



Particle-in-cell simulation of relativistic ions being ejected from a foil target by an ultraintense ("exawatt") laser pulse. The laser ionizes the target and pushes electrons forward; the ions are then accelerated by the charge separation. Shown is an ion-density isosurface; the black curve shows the ion density along the laser axis. See article 175003.



## PHYSICAL REVIEW LETTERS

### Contents

Articles published 24 April–30 April 2004

VOLUME 92, NUMBER 17

30 APRIL 2004

#### General Physics

- Anomalies of Weakened Decoherence Criteria for Quantum Histories ..... 170401  
Lajos Diósi
- Excitation Spectroscopy of Vortex Lattices in a Rotating Bose-Einstein Condensate ..... 170402  
S.J. Woo, L.O. Baksmaty, S. Choi, and N.P. Bigelow
- Ultracold Fermions and the  $SU(N)$  Hubbard Model ..... 170403  
Carsten Honerkamp and Walter Hofstetter
- Reconstructing the Density of States by History-Dependent Metadynamics ..... 170601  
Cristian Micheletti, Alessandro Laio, and Michele Parrinello

#### Gravitation and Astrophysics

- New Nucleosynthesis Constraint on the Variation of  $G$  ..... 171301  
Craig J. Copi, Adam N. Davis, and Lawrence M. Krauss
- Charged-Particle Decay and Suppression of Primordial Power on Small Scales ..... 171302  
Kris Sigurdson and Marc Kamionkowski

#### Elementary Particles and Fields

- Cross Sections and Transverse Single-Spin Asymmetries in Forward Neutral-Pion Production from Proton Collisions at  $\sqrt{s} = 200$  GeV ..... 171801  
J. Adams *et al.* (STAR Collaboration)
- Upper Bound on the Decay  $\tau \rightarrow \mu\gamma$  from the Belle Detector ..... 171802  
K. Abe *et al.* (Belle Collaboration)

#### Nuclear Physics

- Evidence for  $M1$  Scissors Resonances Built on the Levels in the Quasicontinuum of  $^{163}\text{Dy}$  ..... 172501  
M. Krtićka, F. Bečvář, J. Honzátko, I. Tomanđl, M. Heil, F. Käppeler, R. Reifarth, F. Voss, and K. Wisshak
- New Approach for Measuring Properties of  $rp$ -Process Nuclei ..... 172502  
R.R.C. Clement, D. Bazin, W. Benenson, B.A. Brown, A.L. Cole, M.W. Cooper, P.A. DeYoung, A. Estrade, M.A. Famiano, N.H. Frank, A. Gade, T. Glasmacher, P.T. Hosmer, W.G. Lynch, F. Montes, W.F. Mueller, G.F. Peaslee, P. Santi, H. Schatz, B.M. Sherrill, M-J. van Goethem, and M.S. Wallace

#### Atomic, Molecular, and Optical Physics

- Influence of Molecular Structure on Double Ionization of  $\text{N}_2$  and  $\text{O}_2$  by High Intensity Ultrashort Laser Pulses .... 173001  
E. Eremina, X. Liu, H. Rottke, W. Sandner, M.G. Schätzel, A. Dreischuh, G.G. Paulus, H. Walther, R. Moshhammer, and J. Ullrich
- Slowing Heavy, Ground-State Molecules using an Alternating Gradient Decelerator ..... 173002  
M.R. Tarbutt, H.L. Bethlem, J.J. Hudson, V.L. Ryabov, V.A. Ryzhov, B.E. Sauer, G. Meijer, and E.A. Hinds

(Continued on Third Cover)



