state of matter. They have gapless surface states inside a bulk energy gap, which are protected from non-magnetic perturbations by the topology of the electronic structure. Starting with the discovery of two-dimensional TIs, HgTe-based quantum wells, many new topological materials have been theoretically predicted and observed experimentally. Currently known TI materials can possibly be classified into two families: compounds that derive from the cubic HgTe family and compounds that are similar to the layered  $\text{Bi}_2\text{Se}_3$  family. The signatures found in the electronic structure of a TI also cause these materials to be excellent thermoelectric materials, such as narrow band gaps and heavy constituents. On the other hand, excellent thermoelectric materials can be also topologically trivial, such as PbTe. In their Review@RRL article, MÜchler et al. (see pp. S11–S20 here) present a short introduction to topological insulators and thermoelectric materials, and give examples of compound classes where both good thermoelectric properties and topological insulators can be found and how their properties correlate.

The Review@RRL article by MÜchler et al. is part of the Focus Issue on **Topological Insulators – From Materials Design to Reality** published in February 2013 (Guest Editors: Claudia Felser, Shoucheng Zhang, and Binghai Yan)

BACK COVER

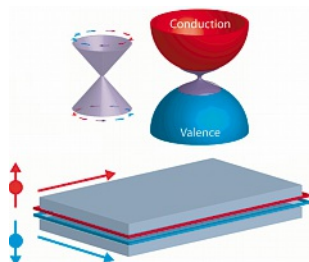
The request for ongoing development of electronic devices stimulates alternative technology research. In this regard, a very promising candidate is the concept of single-molecule electronics based on the state-of-the-art use of modern nanotechnology. On the cover, the concept of a single-molecule electronic device is envisaged. The molecule is designed to perform a given logic task, and is thus equipped with various functional groups responsible for task implementation. Furthermore, it possesses anchoring groups that bind the molecular processor to an underlying surface and metallic nanoelectrodes without severe distortion of its internal structure, i.e. with no alteration to its operation. Below the processor there is an ultrathin buffer layer that decouples it from a (semi-)conducting substrate. The scanning tip is used either for characterisation of the device or for initiating/controlling its operation. The Feature Article by Prauzner-Bechcicki et al. (see pp. S53–S63 here) presents a review of recent experiments proving significant progress in single-molecule computing device technology.



Page **S11–S20****Review@RRL**

Lukas MÜchler, Frederick Casper, Binghai Yan, Stanislav Chadov, and Claudia Felser

## Topological insulators and thermoelectric materials

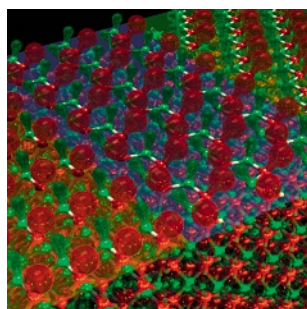
Phys. Status Solidi RRL **7**, No. 1–2 (2013), DOI 10.1002/pssr.201206411

Topological insulators are a new class of materials with a topologically protected edge of surface states with potential application for spintronics devices. Most topological insulators, however, are also excellent thermoelectric materials. In this Review@RRL the authors give a short introduction to topological insulators and their relation to thermoelectrics.

Page **S21–S31****Review@RRL**

Holger Eisele and Philipp Ebert

## Non-polar group-III nitride semiconductor surfaces

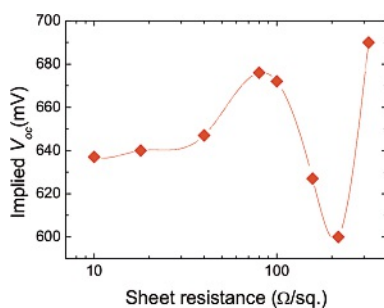
Phys. Status Solidi RRL **6**(9–10), 359–369 (2012), DOI 10.1002/pssr.201206309

Non-polar surfaces of group-III nitride semiconductors have attracted much attention during the past years. On the one hand, using them as growth surface might reduce discontinuities of the piezoelectric polarization in heterostructures for nitride-based light emitting and laser devices. On the other hand, the major fraction of III–V semiconductor nanowires are confined by non-polar surfaces. In this Review@RRL, the authors give a survey of the basic structural and electronic properties of state-of-the-art non-polar group-III nitride surfaces.

