

Prof. Dr. Michael Vollmer



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Teaching

- experimental physics
- physical and technical optics
- laser physics
- vacuum physics
- spectroscopy
- infrared physics and technology
- thin film optics
- renewable energy
- English in physics and technology

Research

three main fields:

1) Infrared Thermal Imaging

- 2) Atmospheric optics / optics
 - 3) Didactics of physics, physics education research
- see also list of publications

Published books

Books:

1. U. Kreibitz und M. Vollmer:
Optical Properties of Metal Clusters,
Springer Series Materials Science 25, Springer (1995)
2. M. Vollmer
Lichtspiele in der Luft - atmosphärische Optik für Einsteiger
Spektrum-Elsevier (2005)
3. M. Vollmer, K.-P. Möllmann
Infrared Thermal Imaging: Fundamentals, Research and Applications
Wiley (2010)
(also Spanish and Korean translations)
4. M. Vollmer, K.-P. Möllmann
Infrared Thermal Imaging: Fundamentals, Research and Applications
2nd completely revised and extended ed., Wiley (2018)
5. M. Vollmer
Atmosphärische Optik für Einsteiger - Lichtspiele in der Luft
2nd ed, Springer (2019)

Publications IR imaging (since 2005)

- *Heiße Quellen im Wärmebild - Yellowstonepark im Infrarot*, M. Vollmer, J.A. Shaw, P.W. Nugent, W. Harris, *Physik in unserer Zeit* **50/5**, 244-250 (2019)
- *Near infrared photography of atmospheric optical phenomena*, J.A. Shaw, M. Vollmer, *Proc. SPIE* 11143, Fifteenth Conference on Education and Training in Optics and Photonics: ETOP 2019, 111431P (2 July 2019); doi: 10.1117/12.2523165
- *Infrared camera accessories for smartphone: facts and needs*, M. Vollmer, K.-P. Möllmann, *Phys. Educ.* **53**, 065019 (2018), 10 pages
- *Thermal imaging in nature*, M. Vollmer, K.-P. Möllmann, *Inframation 2018 Proceedings*, 2018-063
- *Measurement of SWIR background lighting for the detection of methane*, A. Richard, M. Hübner, M. Vollmer, *Proc. SPIE* 10625, *Infrared Imaging Systems: Design, Analysis, Modeling, and Testing XXIX*, 106250P (2018)
- *Teaching physics and understanding infrared thermal imaging*, M. Vollmer, K.-P.

M. Möllmann, in Education and Training in Optics and Photonics (ETOP) 2017, edited by Xu Liu and Xi-Cheng Zhang, Proc. of SPIE Vol. 10452, 104522C-1

Photonics in Nature: Yellowstone National Park in IR, M. Vollmer, J.A. Shaw, P.W. Nugent, W. Harris, K. Gillis, W. Weiss, L. Carpenter, A. Carpenter, B. Scherrer, in Education and Training in Optics and Photonics (ETOP) 2017, edited by Xu Liu and Xi-Cheng Zhang, Proc. of SPIE Vol. 10452, 104521B-1

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· Infrared Yellowstone, J.A. Shaw, P.W. Nugent, W. Harris, M. Vollmer, Optics and Photonics News 28 (6), 37-43 (2017)

· NIR photography and NIR thermal cameras, M. Vollmer, K.-P. Möllmann, Inframation 2016 Proceedings, 2016-039

· Infrared moon imaging for remote sensing of atmospheric smoke layers, J.A. Shaw, P.W. Nugent, M. Vollmer, Applied Optics 54/4, B64-B75 (2015)

· The Physics of Near-Infrared Photography, K. Mangold, J.A. Shaw, M. Vollmer, Eur. J. Phys. 34/6, S51-71 (2013)

· The Allure of Multicolored Images Building Thermography Examined Closely, K.-P. Möllmann, M. Vollmer, Inframation 2013 Proceedings, Vol14

· Moisture detection at building walls using evaporative cooling, F. Pinno, K.-P. Möllmann, M. Vollmer, Inframation 2013 Proceedings, Vol14