*Contents (Continued)*

|                                                                                                                                                         |        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Two-Dimensional Bose-Einstein Condensate in an Optical Surface Trap .....                                                                               | 173003 |
| D. Rychtarik, B. Engeser, H.-C. Nägerl, and R. Grimm                                                                                                    |        |
| Observation of Enhanced Field-Free Molecular Alignment by Two Laser Pulses .....                                                                        | 173004 |
| Christer Z. Bisgaard, Mikael D. Poulsen, Emmanuel Péronne, Simon S. Viftrup, and Henrik Stapelfeldt                                                     |        |
| Coupling of Electron Orbital Motion with Rotation in the High Rydberg States of BH .....                                                                | 173005 |
| A.T. Gilkison, C.R. Viteri, and E.R. Grant                                                                                                              |        |
| Evaporative Cooling of Helium Nanodroplets with Angular Momentum Conservation .....                                                                     | 173401 |
| Kevin K. Lehmann and Adriaan M. Dokter                                                                                                                  |        |
| Crossed Beam Pump and Probe Dynamics in Metal Clusters .....                                                                                            | 173402 |
| K. Andrae, P.-G. Reinhard, and E. Suraud                                                                                                                |        |
| Excited-State Relaxation of Ag <sub>8</sub> Clusters Embedded in Helium Droplets .....                                                                  | 173403 |
| Paul Radcliffe, Andreas Przystawik, Thomas Diederich, Tilo Döppner, Josef Tiggesbäumker, and Karl-Heinz Meiwes-Broer                                    |        |
| <b>Nonlinear Dynamics, Fluid Dynamics, Classical Optics, etc.</b>                                                                                       |        |
| Mesoscopic Correlation with Polarization Rotation of Electromagnetic Waves .....                                                                        | 173901 |
| A. A. Chabanov, N.P. Trégourès, B. A. van Tiggelen, and A.Z. Genack                                                                                     |        |
| Impact of Weak Localization in the Time Domain .....                                                                                                    | 173902 |
| S.K. Cheung, X. Zhang, Z.Q. Zhang, A.A. Chabanov, and A.Z. Genack                                                                                       |        |
| Reactive Particles in Random Flows .....                                                                                                                | 174101 |
| György Károlyi, Tamás Tél, Alessandro P.S. de Moura, and Celso Grebogi                                                                                  |        |
| Diffusion and Mixing in Gravity-Driven Dense Granular Flows .....                                                                                       | 174301 |
| Jaehyuk Choi, Arshad Kudrolli, Rodolfo R. Rosales, and Martin Z. Bazant                                                                                 |        |
| Noise, Coherent Fluctuations, and the Onset of Order in an Oscillated Granular Fluid .....                                                              | 174302 |
| Daniel I. Goldman, J.B. Swift, and Harry L. Swinney                                                                                                     |        |
| Cavitation Inception on Microparticles: A Self-Propelled Particle Accelerator .....                                                                     | 174501 |
| Manish Arora, Claus-Dieter Ohl, and Knud Aage Mørch                                                                                                     |        |
| Ordering Phenomena in Cooling Granular Mixtures .....                                                                                                   | 174502 |
| C. Cattuto and Umberto Marini Bettolo Marconi                                                                                                           |        |
| <b>Plasma and Beam Physics</b>                                                                                                                          |        |
| Space-Charge Driven Emittance Growth in a 3D Mismatched Anisotropic Beam .....                                                                          | 174801 |
| Ji Qiang, Robert D. Ryne, and Ingo Hofmann                                                                                                              |        |
| Strong Reduction of the Degree of Spatial Coherence of a Laser Beam Propagating through a Preformed Plasma .....                                        | 175001 |
| P. Michel, C. Labaune, H.C. Bandulet, K. Lewis, S. Depierreux, S. Hulin, G. Bonnaud, V.T. Tikhonchuk, S. Weber, G. Riazuelo, H.A. Baldi, and A. Michard |        |
| Modeling of a Lower-Hybrid Current Drive by Including Spectral Broadening Induced by Parametric Instability in Tokamak Plasmas .....                    | 175002 |
| R. Cesario, A. Cardinali, C. Castaldo, F. Paoletti, and D. Mazon                                                                                        |        |
| Highly Efficient Relativistic-Ion Generation in the Laser-Piston Regime .....                                                                           | 175003 |
| T. Esirkepov, M. Borghesi, S.V. Bulanov, G. Mourou, and T. Tajima                                                                                       |        |
| Highly Resolved Fluid Flows: “Liquid Plasmas” at the Kinetic Level .....                                                                                | 175004 |
| Gregor E. Morfill, Milenko Rubin-Zuzic, Hermann Rothermel, Alexei V. Ivlev, Boris A. Klumov, Hubertus M. Thomas, Uwe Konopka, and Victor Steinberg      |        |
| Bifurcation and Lorentz-Factor Scaling of Relativistic Magnetized Plasma Expansion .....                                                                | 175005 |
| Edison Liang and Kazumi Nishimura                                                                                                                       |        |
| Theory for Explosive Ideal Magnetohydrodynamic Instabilities in Plasmas .....                                                                           | 175006 |
| H.R. Wilson and S.C. Cowley                                                                                                                             |        |
| Amplification of Ultrashort Laser Pulses by a Resonant Raman Scheme in a Gas-Jet Plasma .....                                                           | 175007 |
| Yuan Ping, Weifeng Cheng, Szymon Suckewer, Daniel S. Clark, and Nathaniel J. Fisch                                                                      |        |
| <b>Condensed Matter: Structure, etc.</b>                                                                                                                |        |
| Excitations of the Orbital Order in RMnO <sub>3</sub> Manganites: Light Scattering Experiments .....                                                    | 175501 |
| L. Martín-Carrón and A. de Andrés                                                                                                                       |        |