Page **S32–S34****Rapid Research Letter**

B. Hoex, M. C. M. van de Sanden, J. Schmidt, R. Brendel, and W. M. M. Kessels

## Surface passivation of phosphorus-diffused n<sup>+</sup>-type emitters by plasma-assisted atomic-layer deposited Al<sub>2</sub>O<sub>3</sub>

Phys. Status Solidi RRL **6**(1), 4–6 (2012), DOI 10.1002/pssr.201105445

Amorphous aluminium oxide (Al<sub>2</sub>O<sub>3</sub>) films yield excellent surface passivation on arbitrarily doped p-type and lightly doped n-type c-Si. In some solar cell structures highly p-type and n-type c-Si surfaces are present; hence it is crucial to know the level of surface passivation of Al<sub>2</sub>O<sub>3</sub> on both these surfaces. Here the authors show that Al<sub>2</sub>O<sub>3</sub> can provide a good level of surface passivation for industrially relevant n<sup>+</sup>-type surfaces.

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Page **S35–S37**

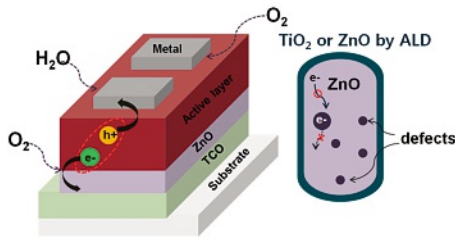


**Rapid Research Letter**

Sun-Young Park, Hyun Ook Seo, Kwang-Dae Kim, Jung Eun Lee, Jung-Dae Kwon, Young Dok Kim, and Dong Chan Lim

**Organic photovoltaics with high stability sustained for 100 days without encapsulation fabricated using atomic layer deposition**

Phys. Status Solidi RRL **6**(5), 196–198 (2012), DOI 10.1002/pssr.201206070



Low stability is a hurdle to be overcome for application of organic photovoltaics (OPV). As described in this Letter, ultrathin layers of ZnO and TiO<sub>2</sub> fabricated using atomic layer deposition on ZnO electron-collecting layers of OPV could greatly enhance the photostability of OPV. Without any additional encapsulation of the solar cells under ambient conditions, no significant decrease in performance of the solar cells could be found for 100 days.

Page **S38–S40**

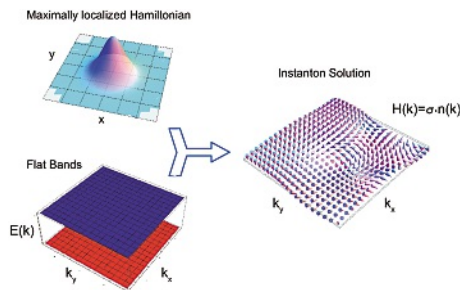


**Rapid Research Letter**

Chao-Ming Jian, Zheng-Cheng Gu, and Xiao-Liang Qi

**Momentum-space instantons and maximally localized flat-band topological Hamiltonians**

Phys. Status Solidi RRL **7**, No. 1–2 (2013), DOI 10.1002/pssr.201206394



Materials with flat energy bands have interesting phases because of strong interaction effects. To find realistic Hamiltonians with flat bands, one wants to realize flat bands with local Hamiltonians. In this Letter, the authors show that the most localized flat-band Hamiltonians have eigenstate wavefunctions which are holomorphic functions in momentum space, and they correspond to instanton solutions in non-linear sigma models.

