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010001 **Editorial: A Tale of Two Anniversaries: 125 Years of the *Physical Review* and 25 Years of *Physical Review E*** Matthew Salter, Michael Thoennessen

010002 **Announcement: *Corrections* in *Physical Review* Publications**

011001 ***Colloquium*: High pressure and road to room temperature superconductivity** Lev P. Gor'kov, Vladimir Z. Kresin

Even after three decades of development, high temperature superconductivity remains one of the most challenging theoretical and experimental areas in condensed matter physics. In this Colloquium some new discoveries in this area are reviewed and possible routes toward much higher transition temperatures are analyzed.

015001 **Weyl and Dirac semimetals in three-dimensional solids** N. P. Armitage, E. J. Mele, Ashvin Vishwanath

In recent years many three-dimensional crystals have been discovered whose low-energy electronic properties are described by the Dirac or Weyl equations for relativistic fermions. This leads to many unusual physical properties and potentially to new applications. This review explains the theory behind these developments, their material realizations, and the current experimental status.

015002 **Adiabatic quantum computation** Tameem Albash, Daniel A. Lidar

The simple act of slowly varying the parameters of a quantum system so that it remains always in its ground state is extremely rich from an information processing point of view. For an ideal, closed system, this adiabatic evolution is equivalent to full quantum computation, and it is convenient for establishing quantum algorithms for optimization. This review presents adiabatic quantum algorithms, proves the closed-system equivalence of the adiabatic and circuit models of quantum computation, reviews the placement of adiabatic quantum computation in the more general classification of computational complexity theory, and discusses the case of "stoquastic" quantum evolutions.

015003 **Nonstandard heavy mesons and baryons: Experimental evidence** Stephen Lars Olsen, Tomasz Skwarnicki, Daria Zieminska

Since the inception of the quark model we have known the simplest examples, mesons made of a quark and antiquark and baryons made of three quarks. But it has long been recognized that more complex structures such as quark-quark-antiquark-antiquark or quark-antiquark-gluon mesons were possible. Such exotic states involving only the light up, down, and strange quarks are difficult to recognize experimentally but those containing the heavier charm or bottom quarks are more distinctive. This paper reviews the experimental status and phenomenological characterization of such exotic hadrons containing heavy quarks.

015004 **Hadronic molecules**

Feng-Kun Guo
Christoph Hanhart
Ulf-G. Meißner
Qian Wang
Qiang Zhao
Bing-Song Zou

Hadrons are composite particles made of quark and gluons. Interestingly, some excited hadronic states resemble the deuteron viewed as a barely bound neutron-proton system. Such hadronic molecules are spatially extended systems lying very close to decay thresholds. This work reviews the current experimental evidence for hadronic molecules and related theoretical descriptions, including effective field theories and lattice quantum chromodynamics.

015005 **Antiferromagnetic spintronics**

V. Baltz
A. Manchon
M. Tsoi
T. Moriyama
T. Ono
Y. Tserkovnyak

Spintronics utilizing antiferromagnetic materials has potential for the next generation of applications and offers opportunities for new ideas. Ultimately, antiferromagnets could replace ferromagnets as the active spin-dependent element on which spintronic devices are based. Central to this endeavor is the need for predictive models, relevant disruptive materials, and new experimental designs. This paper reviews spintronic effects described based on theoretical and experimental analysis of antiferromagnetic materials.

015006 **Edwards statistical mechanics for jammed granular matter**

Adrian Baule
Flaviano Morone
Hans J. Herrmann
Hernán A. Makse

Granular materials are systems of macroscopic grains such as sugar, sand, or rice. These systems exhibit a transition to a jammed state similar to an amorphous solid. Although the jammed state concept is simple as it is determined by excluded volume interactions, describing this state of matter is highly challenging. The approach of Edwards is reviewed here which describes jammed granular materials using the volume ensemble of equally probable jammed states. The Edwards volume ensemble is reviewed for various packings providing insight into a unifying phase diagram for jammed matter.

015007 **Solids, liquids, and gases under high pressure**

Ho-Kwang Mao
Xiao-Jia Chen
Yang Ding
Bing Li
Lin Wang

The effect of adding high pressure as a control parameter in solids, liquids, and gases expands opportunities to observe unexpected novel phenomena and understand matter in extreme environments. This review on high-pressure science highlights subjects ranging from quantum criticality to Earth science. State-of-the-art experimental methods at megabar pressures are also discussed. The proliferation of pressure-induced phases illustrates promising new directions for this field of research.

015008 **High precision analytical description of the allowed β spectrum shape**

Leendert Hayen
Nathal Severijns
Kazimierz Bodek
Dagmara Rozpedzik
Xavier Mougeot

Beta decay is a process that reveals the structure of the standard model and its possible extensions. This review provides a description of the allowed β spectrum shape in view of ongoing and planned measurements searching for physics beyond the standard electroweak model and weak magnetism. The formalism presents a description of the underlying physics. The derived expression for both Fermi and Gamow-Teller transitions is accurate for low- to medium-Z nuclei.

015009 **Fluctuation spectroscopy: From Rayleigh-Jeans waves to Abrikosov vortex clusters**

A. A. Varlamov
A. Galda
A. Glatz

The study of superconducting fluctuations goes back to the work of Aslamazov, Larkin, Maki, and Thompson. It has received renewed attention in the context of high-temperature superconductors, whose short coherence length greatly enhances fluctuations. This review gives an overview of the theoretical treatment of superconducting fluctuations in the entire phase diagram, their observations, and their use in studying unconventional superconductors.