

# PROCEEDINGS OF SPIE

## ***Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VI***

**Wayne S. Holland  
Jonas Zmuidzinas**  
*Editors*

**3–6 July 2012  
Amsterdam, Netherlands**

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SPIE

**Volume 8452**  
Part One of Two Parts

Proceedings of SPIE 0277-786X, v. 8452

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VI,  
edited by Wayne S. Holland, Jonas Zmuidzinas, Proc. of SPIE Vol. 8452,  
845201 © 2012 SPIE · CCC code: 0277-786X/12/\$18 · doi: 10.1117/12.1000040

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

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Author(s), "Title of Paper," in *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VI*, edited by Wayne S. Holland, Jonas Zmuidzinas, Proceedings of SPIE Vol. 8452 (SPIE, Bellingham, WA, 2012) Article CID Number.

ISSN: 0277-786X

ISBN: 9780819491534

Published by

**SPIE**

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

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Printed in the United States of America.

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 B. Shillue, W. Grammer, C. Jacques, National Radio Astronomy Observatory (United States); R. Brito, ALMA Observatory (Chile); J. Meadows, J. Castro, National Radio Astronomy Observatory (United States); Y. Masui, Fujitsu TEN, Ltd. (United States); R. Treacy, National Radio Astronomy Observatory (United States); J.-F. Cliche, TeraXion Inc. (Canada)
- 8452 17 **Performance highlights of the ALMA correlators** [8452-43]  
 A. Baudry, Lab. de Biogenèse Membranaire, CNRS, Univ. Bordeaux (France) and European Southern Observatory (Germany); R. Lacasse, R. Escoffier, J. Webber, J. Greenberg, L. Platt, R. Treacy, National Radio Astronomy Observatory (United States); A. F. Saez, ALMA Observatory (Chile); P. Cais, Lab. de Biogenèse Membranaire, CNRS, Univ. Bordeaux (France); G. Comoretto, INAF - Osservatorio Astrofisico di Arcetri (Italy); B. Quertier, Lab. de Biogenèse Membranaire, CNRS, Univ. Bordeaux (France); S. K. Okumura, National Astronomical Observatory of Japan (Japan); T. Kamazaki, ALMA Observatory (Chile);

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T. Okuda, Nagoya Univ. (Japan); Y. Kurono, S. Iguchi, National Astronomical Observatory  
of Japan (Japan)