· Measurements of the surface temperature of the moon from earth with IR cameras, M. Vollmer, K.-P. Möllmann, J.A. Shaw, P.W. Nugent, Proceedings Temperatur 2013, Ed.:PTB Berlin, p. 149-154 (2013)

· Einfache Charakterisierung der zeitlichen und räumlichen Auflösung von Wärmebildkameras, K.-P. Möllmann, M. Vollmer, Proceedings Temperatur 2013, Ed.:PTB Berlin, p. 137-142 (2013)

· The magic of the invisible: using IR imaging in physics education, M. Vollmer, K.-P. Möllmann, Inframation 2013 Proceedings, Vol14

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· The Allure of Multicolored Images Building Thermography Examined Closely, M. Vollmer, K.-P.

- Möllmann, in Renewable Energy Sustainable Concepts for the Energy Change, Eds.: R. Wengenmayr, Th. Bührcke, 2nd ed., Wiley VCH (2013)
- Wie warm ist es auf dem Mond, M. Vollmer, K.-P. Möllmann, Sterne und Weltraum 51, 82-86 (Dez. 2012)
 - Dark colors of building walls thermal problems due to solar load, F. Pinno, K.-P. Möllmann and M. Vollmer, in Inframation 2012, Proc. Vol 13
 - Surprising warm edges associated with moisture on surfaces, M. Vollmer, K.-P. Möllmann, S. Wood, in Inframation 2012, Proc. Vol 13

- Solar load and reflection effects and respective time constants in outdoor building inspections, F.
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- Microscopic and high-speed thermal imaging: a powerful tool in physics R&D, K.-P. Möllmann, F. Pinno,
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- Perspectives of IR imaging for industrial detection and monitoring of CO₂, M. Vollmer, K.-P. Möllmann,
Proceedings Temperatur 2009, Ed.:PTB Berlin, p.27-36 (2009)
- Thermographie - Grundlagen, Forschung und moderne Anwendungen in Industrie und Technik, M.
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- Infrarotkameras - es gibt mehr zu sehen als unsere Augen wahrnehmen, M. Vollmer, K.-P. Möllmann,
Naturwiss. Rundschau 61/11, 557-565 (2008)
- Cheese cubes, light bulbs, soft drinks: An unusual approach to study convection, radiation and size
dependent heating and cooling, M. Vollmer, K.-P. Möllmann, F. Pinno, Inframation 2008 Proceedings
Vol. 9, 477-492
- Night Sky Radiant Cooling Influence on Outdoor Thermal Imaging Analysis, K.-P. Möllmann, F. Pinno,
M. Vollmer, Inframation 2008 Proceedings Vol. 9, 279-295
- Thermography of window panes problems, possibilities and troubleshooting, F. Pinno, K.-P.
Möllmann and M. Vollmer, Inframation 2008 Proceedings Vol. 9, 355-362
- Infrared thermal imaging as a tool in university physics education, K.-P. Möllmann and M. Vollmer, Eur.
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- Looking through matter: quantitative IR imaging when observing through IR windows, M. Vollmer, K.-
P. Möllmann, F. Pinno, Inframation 2007, Proceedings Vol. 8, 109-127
- Influence of wind effects on thermal imaging results Is the wind chill effect relevant ?
K.-P. Möllmann, F. Pinno, M. Vollmer, Inframation 2007, Proceedings Vol. 8, 21-31
- Cost and energy savings for a factory building after modernizing the heating system, F. Pinno, K.-P.
Möllmann and M. Vollmer, Inframation 2007, Proceedings Vol. 8, 521-527
- Influence of gaseous species on thermal infrared imaging, D. Karstädt, K.P. Möllmann, F. Pinno and M.
Vollmer, Inframation 2006 Proceedings Vol.7, 65-78
- Thermal image quality Visualization of spatial and thermal resolution in thermal imaging, D.
Karstädt, K.P. Möllmann, F. Pinno, and M. Vollmer, Inframation 2006 Proceedings Vol.7, 79-91
- Energy savings for an old factory building by optimization of the heating system, D. Karstädt, K.P.

