Charles M. (Matt) Bradford

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PROFESSIONAL PREPARATION

Stanford University	Bachelor of Science in Physics	1994
Cornell University	Ph.D. Astronomy and Instrumentation	2001

Dissertation: "The Warm Dense Gas in the Central Two Parsecs of the Galaxy: Observations with SPIFI, a New Direct-Detection Submillimeter Spectrometer"

California Institute of Technology	Millikan Prize Postdoctoral Scholar	2001-2003

APPOINTMENTS

2003–present Research Scientist, Jet Propulsion Laboratory, Director's Fellow 2003-2006
2003–present Visiting Faculty Associate, Caltech Department of Physics

AWARDS

2006 NASA Group Achievement Award for Z-Spec Development
2009 Lew Allen Award for Early Career Excellence, Jet Propulsion Laboratory

SELECTED CURRENT RESEARCH ACTIVITIES

2003- PI: SPICA instrument development. Developing concepts for SPICA instrument contributions based on using US far-IR detectors and spectrometers. Developing science case, leading detector development efforts with NASA Strategic Astrophysics Technology (SAT) funding (FY 2018-), interfacing with international partners, primarily at Space Research Organization of the Netherlands (SRON).

2011- PI: SuperSpec technology development. SuperSpec is a novel on-chip submm/ mm-wave spectrometer formed with an array of superconducting filters coupled to direct detectors built in the JPL microdevices lab. Leading 4-institution team developing a R=300 spectrometer chip to cover the full 185 to 320 GHz band, and preparing 1800-pixel demonstration instrument for the Large Millimeter Telescope (LMT).

2016- Instrument PI, study team member: NASA Far-IR Surveyor (now Origins Space Telescope science and technology definition team (STDT). Leading survey spectrograph (OSS) instrument, the workhorse general astrophysics instrument on OST. Co-leading early-Universe science working group.

2016- Co-PI, detector lead: Development of background-limited kinetic-inductance detectors (KIDs) for balloon-borne far-IR spectroscopy. Successfully demonstrated new direct-absorber-coupled aluminum KID which exceeds sensitivity requirements for STARFIRE Balloon experiment. Also a key co-I in STARFIRE concept development and proposal preparation.

2011- Co-PI and science lead: Development of ultrasensitive quantum capacitance detectors (QCD) for far-IR space astrophysics (with Pierre Echternach in Section 389). Key contributions to interpretation of measurements, specification of experimental approach, designing waveguide spectrometer testing apparatus, and preparation for successful NASA APRA proposals.

2012- Co-PI: Development of TIME-Pilot millimeter-wave imaging spectrometer experiment to probe [CII] in the epoch of reionization. Developing science case, designed grating spectrometer, guiding bolometer array development.

2011-2014 PI: Caltech-funded design study of wideband multi-object spectrometer concepts for ground-based submm / mm telescopes such as CCAT. Forms community's vision for a possibilities with new and/or upgraded single-dish telescopes.

2010-2017 PI: Herschel General Observer program studying conditions around early-universe active galactic nuclei using mid- and far-IR fine-structure transitions.

2001- Co-I, instrument lead: Z-Spec. Z-Spec is a broadband mm-wave spectrograph covering the 190-305 GHz band with an array of 160 bolometers cooled to 60 mK. Roles: developed the overall instrument system-level concept; developed and demonstrated a new two-dimensional waveguide grating technology, lead the instrument build, testing, and commissioning. Currently supporting studies of move of Caltech Submillimeter Observatory to Chile.

MENTORING

Ph.D. Students: Bret Naylor (w/ Jonas Zmuidzinas at Caltech). Currently at JPL Div 35
Bade Uzgil (w/ James Aguirre at U. Penn). Currently at MPIA Heidelberg
Joe Redford (current Physics student at Caltech)

Postdocs: Andrew Beyer. Currently JPL Div 38
Steve Hailey-Dunsheath. Currently Caltech Research Scientist

SELECTED PUBLICATIONS:

Sun, G.; Moncelsi, L.; Viero, M. P.; Silva, M. B.; Bock, J.; Bradford, C. M.; Chang, T.-C.; Cheng, Y.-T.; Cooray, A. R.; Crites, A.; Hailey-Dunsheath, S.; Uzgil, B.; Hunacek, J. R.; Zemcov, M. 2018. ***A Foreground Masking Strategy for [C II] Intensity Mapping Experiments Using Galaxies Selected by Stellar Mass and Redshift.*** ApJ, 856, 107.

