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Science

An abstract, colorful visualization of a celestial body, possibly a planet or star, with a complex, irregular yellow and orange surface. The surface is surrounded by a dense, swirling field of magnetic field lines or plasma, rendered in vibrant green, blue, and purple. Numerous bright, thin lines of light, primarily in shades of pink and purple, radiate outwards from the central body, creating a sense of intense energy and dynamic movement. The background is a deep, dark blue or black, suggesting the vastness of space.

Mysteries of Astronomy

 AAAS

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Arthur Eisenkraft

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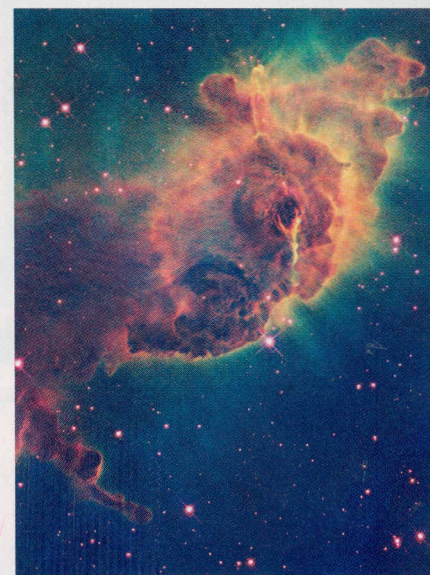
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COVER

Three-dimensional computer models such as this one help researchers explore the mechanisms behind core-collapse supernovae, the violent death of short-lived massive stars. In the image, tubes represent paths of gas falling into a supernova, deflected by an accretion shockwave (horizontal width of 600 km); colors represent different velocities. The question of how stars explode is one of the "Mysteries of Astronomy" described in a special News package beginning on page 1090.

Visualization: Hongfeng Yu and Kwan-Liu Ma, University of California-Davis and the SciDAC Institute for Ultra-Scale Visualization;
Simulation: John Blondin, North Carolina State University

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BREVIA

- 1129** Structure of a 16-nm Cage Designed by Using Protein Oligomers
Y.-T. Lai et al.
A general computational method allows the design of proteins that self-assemble into a desired symmetric architecture.

RESEARCH ARTICLE

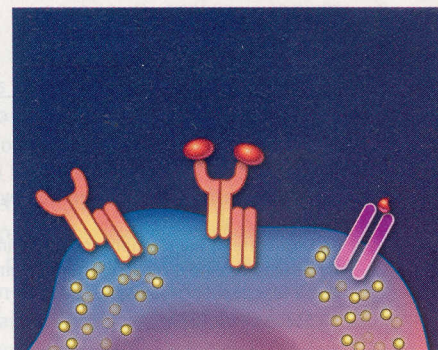
- 1130** Quantum Algorithms for Quantum Field Theories
S. P. Jordan et al.
A quantum computer may be able to efficiently simulate theories used to describe particle scattering in accelerators.
>> *Perspective p. 1122*; *Science Podcast*

REPORTS

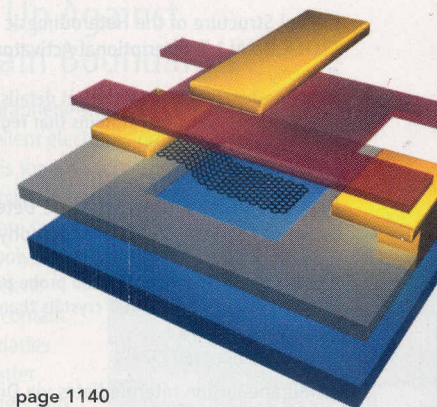
- 1133** The Detection and Characterization of a Nontransiting Planet by Transit Timing Variations
D. Nesvorný et al.
Analysis of the deviations in the orbit of a transiting exoplanet revealed an outer planet in the same planetary system.
>> *Perspective p. 1121*
- 1137** Tracking Cooper Pairs in a Cuprate Superconductor by Ultrafast Angle-Resolved Photoemission
C. L. Smallwood et al.
Time-resolved spectroscopy is used to probe the dynamics of electron pairing recovery in a high-temperature superconductor.
- 1140** Graphene Barristor, a Triode Device with a Gate-Controlled Schottky Barrier
H. Yang et al.
The absence of defects and surface oxides at a graphene-silicon interface enables voltage control of graphene devices.
- 1143** Tailoring Electrical Transport Across Grain Boundaries in Polycrystalline Graphene
A. W. Tsen et al.
Overlap between crystallites in vapor-grown graphene improves its electronic conductivity.
- 1147** Theory Untangles the High-Resolution Infrared Spectrum of the *ortho*-H₂-CO van der Waals Complex
P. Jankowski et al.
High-level calculations assign the unusually complex spectrum of a molecular pair implicated in interstellar chemistry.
- 1150** Secreted Kinase Phosphorylates Extracellular Proteins That Regulate Biomineralization
V. S. Tagliabacci et al.
The elusive enzyme that modifies proteins involved in building bone and teeth has now been identified.

- 1154** Evolution of a Vertebrate Social Decision-Making Network
L. A. O'Connell and H. A. Hofmann
Across vertebrates, behaviorally relevant brain regions are remarkably conserved over 450 million years of evolution.
- 1157** Evolutionary Trade-Offs, Pareto Optimality, and the Geometry of Phenotype Space
O. Shoval et al.
The fitness of an organism can be modeled graphically to determine how phenotypic trade-offs are maximized.
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- 1160** Chitin-Induced Dimerization Activates a Plant Immune Receptor
T. Liu et al.
Structural analysis shows how fungus-derived chitin dimerizes its receptor on target plants and triggers defense responses.
- 1164** Rocket Launcher Mechanism of Collaborative Actin Assembly Defined by Single-Molecule Imaging
D. Breitsprecher et al.
Triple-color microscopy suggests two factors interact to initiate actin formation and then separate as the filament grows.
- 1168** The Amyloid Precursor Protein Has a Flexible Transmembrane Domain and Binds Cholesterol
P. J. Barrett et al.
The structure of the APP transmembrane domain allows processive cleavage and cholesterol binding that may enhance cleavage.
- 1171** Computational Design of Self-Assembling Protein Nanomaterials with Atomic Level Accuracy
N. P. King et al.
A general computational method is used to design protein building blocks that self-assemble into target architectures.
- 1175** Generic Indicators for Loss of Resilience Before a Tipping Point Leading to Population Collapse
L. Dai et al.
Experiments in yeast confirm that statistical indicators can signal the approach of population crashes.
- 1178** B Cell Receptor Signal Transduction in the GC Is Short-Circuited by High Phosphatase Activity
A. M. Khalil et al.
Restricted B cell signaling in the areas responsible for immune memory cell production promotes affinity maturation.
>> *Perspective p. 1120*
- 1182** Restoring Voluntary Control of Locomotion after Paralyzing Spinal Cord Injury
R. van den Brand et al.
A rehabilitation program involving robotic neuroprosthetics restores previously paralyzed hindlimb function.
>> *Science Podcast*

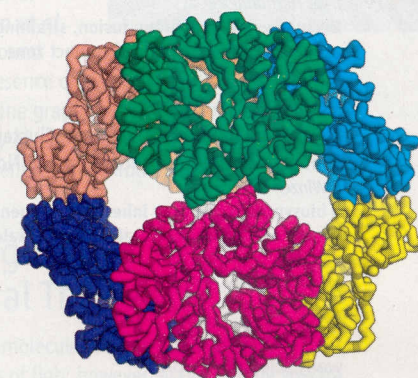
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