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**SESSION 9 CMB INSTRUMENTATION: CURRENT/NEAR TERM**

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- 8452 1A **BICEP2 and Keck array operational overview and status of observations** [8452-46]  
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and Cosmology (United States); P. A. R. Ade, Cardiff Univ. (United Kingdom); R. W. Aikin,  
California Institute of Technology (United States); M. Amiri, The Univ. of British Columbia  
(Canada); S. J. Benton, Univ. of Toronto (Canada); C. A. Bischoff, Harvard-Smithsonian Ctr.  
for Astrophysics (United States); J. J. Bock, Jet Propulsion Lab. (United States) and California  
Institute of Technology (United States); J. A. Bonetti, Jet Propulsion Lab. (United States);  
J. A. Brevik, California Institute of Technology (United States); E. Bullock, Univ. of Minnesota  
(United States); B. Burger, The Univ. of British Columbia (Canada); G. Davis, The Univ. of  
British Columbia (Canada); C. D. Dowell, Jet Propulsion Lab. (United States) and California  
Institute of Technology (United States); L. Duband, Service des Basses Températures, CNRS,  
Univ. Joseph Fourier (France); J. P. Filippini, California Institute of Technology (United  
States); S. Fliescher, Univ. of Minnesota (United States); S. R. Golwala, California Institute of  
Technology (United States); M. Gordon, Harvard-Smithsonian Ctr. for Astrophysics (United  
States); M. Halpern, M. Hasselfield, The Univ. of British Columbia (Canada); G. Hilton,  
National Institute of Standards and Technology (United States); V. V. Hristov, H. Hui,  
California Institute of Technology (United States); K. Irwin, National Institute of Standards  
and Technology (United States); J. P. Kaufman, B. G. Keating, Univ. of California, San Diego  
(United States); S. A. Kerasovskiy, Stanford Univ. (United States); J. M. Kovac, Harvard-  
Smithsonian Ctr. for Astrophysics (United States); C. L. Kuo, Stanford Univ. (United States)  
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E. M. Leitch, The Univ. of Chicago (United States); M. Lueker, Jet Propulsion Lab. (United  
States) and California Institute of Technology (United States); T. Montroy, Case Western  
Reserve Univ. (United States); C. B. Netterfield, Univ. of Toronto (Canada); H. T. Nguyen,  
R. O'Brien, Jet Propulsion Lab. (United States) and California Institute of Technology (United  
States); A. Orlando, Univ. of California, San Diego (United States); C. L. Pryke, Univ. of  
Minnesota (United States); C. Reintsema, National Institute of Standards and Technology  
(United States); S. Richter, Harvard-Smithsonian Ctr. for Astrophysics (United States);  
J. E. Ruhl, Case Western Reserve Univ. (United States); M. C. Runyan, California Institute of  
Technology (United States); R. Schwarz, C. D. Sheehy, Univ. of Minnesota (United States);  
Z. K. Staniszewski, Jet Propulsion Lab. (United States) and California Institute of Technology  
(United States); R. V. Sudiwala, Cardiff Univ. (United Kingdom); G. P. Teply, California  
Institute of Technology (United States); K. Thompson, Stanford Univ. (United States);  
J. E. Tolan, Stanford Univ. (United States) and Kavli Institute for Particle Astrophysics and  
Cosmology (United States); A. D. Turner, Jet Propulsion Lab. (United States);  
A. G. Vieregg, Harvard-Smithsonian Ctr. for Astrophysics (United States); D. V. Wiebe, The  
Univ. of British Columbia (Canada); P. Wilson, Jet Propulsion Lab. (United States);  
C. L. Wong, Harvard-Smithsonian Ctr. for Astrophysics (United States)
- 8452 1B **Optimization and sensitivity of the Keck Array** [8452-47]  
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and Cosmology (United States); P. A. R. Ade, Univ. of Wales, Cardiff (United Kingdom);  
R. W. Aikin, California Institute of Technology (United States); M. Amiri, The Univ. of British  
Columbia (Canada); S. Benton, Univ. of Toronto (Canada); C. Bischoff, Harvard-  
Smithsonian Ctr. for Astrophysics (United States); J. J. Bock, California Institute of

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8452 1C

**The POLARBEAR experiment** [8452-48]

Z. D. Kermish, Univ. of California, Berkeley (United States); P. Ade, Cardiff Univ. (United Kingdom); A. Anthony, Univ. of Colorado at Boulder (United States); K. Arnold, Univ. of California, Berkeley (United States); D. Barron, D. Boettger, Univ. of California, San Diego (United States); J. Borrill, Lawrence Berkeley National Lab. (United States) and Univ. of California, Berkeley (United States); S. Chapman, Dalhousie Univ. (Canada); Y. Chinone, High Energy Accelerator Research Organization (Japan); M. A. Dobbs, McGill Univ. (Canada); J. Errard, G. Fabbian, Lab. Astroparticule et Cosmologie, CNRS, Univ. Paris 7 (France); D. Flanigan, Univ. of California, Berkeley (United States); G. Fuller, Univ. of California, San Diego (United States); A. Ghribi, Univ. of California, Berkeley (United States); W. Grainger, Science & Technology Facilities Council (United Kingdom); N. Halverson, Univ. of Colorado at Boulder (United States); M. Hasegawa, K. Hattori, M. Hazumi, High Energy Accelerator Research Organization (Japan); W. L. Holzappel, J. Howard, Univ. of California, Berkeley (United States); P. Hyland, Austin College (United States); A. Jaffe, Imperial College London (United Kingdom); B. Keating, Univ. of California, San Diego (United States); T. Kisner, Lawrence Berkeley National Lab. (United States); A. T. Lee, Univ. of California, Berkeley (United States); M. Le Jeune, Lab. Astroparticule et Cosmologie, CNRS, Univ. Paris 7 (France); E. Linder, Lawrence Berkeley National Lab. (United States); M. Lungu, Univ. of California, Berkeley (United States); F. Matsuda, Univ. of California, San Diego (United States); T. Matsumura, High Energy Accelerator Research Organization (Japan); X. Meng, Univ. of California, Berkeley (United States); N. J. Miller, Univ. of California, San Diego (United States); H. Morii, High Energy Accelerator Research Organization (Japan);