Miller, T. B.; Chapman, S. C.; Aravena, M.; Ashby, M. L. N.; Hayward, C. C.; Vieira, J. D.; Weiß, A.; Babul, A.; Béthermin, M.; Bradford, C. M.; Brodwin, M.; Carlstrom, J. E.; Chen, Chian-Chou; Cunningham, D. J. M.; De Breuck, C.; Gonzalez, A. H.; Greve, T. R.; Harnett, J.; Hezaveh, Y.; Lacaille, K.; Litke, K. C.; Ma, J.; Malkan, M.; Marrone, D. P.; Morningstar, W.; Murphy, E. J.; Narayanan, D.; Pass, E.; Perry, R.; Phadke, K. A.; Rennehan, D.; Rotermund, K. M.; Simpson, J.; Spilker, J. S.; Sreevani, J.; Stark, A. A.; Strandet, M. L.; Strom, A. L. 2018. ***A massive core for a cluster of galaxies at a redshift of 4.3.*** Nature 556, 7702.

Roelfsema, P. R.; Shibai, H.; Armus, L.; Arrazola, D.; Audard, M.; Audley, M. D.; Bradford, C. M.; Charles, I.; Dieleman, P.; Doi, Y.; Duband, L.; Eggens, M.; Evers, J.; Funaki, I.; Gao, J. R.; Giard, M.; González Fernández, A. di Giorgio L. M.; Griffin, M.; Helmich, F. P.; Hijmering, R.; Huisman, R.; Ishihara, D.; Isobe, N.; Jackson, B.; Jacobs, H.; Jellema, W.; Kamp, I.; Kaneda, H.; Kawada, M.; Kemper, F.; Kerschbaum, F.; Khosropanah, P.; Kohno, K.; Kooijman, P. P.; Krause, O.; van der Kuur, J.; Kwon, J.; Laauwen, W. M.; de Lange, G.; Larsson, B.; van Loon, D.; Madden, S. C.; Matsuhara, H.; Najarro, F.; Nakagawa, T.; Naylor, D.; Ogawa, H.; Onaka, T.; Oyabu, S.; Poglitsch, A.; Reveret, V.; Rodriguez, L.; Spinoglio, L.; Sakon, I.; Sato, Y.; Shinozaki, K.; Shipman, R.; Sugita, H.; Suzuki, T.; van der Tak, F. F. S.; Torres Redondo, J.; Wada, T.; Wang, S. Y.; Wafelbakker, C. K.; van Weers, H.; Withington, S.; Vandenbussche, B.; Yamada, T.; Yamamura, I. 2018. ***SPICA - a large cryogenic infrared space telescope Unveiling the obscured Universe.*** *Publications of the Astronomical Society of Australia*, in press.

Hailey-Dunsheath, S.; Barlis, A. C. M.; Aguirre, J. E.; Bradford, C. M.; Redford, J. G.; Billings, T. S.; LeDuc, H. G.; McKenney, C. M.; Hollister, M. I. 2018. ***Development of Aluminum LEKIDs for Balloon-Borne Far-IR Spectroscopy.*** *J. of Low Temp Phys*, in press (arXiv:1803.02470).

Echternach, P. M.; Pepper, B. J.; Reck, T.; Bradford, C. M. 2017. ***Single photon detection of 1.5 THz radiation with the quantum capacitance detector.*** Nature Astronomy, V.2, 90-97.

Wheeler, J.; Hailey-Dunsheath, S.; Shirokoff, E.; Barry, P. S.; Bradford, C. M.; Chapman, S.; Che, G.; Glenn, J.; Hollister, M.; Kovács, A.; LeDuc, H. G.; Mauskopf, P.; McGeehan, R.; McKenney, C. M.; O'Brient, R.; Padin, S.; Reck, T.; Ross, C.; Shiu, C.; Tucker, C. E.; Williamson, R.; Zmuidzinas, J. 2016. ***SuperSpec: development towards a full-scale filter bank.*** Proc. SPIE 9914, 99143K.

Uzgil, Bade D.; Bradford, C. Matt; Hailey-Dunsheath, Steve; Maloney, Philip R.; Aguirre, James E. 2016. ***Constraining the ISM Properties of the Cloverleaf Quasar Host Galaxy with Herschel Spectroscopy***. *ApJ* 832, 209.