*(Continued on Preceding Page)*

*Contents (Continued)*

|                                                                                                                                                       |        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Mechanical Properties of Nanosprings .....                                                                                                            | 175502 |
| Alexandre F. da Fonseca and Douglas S. Galvão                                                                                                         |        |
| Stability and Mobility of Mono- and Di-Interstitials in $\alpha$ -Fe .....                                                                            | 175503 |
| Chu-Chun Fu, F. Willaime, and P. Ordejón                                                                                                              |        |
| Driving Force of Stacking-Fault Formation in SiC <i>p-i-n</i> Diodes .....                                                                            | 175504 |
| S. Ha, M. Skowronski, J.J. Sumakeris, M.J. Paisley, and M.K. Das                                                                                      |        |
| Metal-to-Semimetal Transition in Supercooled Liquid Silicon .....                                                                                     | 175701 |
| S.S. Ashwin, U.V. Waghmare, and Srikanth Sastry                                                                                                       |        |
| Bridging the Gap between Macro- and Nanotribology: A Quartz Crystal Microbalance Study of Tricresylphosphate Uptake on Metal and Oxide Surfaces ..... | 176101 |
| M. Abdelmaksoud, J.W. Bender, and J. Krim                                                                                                             |        |
| Nanotube Wires on Commensurate InAs Surfaces: Binding Energies, Band Alignments, and Bipolar Doping by the Surfaces .....                             | 176102 |
| Yong-Hyun Kim, M.J. Heben, and S.B. Zhang                                                                                                             |        |
| Surfactant-Induced Surface Freezing at the Alkane-Water Interface .....                                                                               | 176103 |
| Qunfang Lei and Colin D. Bain                                                                                                                         |        |
| “Hot-Atom” O <sub>2</sub> Dissociation and Oxide Nucleation on Al(111) .....                                                                          | 176104 |
| Lucio Colombi Ciacchi and Mike C. Payne                                                                                                               |        |
| <b>Condensed Matter: Electronic Properties, etc.</b>                                                                                                  |        |
| Nonunitary Spin-Charge Separation in a One-Dimensional Fermion Gas .....                                                                              | 176401 |
| Vadim V. Cheianov and M.B. Zvonarev                                                                                                                   |        |
| Angular Distribution of Photoluminescence as a Probe of Bose Condensation of Trapped Excitons .....                                                   | 176402 |
| Jonathan Keeling, L.S. Levitov, and P.B. Littlewood                                                                                                   |        |
| Mott Transition and Suppression of Orbital Fluctuations in Orthorhombic 3d <sup>1</sup> Perovskites .....                                             | 176403 |
| E. Pavarini, S. Biermann, A. Poteryaev, A.I. Lichtenstein, A. Georges, and O.K. Andersen                                                              |        |
| Transition between Quantum States in a Parallel-Coupled Double Quantum Dot .....                                                                      | 176801 |