Page **S41–S43**

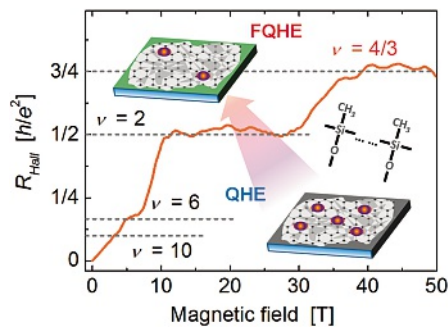


**Rapid Research Letter**

Stefan Hansel, Myrsini Lafkioti, and Vojislav Krstić

**Suppression of short-range scattering via hydrophobic substrates and the fractional quantum Hall effect in graphene**

Phys. Status Solidi RRL **6**(9–10), 376–378 (2012), DOI 10.1002/pssr.201206297

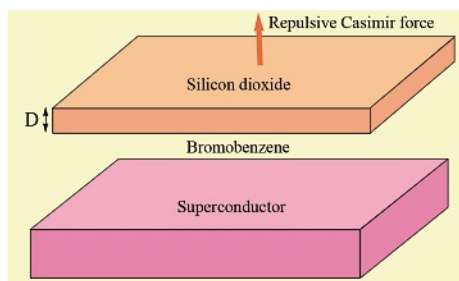


As an all-surface material, graphene's electronic properties are very susceptible to any type of external influences, such as substrate interactions. However, these interactions can probe the physics of fundamental magneto-induced many-body states in graphene. The fractional quantum Hall state with the filling factor 4/3 in non-suspended graphene is realized at 4.2 K by suppressing substrate-induced short-range scatterers via substrate hydrophobisation. This demonstrates the prevalence of an increased ratio of mean free path to charge carrier separation over extraordinarily high mobility needs.

Page **S44–S46****Rapid Research Letter**

Anh D. Phan and N. A. Viet

## Repulsive Casimir force between silicon dioxide and superconductor

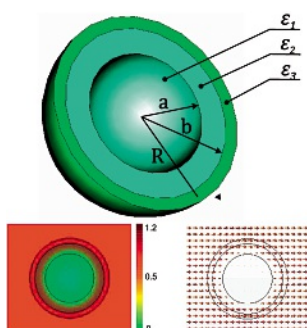
Phys. Status Solidi RRL **6**(6), 274–276 (2012), DOI 10.1002/pssr.201206166

At nanoscale distances, there are interactions, so-called Casimir forces, that exist between neutral bodies. Arising from quantum fluctuations, these forces play a significant role in micro- and nanomechanical devices. The Casimir force can be attractive or repulsive depending on the geometry and properties of the objects, and on whether a liquid is present in between. In current attempts to resolve stiction problems, much attention is given to the repulsive interaction. This Letter shows that the interaction forces between a silicon dioxide slab and a cuprate (BSCCO) plate are repulsive. The thickness and temperature dependence of the Casimir force are also calculated and discussed.

Page **S47–S49****Rapid Research Letter**

Dmitry S. Filonov, Alexey P. Slobozhanyuk, Pavel A. Belov, and Yuri S. Kivshar

## Double-shell metamaterial coatings for plasmonic cloaking

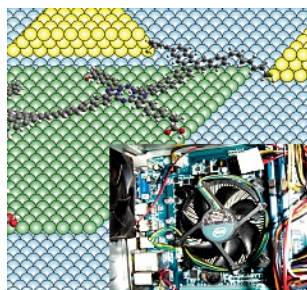
Phys. Status Solidi RRL **6**(1), 46–48 (2012), DOI 10.1002/pssr.201105475

A cloak for both hiding objects and shielding their interiors is studied. The structure consisting of a dielectric layer and a layer of an epsilon-near-zero material can suppress substantially the scattering from a sphere and at the same time produce zero electric field inside. The double-layer coating allows to cloak different objects with various material and geometrical parameters, but with the dimensions less or comparable with the radiation wavelength.

Page **S50–S52****More to read in physica status solidi (RRL)**Page **S53–S63****Feature Article**

Jakub S. Prauzner-Bechicki, Szymon Godlewski, and Marek Szymonski

## Atomic- and molecular-scale devices and systems for single-molecule electronics

Phys. Status Solidi A **209**(4), 603–613 (2012), DOI 10.1002/pssa.201127623

The end of silicon scaling is inevitable. The need for ongoing development of electronic devices triggers the quest for alternative, radically new ideas in the realm of computing. Among many possible concepts single-molecule electronics seems to be very promising. In this Feature Article a concise description of the finest selection of recent experiments addressing milestones of the single-molecule computing devices technology is presented.