- Möllmann, F. Pinno, and M. Vollmer, Inframation 2006 Proceedings Vol.7, 253-261
- Thermography of microwave ovens, M. Vollmer, F. Pinno, K.-P. Möllmann, D. Karstädt, Inframation 2005 Proceedings Vol.6, 29-40
- Optimization, quality control and minimization of damages of floor heating systems, F. Pinno, D. Karstädt, K.-P. Möllmann, and M. Vollmer, Inframation 2005 Proceedings Vol.6, 313-321
- Selected critical applications for thermography: convections in fluids, selective emitters and highly reflecting materials, mK.-P. Möllmann, D. Karstädt, F. Pinno, and M. Vollmer, Inframation 2005 Proceedings Vol.6, 161-173

Publications Atmospheric Optics / Optics (since 2005)

- Extended visual range during solar eclipses, M.Vollmer, J.A. Shaw, Applied Optics **57**/14, 140001 (2018)
- Atmospheric Optics in the Near Infrared, J.A. Shaw, M. Vollmer, Applied Optics, **56**/19, G145 (2017)
- Blue sun glints on water viewed through a polarizer, J.A. Shaw, M. Vollmer, Applied Optics, **56**/19, G36 (2017)
- Near infrared photography of atmospheric optical phenomena, J.A. Shaw, M. Vollmer, Proc. SPIE 11143, Fifteenth Conference on Education and Training in Optics and Photonics: ETOP 2019, 111431P (2 July 2019); doi: 10.1117/12.2523165
- Extended visual range: an observation during a total solar eclipse, M. Vollmer, J.A. Shaw, Proc. SPIE 11143, Fifteenth Conference on Education and Training in Optics and Photonics: ETOP 2019, 111431Q (2 July 2019); doi: 10.1117/12.2523167
- Blue sun reflected from water: optical lessons from observations of nature, J.A. Shaw, M. Vollmer, in Education and Training in Optics and Photonics (ETOP) 2017, edited by Xu Liu and Xi-Cheng Zhang, Proc. of SPIE Vol. 10452, 104523B-1
- Colors of the Yellowstone Thermal Pools for Teaching Optics , J.A. Shaw, P.W. Nugent, M. Vollmer, Education and Training in Optics and Photonics (ETOP) 2015, edited by Eric Cormier, Laurent Sarger, Proc. of SPIE Vol. 9793, 97931S
- Colors of thermal pools at Yellowstone National Park, P.W. Nugent, J.A. Shaw, M. Vollmer, Applied Optics 54/4, B128-B139 (2015)
- Artificially generated halos: rotating samples crystals around various axes, M. Großmann,

K.-P.

Möllmann, M. Vollmer, Applied Optics 54/4, B97-B106 (2015)

· Infrared moon imaging for remote sensing of atmospheric smoke layers, J.A. Shaw, P.W. Nugent, M.

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· Visible and invisible mirages: Comparing inferior mirages in the visible and thermal infrared,

M.Vollmer, J.A. Shaw, P.W. Nugent, Applied Optics 54/4, B76-B84 (2015)

· Flimmernde Luft und funkelnde Sterne, (Rasante Physik) M. Vollmer, K.-P. Möllmann, Physik in

unserer Zeit Heft 46/5, 254-255 (2015)

· Double pane windows elastic deformations, gas thermodynamics, thermal and optical phenomena,

M. Vollmer, K.-P. Möllmann, H.J. Schlichting, Eur. J. Phys. 35, 045023 (2014)

· Achtung Solarofen, Kaustiken von Hochhausverglasungen, M. Vollmer, K.-P. Möllmann, Physik in

unserer Zeit Heft 45/3, 134-139 (2014)

· Das farbenprächtige Glitzern frischen Schnees, M. Vollmer, J. A. Shaw, Physik in unserer Zeit Heft

45/2, 97-98 (2014)

· Light cone: Engaging students of all levels in processes that physicists use in research, E. Etkina, G.