Gullberg, B.; De Breuck, C.; Vieira, J. D.; Weiß, A.; Aguirre, J. E.; Aravena, M.; Béthermin, M.; Bradford, C. M.; Bothwell, M. S.; Carlstrom, J. E.; Chapman, S. C.; Fassnacht, C. D.; Gonzalez, A. H.; Greve, T. R.; Hezaveh, Y.; Holzapfel, W. L.; Husband, K.; Ma, J.; Malkan, M.; Marrone, D. P.; Menten, K.; Murphy, E. J.; Reichardt, C. L.; Spilker, J. S.; Stark, A. A.; Strandet, M.; Welikala, N. 2015. ***The nature of the [C II] emission in dusty star-forming galaxies from the SPT survey.*** *MNRAS*, 449, 2883.

Bradford, C. M.; Goldsmith, P. F.; Bolatto, A.; Armus, L.; Bauer, J.; Appleton, P.; Cooray, A.; Casey, C.; Dale, D.; Uzgil, B.; Aguirre, J.; Smith, J. D.; Sheth, K.; Murphy, E. J.; McKenney, C.; Holmes, W.; Rizzo, M.; Bergin, E.; Stacey, G. 2016. ***A Cryogenic Space Telescope for Far-Infrared Astrophysics: A Vision for NASA in the 2020 Decade***. arXiv: 1505.05551.

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Hailey-Dunsheath, S.; Shirokoff, E.; Barry, P. S.; Bradford, C. M.; Chapman, S.; Che, G.; Glenn, J.; Hollister, M.; Kovács, A.; LeDuc, H. G.; Mauskopf, P.; McKenney, C.; O'Brient, R.; Padin, S.; Reck, T.; Shiu, C.; Tucker, C. E.; Wheeler, J.; Williamson, R.; Zmuidzinas, J. 2015. ***Low Noise Titanium Nitride KIDs for SuperSpec: A Mm-Wave On-Chip Spectrometer***. *J. Low Temp. Physics* 184, 180.

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Lupu, R. E.; Scott, K. S.; Aguirre, J. E.; Aretxaga, I.; Auld, R.; Barton, E.; Beelen, A.; Bertoldi, F.; Bock, J. J.; Bonfield, D.; Bradford, C. M.; Buttiglione, S.; Cava, A.; Clements, D. L.; Cooke, J.; Cooray, A.; Dannerbauer, H.; Dariush, A.; De Zotti, G.; Dunne, L.; Dye, S.; Eales, S.; Frayer, D.; Fritz, J.; Glenn, J.; Hughes, D. H.; Ibar, E.; Ivison, R. J.; Jarvis, M. J.; Kamenetzky, J.; Kim, S.; Lagache, G.; Leeuw, L.; Maddox, S.; Maloney, P. R.; Matsuhara, H.; Murphy, E. J.; Naylor, B. J.; Negrello, M.; Nguyen, H.; Omont, A.; Pascale, E.; Pohlen, M.; Rigby, E.; Rodighiero, G.; Serjeant, S.; Smith, D.; Temi, P.; Thompson, M.; Valtchanov, I.; Verma, A.; Vieira, J. D.; Zmuidzinas, J.. et al., 2012. ***Measurements of CO Redshifts with Z-Spec for Lensed Submillimeter Galaxies Disovered in the H-ATLAS Survey***, *Astrophys. J.,* 757, 135.

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Uzgil, B.; Aguirre, J.E.; Bradford, C.M.; and Lidz, A., 2014. ***Measuring Galaxy Clustering and the Evolution of [C II] Mean Intensity with Far-IR Line Intensity Mapping during 0.5 < z < 1.5.*** *Astrophys. J.* 793, article 112.

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Bradford, C.M., Nikola, T., Stacey, G.J., Bolatto, A.D., Jackson, J.M., Savage, M.L., Davidson, J.A. 2005, ***High Resolution Imaging of CO (J=7->6) in the Central 2 pc of the Galaxy: Dynamical Heating of the Circumnuclear Disk***, *Astrophys. J.* 623, 866.

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Bradford, C.M., Stacey, G.J., Swain, M.R., Nikola, T., Bolatto, A.D., Jackson, J.M., Savage, M.L., Davidson, J.A. and Ade, P., 2002. ***SPIFI: A Direct-Detection Imaging Spectrometer for Submillimeter Wavelengths***, *Applied Optics*, 41, 2561–2575.