| J.C. Chen, A.M. Chang, and M.R. Melloch                                                                                                               |        |
| Observation of “Partial Coherence” in an Aharonov-Bohm Interferometer with a Quantum Dot .....                                                        | 176802 |
| Hisashi Aikawa, Kensuke Kobayashi, Akira Sano, Shingo Katsumoto, and Yasuhiro Iye                                                                     |        |
| Are Current-Induced Forces Conservative? .....                                                                                                        | 176803 |
| M. Di Ventra, Y.-C. Chen, and T.N. Todorov                                                                                                            |        |
| Frequency Scales for Current Statistics of Mesoscopic Conductors .....                                                                                | 176804 |
| K.E. Nagaev, S. Pilgram, and M. Büttiker                                                                                                              |        |
| Coulomb Blockade of Proximity Effect at Large Conductance .....                                                                                       | 176805 |
| P.M. Ostrovsky, M.A. Skvortsov, and M.V. Feigel'man                                                                                                   |        |
| Nondemolition Measurements of a Single Quantum Spin using Josephson Oscillations .....                                                                | 177001 |
| L. Bulaevskii, M. Hruška, A. Shnirman, D. Smith, and Yu. Makhlin                                                                                      |        |
| Staggered Flux Vortices and the Superconducting Transition in the Layered Cuprates .....                                                              | 177002 |
| Carsten Honerkamp and Patrick A. Lee                                                                                                                  |        |
| Test of the Wiedemann-Franz Law in an Optimally Doped Cuprate .....                                                                                   | 177003 |
| Romain Bel, Kamran Behnia, Cyril Proust, Peter van der Linden, Duncan Maude, and Sergey I. Vedenev                                                    |        |
| Thermopower Induced by a Supercurrent in Superconductor–Normal-Metal Structures .....                                                                 | 177004 |
| Pauli Virtanen and Tero T. Heikkilä                                                                                                                   |        |
| Competition between Helimagnetism and Commensurate Quantum Spin Correlations in LiCu <sub>2</sub> O <sub>2</sub> .....                                | 177201 |
| T. Masuda, A. Zheludev, A. Bush, M. Markina, and A. Vasiliev                                                                                          |        |
| Ordering and Excitations in the Field-Induced Magnetic Phase of Cs <sub>3</sub> Cr <sub>2</sub> Br <sub>9</sub> .....                                 | 177202 |
| B. Grenier, Y. Inagaki, L.P. Regnault, A. Wildes, T. Asano, Y. Ajiro, E. Lhotel, C. Paulsen, T. Ziman, and J.P. Boucher                               |        |
| Griffiths Phase in Diluted Magnetic Semiconductors .....                                                                                              | 177203 |
| V.M. Galitski, A. Kaminski, and S. Das Sarma                                                                                                          |        |
| Time-Resolved Fluorescence of Carbon Nanotubes and Its Implication for Radiative Lifetimes .....                                                      | 177401 |
| Feng Wang, Gordana Dukovic, Louis E. Brus, and Tony F. Heinz                                                                                          |        |