Planinsic, M. Vollmer, Am. J. Phys. 81/11, 815-822 (2013)

· Brilliant colours from a white snow cover, M. Vollmer, J.A. Shaw, Physics Ed. 48/3, 322-331 (2013)

· Caustic effects due to sun light reflections from skyscrapers: simulations and experiments, M.

Vollmer, K.-P. Möllmann, Eur. J. Phys. 33, 1429 1455 (2012)

· Optical Phenomena in the Atmosphere, M. Vollmer, überarbeitetes und ergänztes Kapitel für 2.

Auflage: p. 1493-1517, Sect. 23.6 23.12, Springer Handbook of Lasers and Optics, 2nd ed., F.

Träger (Ed.), 2012

· Crepuscular rays: laboratory experiments and simulations: S. D. Gedzelman, M.Vollmer, Applied

Optics 50/28, pp. F142 F151 (2011)

· Rainbows, water droplets, and seeing slow motion analysis of experiments in atmospheric optic, M.

Vollmer, K.-P. Möllmann, Applied Optics 50/28, pp. F21 F28 (2011)

· Twice in a blue moon, S.D. Gedzelman, M. Vollmer, Weatherwise 62/5, 28-35 (2009)

· Blauer Mond: poetische Methapher oder beobachtbares Phänomen ? M. Vollmer, S.D. Gedzelman,

Naturwissenschaftliche Rundschau 62/6, 285-291 (2009)

· Progress in atmospheric optics and light and color in nature, S.D.Gedzelman, M. Vollmer, Bull. Am.

Met. Soc. 90, 689-693 (May 2009)

· Mirrors in the air:mirages in nature and in the laboratory, M. Vollmer, Physics Education

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165-174 (2009)
- Sonnen- und Mondfinsternisse: Beobachtungen Messungen und quantitative Modelle, M. Vollmer,
Praxis d. Naturwiss. Physik, 58/2, 38-44 (2009)
 - Simulating irradiance during lunar eclipses: the spherically symmetric case, M. Vollmer, S. D. Gedzelman, Applied Optics 47/34, H52-61 (2008)
 - Simulating irradiance and color during lunar eclipses using satellite data, S. D. Gedzelman, M. Vollmer, Applied Optics 47/34, H149-156 (2008)
 - Lunar Eclipse Photometry: Absolute Luminance Measurements and Modeling, N. Hernitschek, E. Schmidt, and M. Vollmer, Applied Optics 47/34, H62-71 (2008)
 - Atmospheric Optical Phenomena and Radiative Transfer, S. Gedzelman, M. Vollmer, Bull. Am. Met. Soc. 89, 471-485 (April 2008)
 - Optical Phenomena in the Atmosphere; M. Vollmer, p. 1182-1203, Sect. 19.6, in Springer Handbook of Lasers and Optics, F. Träger (Hrsg.) 2007
 - Measurements and predictions of the illuminance during a solar eclipse, K.-P. Möllmann and M. Vollmer, Eur. J. Phys. 27 (2006) 1299-1314
 - Colors of the sun and moon: the role of the optical air mass, M. Vollmer, S. Gedzelman, Eur. J. Phys. 27 299-309 (2006)
 - Farben der Sonne: die Rolle der optischen Dicke der Atmosphäre, M. Vollmer, Praxis d. Naturwiss. Physik, 55/3, 24-28 (2006)
 - Rings around sun and moon: coronae and diffraction, L. Cowley, Ph. Laven, and M. Vollmer, Physics Education 40/1, 51-59 (2005)
 - Koronen: farbige Ringe um Sonne und Mond; L. Cowley, P. Laven, M. Vollmer, Physik in unserer Zeit 36/6, 266-273 (2005)
 - Effects of absorbing particles on coronas and glories, M. Vollmer, Appl. Opt. 44/27, 5658-5666 (2005)
 - Experimental simulations of pollen coronas, W. Schneider, M. Vollmer, Appl. Opt. 44/27, 5746-5753 (2005)