S. Moyerman, Univ. of California, San Diego (United States); M. J. Myers, H. Nishino, Univ. of California, Berkeley (United States); H. Paar, Univ. of California, San Diego (United States); E. Quealy, C. L. Reichardt, P. L. Richards, Univ. of California, Berkeley (United States); C. Ross, Dalhousie Univ. (Canada); A. Shimizu, High Energy Accelerator Research Organization (Japan); M. Shimon, Univ. of California, San Diego (United States); C. Shimmin, Univ. of California, Berkeley (United States); M. Sholl, Lawrence Berkeley National Lab. (United States); P. Siritanasak, Univ. of California, San Diego (United States); H. Spieler, Lawrence Berkeley National Lab. (United States); N. Stebor, Univ. of California, San Diego (United States); B. Steinbach, Univ. of California, Berkeley (United States); R. Stompor, Lab. Astroparticule et Cosmologie, CNRS, Univ. Paris 7 (France); A. Suzuki, Univ. of California, Berkeley (United States); T. Tomaru, High Energy Accelerator Research Organization (Japan); C. Tucker, Cardiff Univ. (United Kingdom); O. Zahn, Lawrence Berkeley National Lab. (United States) and Univ. of California, Berkeley (United States)

8452 1D

**The bolometric focal plane array of the POLARBEAR CMB experiment [8452-49]**

K. Arnold, Univ. of California, Berkeley (United States); P. A. R. Ade, Cardiff Univ. (United Kingdom); A. E. Anthony, Univ. of Colorado at Boulder (United States); D. Barron, D. Boettger, Univ. of California, San Diego (United States); J. Borrill, Lawrence Berkeley National Lab. (United States) and Univ. of California, Berkeley (United States); S. Chapman, Dalhousie Univ. (Canada); Y. Chinone, High Energy Accelerator Research Organization (Japan); M. A. Dobbs, McGill Univ. (Canada); J. Errard, G. Fabbian, Lab. Astroparticule et Cosmologie, CNRS, Univ. Paris 7 (France); D. Flanigan, Univ. of California, Berkeley (United States); G. Fuller, Univ. of California, San Diego (United States); A. Ghribi, Univ. of California, Berkeley (United States); W. Grainger, Science and Technology Facilities Council (United Kingdom); N. Halverson, Univ. of Colorado at Boulder (United States); M. Hasegawa, K. Hattori, M. Hazumi, High Energy Accelerator Research Organization (Japan); W. L. Holzapfel, J. Howard, Univ. of California, Berkeley (United States); P. Hyland, Austin College (United States); A. Jaffe, Lawrence Berkeley National Lab. (United States); B. Keating, Univ. of California, San Diego (United States); Z. Kermish, Univ. of California, Berkeley (United States); T. Kisner, Lawrence Berkeley National Lab. (United States); M. Le Jeune, Lab. Astroparticule et Cosmologie, CNRS, Univ. Paris 7 (France); A. T. Lee, Univ. of California, Berkeley (United States) and Lawrence Berkeley National Lab. (United States); E. Linder, Science and Technology Facilities Council (United Kingdom); M. Lungu, Univ. of California, Berkeley (United States); F. Matsuda, Univ. of California, San Diego (United States); T. Matsumura, High Energy Accelerator Research Organization (Japan); N. J. Miller, Univ. of California, San Diego (United States); X. Meng, Univ. of California, Berkeley (United States); H. Morii, High Energy Accelerator Research Organization (Japan); S. Moyerman, Univ. of California, San Diego (United States); M. J. Myers, H. Nishino, Univ. of California, Berkeley (United States); H. Paar, Univ. of California, San Diego (United States); E. Quealy, C. Reichardt, P. L. Richards, Univ. of California, Berkeley (United States); C. Ross, Dalhousie Univ. (Canada); A. Shimizu, High Energy Accelerator Research Organization (Japan); C. Shimmin, Univ. of California, Berkeley (United States); M. Shimon, Univ. of California, San Diego (United States); M. Sholl, Lawrence Berkeley National Lab. (United States); P. Siritanasak, Univ. of California, San Diego (United States); H. Spieler, Lawrence Berkeley National Lab. (United States); N. Stebor, Univ. of California, San Diego (United States); B. Steinbach, Univ. of California, Berkeley (United States); R. Stompor, Lab. Astroparticule et Cosmologie, CNRS, Univ. Paris 7 (France); A. Suzuki, Univ. of California, Berkeley (United States); T. Tomaru, High Energy Accelerator Research Organization (Japan); C. Tucker, Cardiff Univ. (United Kingdom); O. Zahn, Univ. of California, Berkeley (United States) and Lawrence Berkeley National Lab. (United States)