*(Continued on Preceding Page)*

## Contents (Continued)

|                                                                                                                                                                          |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Femtosecond Study of the Interplay between Excitons, Trions, and Carriers in (Cd,Mn)Te Quantum Wells .....                                                               | 177402 |
| P. Plochocka, P. Kossacki, W. Mařłana, J. Cibert, S. Tatarenko, C. Radzewicz, and J.A. Gaj                                                                               |        |
| <b>Interdisciplinary Physics: Biological Physics, Quantum Information, etc.</b>                                                                                          |        |
| Generation and Characterization of Werner States and Maximally Entangled Mixed States by a Universal Source of Entanglement .....                                        | 177901 |
| M. Barbieri, F. De Martini, G. Di Nepi, and P. Mataloni                                                                                                                  |        |
| Efficient Decomposition of Quantum Gates .....                                                                                                                           | 177902 |
| Juha J. Vartiainen, Mikko Möttönen, and Martti M. Salomaa                                                                                                                |        |
| Tripartite Quantum State Sharing .....                                                                                                                                   | 177903 |
| Andrew M. Lance, Thomas Symul, Warwick P. Bowen, Barry C. Sanders, and Ping Koy Lam                                                                                      |        |
| Magnetic Phase Shifter for Superconducting Qubits .....                                                                                                                  | 177904 |
| D.S. Golubović, W.V. Pogosov, M. Morelle, and V.V. Moshchalkov                                                                                                           |        |
| Distinguishability and Indistinguishability by Local Operations and Classical Communication .....                                                                        | 177905 |
| Heng Fan                                                                                                                                                                 |        |
| Exponential Speedup with a Single Bit of Quantum Information: Measuring the Average Fidelity Decay .....                                                                 | 177906 |
| David Poulin, Robin Blume-Kohout, Raymond Laflamme, and Harold Ollivier                                                                                                  |        |
| Anomalous Diffusion Probes Microstructure Dynamics of Entangled F-Actin Networks .....                                                                                   | 178101 |
| I. Y. Wong, M.L. Gardel, D.R. Reichman, Eric R. Weeks, M.T. Valentine, A.R. Bausch, and D.A. Weitz                                                                       |        |
| Dephasing of Solid-State Qubits at Optimal Points .....                                                                                                                  | 178301 |
| Yuriy Makhlin and Alexander Shnirman                                                                                                                                     |        |
| Nonvolatile Memory with Multilevel Switching: A Basic Model .....                                                                                                        | 178302 |
| M.J. Rozenberg, I.H. Inoue, and M.J. Sánchez                                                                                                                             |        |
| Velocity and Hierarchical Spread of Epidemic Outbreaks in Scale-Free Networks .....                                                                                      | 178701 |
| Marc Barthélemy, Alain Barrat, Romualdo Pastor-Satorras, and Alessandro Vespignani                                                                                       |        |
| Hierarchy Measures in Complex Networks .....                                                                                                                             | 178702 |
| Ala Trusina, Sergei Maslov, Petter Minnhagen, and Kim Sneppen                                                                                                            |        |
| <b>Comments</b>                                                                                                                                                          |        |
| Comment on “Higher Surface Energy of Free Nanoparticles” .....                                                                                                           | 179601 |
| H.M. Lu and Q. Jiang                                                                                                                                                     |        |
| Nanda <i>et al.</i> Reply .....                                                                                                                                          | 179602 |
| K.K. Nanda, A. Maisels, F.E. Kruis, H. Fissan, and S. Stappert                                                                                                           |        |
| <b>Errata</b>                                                                                                                                                            |        |
| Erratum: Electron and Orbital Correlations in $\text{Ca}_{2-x}\text{Sr}_x\text{RuO}_4$ Probed by Optical Spectroscopy [Phys. Rev. Lett. <b>89</b> , 257402 (2002)] ..... | 179901 |
| J.S. Lee, Y.S. Lee, T.W. Noh, S.-J. Oh, Jaejun Yu, S. Nakatsuji, H. Fukazawa, and Y. Maeno                                                                               |        |