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- *Blue the color of (p)re-aster*, M. Vollmer, A. Mard, Ph. Ed. c. **54**, 45001 (2019) (10 p)
- *The free ing of lake in in er*, M. Vollmer, Eur. J. Phys. **40** (2019) 35101 (20p)

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· *Direct speed of o nd mea remen i hin he a mo phere d ring a na ional holid a in*
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Und ie dreh ich doch (Rasante Physik), M. Vollmer | K.-P. Möllmann, Physik in
unserer Zeit **49/5**,

254 (2018)

Von Ei rfeln nd gefrorenen Seen (Rasante Physik), M. Vollmer | K.-P. Möllmann,
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Ed.: V. Koudelková, 2016, ISBN 978-80-87343-58-6
- *Flüchtige Regenbogen ein elner Tropfen* (Rasante Physik) M. Vollmer, K.-P. Möllmann, Physik in unserer Zeit Heft **47/6**, 305-306 (2016)
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- Otto von Guericke's Windbüchse, (Rasante Physik), M. Vollmer, K.-P. Möllmann, Physik in unserer Zeit Heft 46/1, 46-47 (2015)
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- Flackernde Entladungslampen unter der (Zeit-)lupe (Rasante Physik), M. Vollmer, K.-P. Möllmann, Physik in unserer Zeit Heft 45/4, 199-200 (2014)
- Wenn es knallt und kracht (Rasante Physik), M. Vollmer, K.-P. Möllmann, Physik in unserer Zeit Heft 45/3, 148-149 (2014)
- Achtung Solarofen, Kaustiken von Hochhausverglasungen, M. Vollmer, K.-P. Möllmann, Physik in unserer Zeit Heft 45/3, 134-139 (2014)
- Das farbenprächtige Glitzern frischen Schnees, M. Vollmer, J. A. Shaw, Physik in unserer Zeit Heft 45/2, 97-98 (2014)
- Physikalische Zauberei: die Kette im Ring (Rasante Physik), M. Vollmer, K.-P. Möllmann, Physik in unserer Zeit Heft 45/1, 44-45 (2014)
- The Physics of Near-Infrared Photography, K. Mangold, J.A. Shaw, M. Vollmer, Eur. J. Phys. 34/6, S51-71 (2013)
- Teaching Fourier Transform Infrared Spectroscopy in physics lab courses, K.-P. Möllmann, M. Vollmer, Eur. J. Phys. 34/6, S123-37 (2013)
- Infrared, Preface special issue on Infrared, Eur. J. Phys. 34/6, S49-50 (2013)
- Light cone: Engaging students of all levels in processes that physicists use in research, E. Etkina, G. Planinsic, M. Vollmer, Am. J. Phys. 81/11, 815-822 (2013)
- Is there a maximum size of water drops in nature, M. Vollmer, K.-P. Möllmann, The Physics Teacher 51, 400 - 402 (October 2013)
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- Schneller als der freie Fall (Rasante Physik), M. Vollmer, K.-P. Möllmann, Physik in unserer Zeit, 44/1, 46-47 (2013)
- Prost Neujahr: die Physik von Champagnerflaschen (Rasante Physik), M. Vollmer, K.-P. Möllmann, Physik in unserer Zeit, 43/6, 307 308 (2012)
- Oscillating droplets and incompressible liquids: slow motion visualization of experiments with fluids, M. Vollmer, K.-P. Möllmann, Physics Education 47, 664-679 (2012)
- Low cost hands-on experiments for Physics teaching, M. Vollmer, K.-P. Möllmann, Lat. Am. J. Phys. Educ. Vol. 6, Suppl. I, pp. 3-9 (2012). www.lajpe.org
- Faster than g a never ending story? M. Vollmer, K.-P. Möllmann, Eur. J. Phys. 33, 1277 1288 (2012)
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- Tropfen auf dem kalten Wein (Rubrik Rasante Physik), M. Vollmer, K.-P. Möllmann, Physik in unserer Zeit, 43/5, 252-253 (2012)
- Raindrops keep falling on my head (Rubrik Rasante Physik), M. Vollmer, K.-P. Möllmann, Physik in unserer Zeit 43/4, 200 201 (2012)
- Lorentz-Pendel in der Glühbirne (Rubrik Rasante Physik), M. Vollmer, K.-P. Möllmann, Physik in unserer Zeit, 43 (2), 96-97 (2012)
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- Ring falling into a chain: no magic just physics, M. Vollmer, K.-P. Möllmann, The Physics Teacher 49, 337-339 (2011)
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· Exploding balloons, deformed balls, strange reflections, and breaking rods: slow motion analysis of