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Page **S64–S69**

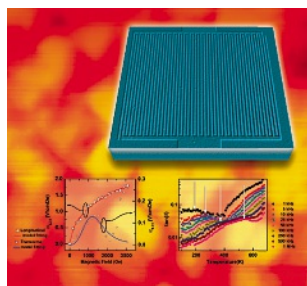


**Advanced Materials Physics**

Ashok Kumar, J. F. Scott, R. Martínez, G. Srinivasan, and R. S. Katiyar

**In-plane dielectric and magnetoelectric studies of BiFeO<sub>3</sub>**

Phys. Status Solidi A **209**(7), 1207–1212 (2012), DOI 10.1002/pssa.201228154



In 1974, Polomska et al. discovered an anomaly in bismuth ferrite (BiFeO<sub>3</sub>) at 458 K. Despite a large number of publications, the origin of this anomaly has proven enigmatic. By use of in-plane interdigital electrodes, Ashok Kumar et al. have shown that it is a surface phase transition. Two other surface phase transitions are confirmed at 201 K and 548 K, bringing the total of bulk and surface transitions in BiFeO<sub>3</sub> to nine. Bismuth ferrite is the only room-temperature multiferroic magnetoelectric known with device-worthy switched polarization in the range of  $\mu\text{C}/\text{cm}^2$ . The new work is of special importance for devices that involve surfaces such as THz emitters.

Page **S70–S75**

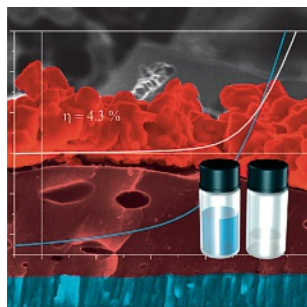


**Editor's Choice**

Carolin M. Fella, Alexander R. Uhl, Yaroslav E. Romanyuk, and Ayodhya N. Tiwari

**Cu<sub>2</sub>ZnSnSe<sub>4</sub> absorbers processed from solution deposited metal salt precursors under different selenization conditions**

Phys. Status Solidi A **209**(6), 1043–1048 (2012), DOI 10.1002/pssa.201228003



Kesterite compounds Cu<sub>2</sub>ZnSnS<sub>4</sub> (CZTS) and Cu<sub>2</sub>ZnSnSe<sub>4</sub> (CZTSe) are emerging as promising absorber materials for thin-film solar cells because they consist of earth abundant, non-toxic elements and their optoelectronic properties suggest great potential for cost-effective high efficiency solar cells. The metal ratios of the thin layers strongly influence the solar cell device efficiency. Therefore, it is important to understand whether initial metal ratios are retained in the sulfurized/selenized layer or any losses occur due to the formation of volatile phases that originate during the precursor conversion. Fella et al. report on controlling the overall composition of selenized Cu<sub>2</sub>ZnSnSe<sub>4</sub> layers. A simple, sustainable, and low cost solution approach is employed for depositing the metal precursor.

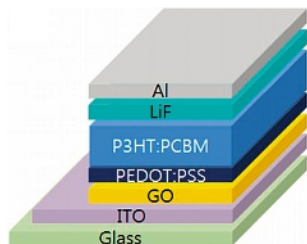
Page **S76–S81**



Yensil Park, Kyoung Soon Choi, and Soo Young Kim

**Graphene oxide/PEDOT:PSS and reduced graphene oxide/PEDOT:PSS hole extraction layers in organic photovoltaic cells**

Phys. Status Solidi A **209**(7), 1363–1368 (2012), DOI 10.1002/pssa.201228040



In this study, Park et al. investigate the effect of graphene oxide (GO) or reduced graphene oxide (rGO) beneath PEDOT:PSS as the hole extraction layer (HEL) of organic photovoltaic (OPV) cells. A simple spin-coating process was used to modify the indium-tin-oxide anode contact. After GO or rGO was inserted, the performances of the OPVs were measured. It is shown that GO is more suitable as a HEL than rGO. The OPV cell with the GO/PEDOT:PSS HEL exhibits a power conversion efficiency of 3.53% (i.e. nearly twice the value of an OPV cell without HEL).