- 8452 1E **SPTpol: an instrument for CMB polarization measurements with the South Pole Telescope** [8452-50]  
J. E. Austermann, Univ. of Colorado, Boulder (United States); K. A. Aird, The Univ. of Chicago (United States); J. A. Beall, D. Becker, National Institute of Standards and Technology (United States); A. Bender, McGill Univ. (Canada); B. A. Benson, L. E. Bleem, The Univ. of Chicago (United States); J. Britton, National Institute of Standards and Technology (United States); J. E. Carlstrom, C. L. Chang, The Univ. of Chicago (United States) and Argonne National Lab. (United States); H. C. Chiang, The Univ. of Chicago (United States); H.-M. Cho, National Institute of Standards and Technology (United States); T. M. Crawford, A. T. Crites, The Univ. of Chicago (United States); A. Datesman, Argonne National Lab. (United States); T. de Haan, M. A. Dobbs, McGill Univ. (Canada); E. M. George, Univ. of California, Berkeley (United States); N. W. Halverson, Univ. of Colorado at Boulder (United States); N. Harrington, Univ. of California, Berkeley (United States); J. W. Henning, Univ. of Colorado at Boulder (United States); G. C. Hilton, National Institute of Standards and Technology (United States); G. P. Holder, McGill Univ. (Canada); W. L. Holzapfel, Univ. of California, Berkeley (United States); S. Hoover, N. Huang, The Univ. of Chicago (United States); J. Hubmayr, K. D. Irwin, National Institute of Standards and Technology (United States); R. Keisler, The Univ. of Chicago (United States); J. Kennedy, McGill Univ. (Canada); L. Knox, Univ. of California, Davis (United States); A. T. Lee, Univ. of California, Berkeley (United States); E. Leitch, The Univ. of Chicago (United States); D. Li, National Institute of Standards and Technology (United States); M. Lueker, California Institute of Technology (United States); D. P. Marrone, The Univ. of Arizona (United States); J. J. McMahon, Univ. of Michigan (United States); J. Mehl, S. S. Meyer, The Univ. of Chicago (United States); T. E. Montroy, Case Western Reserve Univ. (United States); T. Natoli, The Univ. of Chicago (United States); J. P. Nibarger, M. D. Niemack, National Institute of Standards and Technology (United States); V. Novosad, Argonne National Lab. (United States); S. Padin, The Univ. of Chicago (United States); C. Pryke, Univ. of Minnesota (United States); C. L. Reichardt, Univ. of California, Berkeley (United States); J. E. Ruhl, B. R. Saliwanchik, J. T. Sayre, Case Western Reserve Univ. (United States); K. K. Schaffer, The School of the Art Institute of Chicago (United States); E. Shirokoff, California Institute of Technology (United States); A. A. Stark, Harvard-Smithsonian Ctr. for Astrophysics (United States); K. Story, The Univ. of Chicago (United States); K. Vanderlinde, McGill Univ. (Canada); J. D. Vieira, California Institute of Technology (United States); G. Wang, Argonne National Lab. (United States); R. Williamson, The Univ. of Chicago (United States); V. Yefremenko, Argonne National Lab. (United States); K. W. Yoon, National Institute of Standards and Technology (United States); O. Zahn, Univ. of California, Berkeley (United States)
- 8452 1F **Performance and on-sky optical characterization of the SPTpol instrument** [8452-51]  
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8452 1G