selected hands-on experiments, M. Vollmer, K.-P. Möllmann, Physics Education 46(4) p.472-485

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· High speed slow motion: technology of modern high speed cameras, M. Vollmer, K.-P. Möllmann,

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· Fobinet: an internet supported platform for nationwide coordination, promotion and funding of

physics teacher training activities in Germany, A. Franke-Wiekhorst, V. Nordmeier, M. Vollmer, M.

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· Der Ring-in-die-Kette Zaubertrick und ein historisches Vakuumexperiment in neuem Gewand:

Eckenroth, B. Edwons Ize Ize p.472-485

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- Locomotion by blowing into the sail of a sailboat? From a basic physics question to thrust reversal of jet airplanes, M. Vollmer, K.-P. Möllmann, F. Arnold, Phys. Ed. 42, 369-377 (2007)
- Physiklehrerweiterbildung am Physikzentrum Bad Honnef, V. Nordmeier, W.B. Schneider, M. Vollmer, S. 61-63 in B. Schoch (Hrsg.), Physikzentrum Bad Honnef- Ein Platz für Dialog und Inspiration, Bonn (2006)
- Learning Physics from the experiments, Ch. Chiaverina, M. Vollmer, Girep seminar in Ljubljana 2005, ed. G. Planinsic, see: www.girep2005.fmf.uni-lj.si
- Diffraction revisited, position of diffraction spots upon rotation of a transmission grating, M. Vollmer, Physics Education, 40, 562-565 (2005)
- Hot gases: transition from line spectra to thermal radiation, M. Vollmer, Am. J. Phys. 73, 215-223 (2005)
- Anfassen erwünscht Science Center unter der Lupe, W. Schneider, M. Vollmer, Physik in unserer Zeit 36/2, 98-99 (2005)
- Zur Intonation von Blechblasinstrumenten bei sehr niedrigen Umgebungstemperaturen, M. Vollmer, K. Wogram, Instrumentenbau-Zeitschrift - Musik International 59/3-4, 69-74 (2005)

Selected English Conference Talks (since 2005)

- Locomotion by blowing into the sail of your own sailboat: Muenchhausen story or real physics? 3rd International GIREP Seminar, Ljubljana, 09/2005
- Thermography of microwave ovens, Inframation 2005 in Las Vegas / USA, 10/2005
- Hands-on experiments, Fisica Nocturna, Puebla, Mexico, 05/2006
- Influence of Gaseous species on Thermal Infrared Imaging, Inframation 2006 in Las Vegas/USA, 10/2006
- Demonstration of Quetelet fringes, Illuminance during a solar eclipse and Luminance during a total lunar eclipse, 9th International Meeting on Light and Color in Nature in Bozeman, Montana (USA), 06/2007
- Looking through matter: quantitative IR imaging when observing through IR windows, Physics for Nonscientists, Inframation 2007 in Las Vegas/USA, 10/2007
- Cheese cubes, light bulbs, soft drinks: An unusual approach to study convection, radiation

and size

dependent heating and cooling, Inframation 2008 in Reno/ USA, 11/2008

- IR imaging of gases: potential applications for CO2 cameras, IR feedback loops to spotlights:

thermography and contemporary dancing, Inframation 2009 in Las Vegas/ USA, 10/2009