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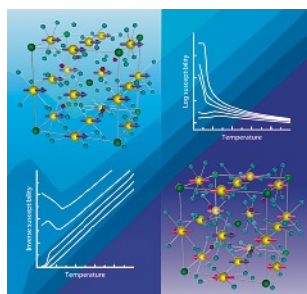
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Page **S82–S83**

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Page **S84–S95****Feature Article**

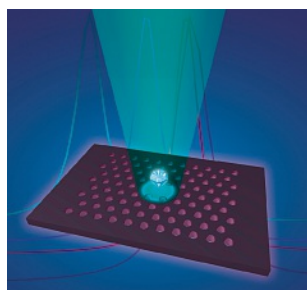
Yuichi Shimakawa and Takashi Saito

**A-site magnetism in A-site-ordered perovskite-structure oxides**Phys. Status Solidi B **249**(3), 423–434 (2012), DOI 10.1002/pssb.201147477

The A-site-ordered perovskite-structure oxides  $AA'_3B_4O_{12}$  are attracting much interest due to a variety of physical properties. When the B-site ions in  $AA'_3B_4O_{12}$  are non-magnetic species, one can see unusual magnetic behavior of spins in the A- and A'-site sublattices. Shimakawa and Saito summarize the A-site magnetism in these oxides. The authors synthesized some new compounds under high-pressure and high-temperature conditions. They found that either ferromagnetism ( $CaCu_3Ge_4O_{12}$  and  $CaCu_3Sn_4O_{12}$ ) or antiferromagnetism ( $CaCu_3Ti_4O_{12}$ ) arises in the A'-site sublattice.

Page **S96–S102****Editor's Choice**

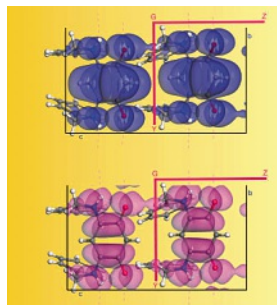
Janik Wolters, Günter Kewes, Andreas W. Schell, Nils Nüsse, Max Schoengen, Bernd Löchel, Tobias Hanke, Rudolf Bratschitsch, Alfred Leitenstorfer, Thomas Aichele, and Oliver Benson

**Coupling of single nitrogen-vacancy defect centers in diamond nanocrystals to optical antennas and photonic crystal cavities**Phys. Status Solidi B **249**(5), 918–924 (2012), DOI 10.1002/pssb.201100156

Nitrogen-vacancy (NV) centers in diamond are a promising resource for solid state quantum technology. Wolters et al. demonstrate the ability to integrate single NV centers in diamond nanocrystals into photonic or plasmonic hybrids using state of the art scanning probe lithography. Hereby the emission properties of the single NV centers are strongly modified. The authors review experiments concerning the controlled coupling of single defect centers in nano-diamonds to optical nanoantennas made of gold bowtie structures.

Page **S103–S108**

Luis G. Rosa, Julian Velez, Zhengzheng Zhang, Jose Alvira, Omar Vega, Gerson Diaz, Lucie Routaboul, Pierre Braunstein, Bernard Doudin, Yaroslav B. Losovyj, and Peter A. Dowben

**Approaching an organic semimetal: Electron pockets at the Fermi level for a *p*-benzoquinonemonoimine zwitterion**Phys. Status Solidi B **249**(8), 1571–1576 (2012), DOI 10.1002/pssb.201147426

Most organic materials are insulators or semiconductors and few explicitly exhibit a density of states at the Fermi level. Stable charge-neutral organic molecules do not usually behave as metals. There are exceptions, notably the tetra-thiafulvalene–tetracyanoquinodimethane (TTF-TCNQ) system. Yet a single-component organic conductor remains a Holy Grail of organic chemistry. Now there is compelling evidence of electron pockets, at the Fermi level, in the band structure for an organic zwitterion molecule of the *p*-benzoquinonemonoimine type.

Page **S109–S111****More to read in physica status solidi (b)****best  
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