Determination of the Chiral Condenate from QCD Dirac Spectrum on the Lattice


PHYSICAL REVIEW D 83, 074501 (2011)

Antisense-Induced Guanine Quadruplex Inhibit Reverse Transcription by HIV-1 Reverse Transcriptase

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Journal of the American Chemical Society, 132, 11171-11178 (2010)


Extreme Oxygen Isotope Anomaly with a Solar Origin Detected in Meteoritic Organics

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Nature Geoscience, 4, 165-168 (2011)

Materials that characterize the surface of Earth, atmosphere, ocean, and life, are considered to have derived from organics and water included in primitive meteorites. These volatile compounds are conceived to have originated from a cold space medium, although the exact origins remain unknown. We were able to identify the origin of the meteoritic organics by the detection of characteristic isotope anomalies of oxygen and carbon using an isotope imaging microscope. The enrichments in δ18O, δ13C found in micron-sized organic grains suggest that they were formed at the envelope of the solar nebula illuminated by the sun-light, triggered by a photochemical reaction. The figure demonstrates the composition image for the δ18O/16O ratio of the organics, where the part pasted in warm colors represents the detected organic grains.

A New Idea to Search for Charged Lepton Flavor Violation Using a Muonic Atom

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A new process of μ → e+νe in a muonic atom for a quest of charged lepton flavor violation, which has not been discussed before, is proposed. Charged lepton flavor is known to be one of the important processes to search for new physics beyond the standard model of elementary particle physics. In this newly proposed process, the Coulomb attraction from the nucleus in a heavy muonic atom leads to significant enhancement in its rate by Z, where Z is an atomic number of the nucleus in the muonic atom, compared to μ → e+νe. The upper limit of the branching ratio is estimated to be of the orders of O(10^-15), and will become feasible in future experiments. This process could serve potentially promising opportunity to find new physics phenomena.

Science

Pressure-induced Superconductivity and Large Upper Critical Field in the Noncentrosymmetric Antiferromagnet CeIrGe

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The interplay of magnetism and superconductivity has attracted a great interest in strongly correlated electron systems. An antiferromagnet CeIrGe crystallizes in the tetragonal structure without inversion symmetry along the [001] direction. Our electrical resistivity measurements under high pressures revealed that CeIrGe becomes superconductive above 20 GPa. The superconducting (SC) state coexists with the antiferromagnetic (AFM) state at around 20 GPa, and only a superconducting transition occurs at 24 GPa, as shown in the deduced P-T phase diagram. Note that the superconducting state has a huge upper critical field $Hc > 15$ T at 24 GPa, for the magnetic field along the [001] direction, which is based on the non-centrosymmetric structure and heavy fermion state.

Common Architecture of the Flagellar Type III Protein Export Apparatus and F- and V-type ATPases


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Nature Structural & Molecular Biology, 18, 277-282 (2011)

For construction of the bacterial flagellum, which is a filamentous organ for motility, most of the component proteins require a specific protein export apparatus to be exported from the cytoplasm into the central channel of the growing flagellum. FilF and FilI are soluble components of the export apparatus. We determined the crystal structure of FilI at 2.1 Å resolution, and analyzed the FilI–Fili ring complex structure by electron cryo-microscopy. These studies clearly show significant structural similarities between the flagellar protein export apparatus and F- and V-type ATPases.

Nature of Electron Transport by Pyridine-Based Tripodal Anchors: Potential for Robust and Conductive Single-Molecule Junctions with Gold Electrodes


Journal of the American Chemical Society, 133, 3014-3022 (2011)

We have designed and synthesized a pyridine-based tripodal anchor unit to construct a single-molecule junction with a gold electrode. The advantage of tripodal anchoring to a gold surface was unambiguously demonstrated by cyclic voltammetry measurements. X-ray photoelectron spectroscopy measurements indicated that the π orbital of pyridine contributes to the physical adsorption of the tripodal anchor unit to the gold surface. The consequence of a single-molecule junction that consists of the tripodal anchor and diphenyl acetylene was measured by modified scanning tunneling microscope techniques. Finally, by analyzing the transport mechanism based on ab initio calculations, the participation of the π orbital of the anchor moieties and π-channel electric transport were predicted.