- Inframation 2009, Las Vegas, 10/2009

- High speed - slow motion I: new insights for hands on experiments in mechanics, II : more experiments using gases, fluids, heat and electromagnetism, GIREP-ICPE-MPTL

International

Conference on Teaching and Learning Physics Today in Reims/France, 08/2010

- Measurements of sky, clouds and moon with IR cameras: effects of air mass, Inframation 2010, Las

Vegas/USA, 10/2010

- High speed slow motion: fascinating phenomena observed in hands-on experiments, Science on

Stage, Copenhagen 04/2011 (with K.-P. Möllmann)

- IR Imaging of CO2: Basics, Experiments, and Potential Industrial Applications, IRS2, Nürnberg,

05/2011

- Low cost hands-on experiments for physics teaching, ICPE, Mexico City, 08/2011

- Optics of glass fronts of buildings: the science of skyscraper death rays and Camera Performance

and Simple Image Processing for Everybody (with K.-P. Möllmann), Inframation 2011 in Las

Vegas/USA, 11/2011

- Beautiful phenomena in the skies: a colorful journey in the realm of atmospheric optics, DGaO ,

Eindhoven /NL, 06/2012

- Surprising warm edges associated with moisture on surfaces, Inframation 2012 in Orlando / USA,

11/2012

- Brilliant colors from a white snow cover, Visible and invisible mirages: comparing inferior mirages in

the visible and thermal infrared spectral range, Light and Color, Fairbanks/Alaska

(USA)m 08/2013

- The magic of the invisible: using IR imaging in physics education, Inframation 2013 in Orlando / USA,

11/2013

- IR Imaging Master Class History, Science and Modern Technology, 4h workshop (with K.-P.

Möllmann), Inframation 2015 in Nashville/Tennessee (USA), 05/2015

- Optics and Physics of Near Infrared imaging, Education and Training in Optics, Bordeaux/ France,

06/2015

- Experiments in Physics Education, Physics Teachers Invention Fair, Prag/Cz, 08/2015

- High Speed Cameras in Physics Education, AAPT New Orleans/USA, 01/2016

- Optical effects due to man-made structures, Light and Color in Nature in Granada /

Spanien,

06/2016

- The optics and physics of NIR imaging, Light and Color in Nature in Granada / Spanien, 06/2016
- NIR photography and NIR thermal cameras, Inframation, Las Vegas, 09/2016
- Workshop Basics of thermography: IR camera parameters and selected topics, Inframation, Las Vegas, 09/2016
- Photonics in Nature: Yellowstone National Park in IR, ETOP, Hangzhou/China, 05/2017
- Teaching physics and understanding infrared thermal imaging, ETOP, Hangzhou/China, 05/2017
- Blue sun reflected from water: optical lessons learned from observations of nature, ETOP, Hangzhou/China, 05/2017
- Using action cams to teach and learn physics, AAPT, San Diego, 01/2018
- Thermal Imaging for every Teacher, AAPT, San Diego, 01/2018
- Thermal imaging in nature, Inframation, Austin/Texas (USA), 10/2018
- Studying the transition from light emitting diodes to semiconductor lasers in physics laboratories, ETOP, Quebec (Kanada) 05/2019
- Extended visual range: an observation during a total solar eclipse, ETOP, Quebec (Kanada) 05/2019
- Intrinsic blue color of clearest natural water, Light and Color in Nature, Bar Harbor / Maine (USA) 07/2019
- 530 km record visual range observation: can it be true? Light and Color in Nature, Bar Harbor / Maine (USA) 07/2019
- Visual range changes during the 2017 eclipse, , Light and Color in Nature, Bar Harbor / Maine (USA) 07/2019

Physics teacher training

International

1. Annual teacher training of Austrian Physical Society, in Vienna/Austria (with K.-P. Möllmann):

02/2000: Von Sonnenhunden, Seeungeheuern und grünem Strahl, ein Ausflug in die atmosphärische