**Antenna-coupled TES bolometers for the Keck Array, Spider, and Polar-1 [8452-52]**

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8452 1H **The POLARBEAR-2 experiment** [8452-53]

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**SESSION 11 CMB INSTRUMENTATION: NEW DEVELOPMENTS II**

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8452 1J **The Primordial Inflation Polarization Explorer (PIPER)** [8452-55]

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Johns Hopkins Univ. (United States); D. J. Fixsen, NASA Goddard Space Flight Ctr. (United States); M. Halpern, The Univ. of British Columbia (Canada); G. Hilton, National Institute of Standards and Technology (United States); J. Hinderks, NASA Goddard Space Flight Ctr. (United States); G. F. Hinshaw, The Univ. of British Columbia (Canada); K. Irwin, National Institute of Standards and Technology (United States); C. Jhabvala, NASA Goddard Space Flight Ctr. (United States); B. Johnson, Columbia Univ. (United States); J. Lazear, Johns Hopkins Univ. (United States); L. Lowe, T. Miller, P. Mirel, S. H. Moseley, S. Rodriguez, E. Sharp, J. G. Staguhn, NASA Goddard Space Flight Ctr. (United States); C. E. Tucker, Cardiff Univ. (United Kingdom); A. Weston, E. J. Wollack, NASA Goddard Space Flight Ctr. (United States)

8452 1L **MuSE: a novel experiment for CMB polarization measurement using highly multimoded bolometers** [8452-57]  
A. Kusaka, Princeton Univ. (United States); D. J. Fixsen, A. J. Kogut, NASA Goddard Space Flight Ctr. (United States); S. S. Meyer, The Univ. of Chicago (United States); S. T. Staggs, Princeton Univ. (United States); T. R. Stevenson, NASA Goddard Space Flight Ctr. (United States)

8452 1M **GroundBIRD: an experiment for CMB polarization measurements at a large angular scale from the ground** [8452-58]  
O. Tajima, High Energy Accelerator Research Organization (Japan) and The Graduate Univ. for Advanced Studies (Japan); J. Choi, Korea Univ. (Korea, Republic of); M. Hazumi, High Energy Accelerator Research Organization (Japan) and The Graduate Univ. for Advanced Studies (Japan); H. Ishitsuka, The Graduate Univ. for Advanced Studies (Japan); M. Kawai, High Energy Accelerator Research Organization (Japan); M. Yoshida, High Energy Accelerator Research Organization (Japan) and The Graduate Univ. for Advanced Studies (Japan)

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- 8452 1Y **Phase-controlled polarization modulators** [8452-70]  
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H. T. Nguyen, R. O'Brient, California Institute of Technology (United States) and Jet Propulsion Lab. (United States); R. W. Ogburn, Stanford Univ. (United States); C. Pryke, Univ. of Minnesota (United States); J. E. Ruhl, Case Western Reserve Univ. (United States); M. Runyan, California Institute of Technology (United States); R. Schwarz, Univ. of Minnesota (United States); C. Sheehy, Univ. of Minnesota (United States) and The Univ. of Chicago (United States); Z. Staniszewski, California Institute of Technology (United States) and Jet Propulsion Lab. (United States); R. Sudiwala, Univ. of Wales, Cardiff (United Kingdom); G. Teply, California Institute of Technology (United States); J. Tolan, Stanford Univ. (United States); . D. Turner, P. Wilson, Jet Propulsion Lab. (United States); C. L. Wong, Harvard-Smithsonian Ctr. for Astrophysics (United States)

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(United States); J. Zmuidzinis, California Institute of Technology (United States) and Univ. of Minnesota (United States)

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