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Breakthrough of the Year

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COVER

Mosaic of the CMS and ATLAS detectors (as in 2007), part of the Large Hadron Collider at CERN. In 2012, research teams used these detectors to fingerprint decay products from the long-sought Higgs boson and determine its mass, successfully testing a key prediction of the standard model of particle physics. See the Breakthrough of the Year special section beginning on page 1524, three Articles beginning on page 1558, and www.sciencemag.org/special/btoy2012.

Photos: Maximilien Brice and Claudia Marcelloni/CERN

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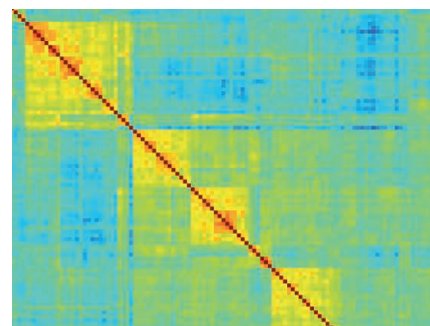
- 1558 **The Higgs Boson**
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M. Della Negra et al.
- 1569 **A New Boson with a Mass of 125 GeV Observed with the CMS Experiment at the Large Hadron Collider**
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- 1576 **A Particle Consistent with the Higgs Boson Observed with the ATLAS Detector at the Large Hadron Collider**
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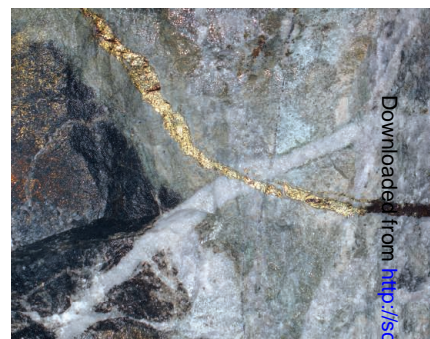
- 1583 **Radar-Enabled Recovery of the Sutter's Mill Meteorite, a Carbonaceous Chondrite Regolith Breccia**
P. Jenniskens et al.
Analysis of this rare meteorite implies that the surfaces of C-class asteroids can be more complex than previously assumed.
>> *News story p. 1521*
- 1587 **The Evolutionary Landscape of Alternative Splicing in Vertebrate Species**
N. L. Barbosa-Morais et al.
The patterns and complexity of messenger RNA splicing across vertebrates cluster by species rather than by organ.
- 1593 **Evolutionary Dynamics of Gene and Isoform Regulation in Mammalian Tissues**
J. Merkin et al.
Messenger RNA alternative splicing is highly variable among vertebrates and links to kinase signaling pathways.
>> *Perspective p. 1547*
- 1599 **C/EBP Transcription Factors Mediate Epicardial Activation During Heart Development and Injury**
G. N. Huang et al.
Transcriptional mechanisms controlling gene expression in the heart's outer layer are exploited for cardiac repair.
>> *Perspective p. 1549*

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- 1604 **Symmetry-Protected Topological Orders in Interacting Bosonic Systems**
X. Chen et al.
Counterparts of topological insulators are predicted to exist in interacting bosonic systems.
>> *Perspective p. 1550*
- 1606 **Sign-Problem-Free Quantum Monte Carlo of the Onset of Antiferromagnetism in Metals**
E. Berg et al.
An effective lattice theory enables an efficient computational solution to an otherwise intractable problem.
- 1609 **Optomechanical Dark Mode**
C. Dong et al.
The formation of a mechanical dark mode can be used to isolate an optomechanical system from thermal noise.
- 1613 **Porphyry-Copper Ore Shells Form at Stable Pressure-Temperature Fronts Within Dynamic Fluid Plumes**
P. Weis et al.
A numerical model attributes ore metal accumulation in porphyry deposits to fluid plumes draining from large magma chambers.
>> *Perspective p. 1551*
- 1616 **Apatite $^4\text{He}/^3\text{He}$ and (U-Th)/He Evidence for an Ancient Grand Canyon**
R. M. Flowers and K. A. Farley
The Colorado River carved the Grand Canyon to nearly its modern depth 60 million years earlier than was generally believed.
- 1619 **Multiplex Targeted Sequencing Identifies Recurrently Mutated Genes in Autism Spectrum Disorders**
B. J. O'Roak et al.
Large-scale human autism candidate gene resequencing implicates de novo mutations in six genes in ~1% of sporadic cases.
- 1622 **Genome-Wide Detection of Single-Nucleotide and Copy-Number Variations of a Single Human Cell**
C. Zong et al.
A whole-genome amplification method with reduced bias compares a single cell with its descendants.
- 1627 **Probing Meiotic Recombination and Aneuploidy of Single Sperm Cells by Whole-Genome Sequencing**
S. Lu et al.
A whole-genome amplification method with reduced bias yields a personal meiotic recombination map.