Optik; Es gibt mehr zu sehen als unsere Augen wahrnehmen

02/2011: High speed - slow motion: Experimente mit der Hochgeschwindigkeitskamera

2. Technorama teacher training for Swiss physics teachers in Winterthur/CH (with K.-P. Möllmann):

03/2003: Low cost Experimente für den Physikunterricht,

09/2004: Lernen am Phänomen - low cost Experimente im naturwissenschaftlichen

Unterricht

09/2006: Lichtspiele in der Luft - optische Phänomene der Atmosphäre / Schulexperimente mit Lasern

02/2010: High speed - slow motion: Experimente mit der Hochgeschwindigkeitskamera

02/2014: Freihandexperimente und Experimente mit IR Kameras

1. 1998: Mechanik, Akustik, Fluide
2. 1998: Wärmelehre
3. 1999: Elektrodynamik
4. 1999: Optik
5. 2000: Moderne Physik, physikalisches Spielzeug (C. Ucke/München)
6. 2001: Physik im Alltag, Low cost high tech-Experimente (W. Stetzenbach/Winnweiler)
7. 2002: Low cost Experimente, Messwerterfassung easy und low cost (V. Nordmeier/Münster,
Komplexität und Selbstorganisation (H.-J. Schlichting/Münster)
8. 2003: Mikrotechnik, Mikroelektronik und Mikrosystemtechnik, Reise in die Mikrowelten (M. Euler/Kiel)
9. 2004: Mechanik, Resonanzen, Schwebungen und Interferenzen (O. Lührs/Berlin)
10. 2005: Wärmelehre, Die Gezeiten (W. Schneider/Erlangen)
11. 2006: Elektromagnetismus, Sport im Physikunterricht (L. Mathelitsch/Graz)
12. 2007: Optik, Mädchen im Physikunterricht (R. Wodzinski/Kassel)
13. 2008: Laser im Physikunterricht, Medizin (H. Wiesner/München)
14. 2009: Physik im Alltag, Energie und Klima, Astronomie (Th. Bürke / Schwetzingen)
15. 2010: High speed-slow motion: Experimente unter der Lupe, Physik in der Primarstufe
(Welzel/Heidelberg)
16. 2011: Mechanik, Physik im Film (Müller/Braunschweig)
17. 2012: Wärmelehre, Astronomie (Lotze/Jena)
18. 2013: Elektromagnetismus, Wasserdichtigkeit von Textilien (Suhr/ Münster)
19. 2014: Optik, Neue Experimente, Physik mit dem Smartphone (Wöste, Wilhelm)
20. 2015: Freihandexperimente, Einfache astronomische Beobachtungen (Steinrücken)

Regional in Berlin and Brandenburg

Physics teacher training courses with talks in the Magnushaus/Berlin (Thursday, Friday) and practical work in a school (Saturday). Organized together with L. Wöste, W. Eberhard and Ch. Strube from Berlin. Typically 100 teachers attend from both states. Funding: Wilhelm und Else Heraeus-foundation.

- 04/2018: Klima und Energie
 05/2019: Licht (incl. a talk by Nobel Prize winner Th. Hänsch)
 05/2020: Astronomie und Astrophysik (planned)

Public Talks

at the University of Applied Sciences Brandenburg

- Von Sonnenhunden und Brockengespenst
- Licht, Musik und Sinnestäuschung
- Kometen
- Treibhauseffekt, Ozonloch und Ozonsmog
- Ton, Klang Geräusch - eine experimentelle Einführung in die Welt des Schalls
- Lassen Sie sich überraschen: ein Potpourri physikalischer Experimente

- Totale Sonnenfinsternis in Deutschland
- Lichtspiele in der Luft - optische Phänomene der Atmosphäre
- Die Sonnenfinsternis vom 29.03.2006 in der Türkei
- Die Rückkehr der Physiker Unterhaltsame Experimente am laufenden Band Audimax
FHB
- Was haben Klimawandel, Treibhauseffekt und regenerative Energien miteinander zu tun