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- 1631 **Organization of the Influenza Virus Replication Machinery**
A. Moeller et al.
Electron microscopic analysis of a reconstituted RNA-protein complex outlines pathways of transcription.
- 1634 **The Structure of Native Influenza Virion Ribonucleoproteins**
R. Arranz et al.
Electron microscopic analysis of a purified RNA-protein complex links its structure to the influenza life cycle.
>> *Perspective p. 1545*

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ONLINE HIGHLIGHTS

SCIENCEEXPRESS

www.sciencexpres.org

Publication Ahead of Print

Reconstitution of the Vital Functions of Munc18 and Munc13 in Neurotransmitter Release

C. Ma et al.

10.1126/science.1230473

Comparative Analysis of Bat Genomes Provides Insight into the Evolution of Flight and Immunity

G. Zhang et al.

10.1126/science.1230835

An Update of Wallace's Zoogeographic Regions of the World

B. G. Holt et al.

10.1126/science.1228282

Cyclic GMP-AMP Is an Endogenous Second Messenger in Innate Immune Signaling by Cytosolic DNA

J. Wu et al.

10.1126/science.1229963

Cyclic GMP-AMP Synthase Is a Cytosolic DNA Sensor That Activates the Type I Interferon Pathway

L. Sun et al.

10.1126/science.1232458

Olefin Cyclopropanation via Carbene Transfer Catalyzed by Engineered Cytochrome P450 Enzymes

P. S. Coelho et al.

10.1126/science.1231434

Boson Sampling on a Photonic Chip

J. B. Spring et al.

10.1126/science.1231692

Photonic Boson Sampling in a Tunable Circuit

M. A. Broome et al.

10.1126/science.1231440

TECHNICAL COMMENTS

Comment and Response on "The Local Structure of Amorphous Silicon"

Comment: S. Roorda and L. J. Lewis

<http://dx.doi.org/10.1126/science.1221738>

Response: M. M. J. Treacy and K. B. Borisenko

<http://dx.doi.org/10.1126/science.1222571>

SCIENCE NOW

www.sciencenow.org

Highlights From Our Daily News Coverage

Cloud Forest Trees Drink From the Fog

Plants take up a surprising amount of moisture from the air.

http://scim.ag/Moisture_Air

Revved-Up Protein Fights Aging

Boosting a protein that keeps chromosomes in order protects mice from cancer and increases life span.

http://scim.ag/Protein_Aging

Pee Marks the Spot

A single protein in male mouse urine makes females return to old haunts.

<http://scim.ag/Single-Protein>

SCIENCE SIGNALING

www.sciencesignaling.org

The Signal Transduction Knowledge Environment

18 December issue: <http://scim.ag/ss121812>

RESEARCH ARTICLE: IGFBP7 Binds to the IGF-1 Receptor and Blocks Its Activation by Insulin-like Growth Factors

V. Evdokimova et al.

By inactivating the IGF1R, IGFBP7 suppresses growth and promotes cell death.

RESEARCH ARTICLE: c-FLIP Maintains Tissue Homeostasis by Preventing Apoptosis and Programmed Necrosis

X. Piao et al.

The anti-apoptotic protein c-FLIP blocks multiple cell death pathways in mice.

RESEARCH ARTICLE: A CC-SAM, for Coiled-Coil–Sterile α Motif, Domain Targets the Scaffold KSR1 to Specific Sites in the Plasma Membrane

D. Koveal et al.

A previously unknown module that mediates membrane binding is identified in the scaffold KSR.

REVIEW: Extracellular Phosphorylation and Phosphorylated Proteins—Not Just Curiosities But Physiologically Important

G. Yalak and V. Vogel

Extracellular proteins and extracellular protein domains can be phosphorylated.

SCIENCE TRANSLATIONAL MEDICINE

www.sciencetranslationalmedicine.org

Integrating Medicine and Science

19 December issue: <http://scim.ag/stm121912>

COMMENTARY: To Share or Not To Share—That Is Not the Question

L. Ohno-Machado

Sharing clinical and biomedical data could accelerate translational research.

REVIEW: Hidden Killers—Human Fungal Infections

G. D. Brown et al.

Lack of rapid diagnostic tests, drugs, and vaccines impedes treatment and prevention of invasive fungal infections.

RESEARCH ARTICLE: Genetic Correction of Human Induced Pluripotent Stem Cells from Patients with Spinal Muscular Atrophy

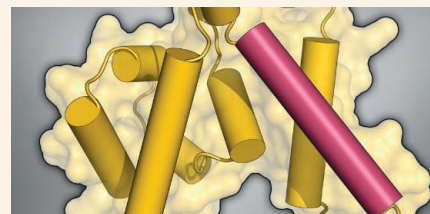
S. Corti et al.

Induced pluripotent stem cell–derived motor neurons from spinal muscular atrophy patients show phenotype rescue after genetic correction.

RESEARCH ARTICLE: Long-Term Follow-Up After Gene Therapy for Canavan Disease

P. Leone et al.

Gene therapy for Canavan disease results in a decrease in pathologically elevated *N*-acetyl-aspartate concentrations in the brain and long-term clinical stabilization.



SCIENCE SIGNALING

Membrane-binding domain in KSR1.

RESEARCH ARTICLE: Multimodal Actions of Neural Stem Cells in a Mouse Model of ALS—A Meta-Analysis

Y. D. Teng et al.

A meta-analysis reports the beneficial effects of transplanting mouse or human neural stem cells into the spinal cord of the SOD1^{G93A} mouse, a model of ALS.

SCIENCE CAREERS

www.sciencereaders.org/career_magazine

Free Career Resources for Scientists

<http://scim.ag/SciCareers21December2012>

Breakthrough of the Year: Seekers of the Higgs Boson

E. Pain

Science Careers talks to three young investigators who contributed to this year's monumental discovery.

>> *Breakthrough of the Year* section p. 1524

Science Careers's Person of the Year:

Paula Stephan

B. L. Benderly

The labor economist has worked for years behind the scenes, but this year she went public.

SCIENCE PODCAST

www.sciencemag.org/multimedia/podcast

Free Weekly Show for 21 December 2012

A special year-in-review show featuring the Breakthrough of the Year and Runners-Up and science news highlights from 2012.

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