

Osku Kempainen

Contact and personal

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Education

Aalto University School of Science, Finland 2016
Degree Programme of Engineering Physics and Mathematics
Ph.D.: Major in Theoretical and Computational Physics
Dissertation *Computational light scattering of atmospheric dust particles*

Aalto University School of Science, Finland 2011
Degree Programme of Engineering Physics and Mathematics
M.Sc.: Major in Engineering Physics, minor in Computational Science
Thesis *Analysis of Unpublished High-Resolution Martian Meteorological Data from Viking Landers 1 and 2*
Minor thesis *Emergent Pain-Evasion and Gripping Behavior of a Robotic Hand*

Aalto University School of Science, Finland 2010
Degree Programme of Engineering Physics and Mathematics
B.Sc.: Major in Engineering Physics, minor in Computer Science
Thesis *Re-Analysis of Martian Meteorological Data measured by Viking Landers 1 and 2*

Research experience

Kansas State University Research Assistant Professor
Department of Physics **2018 – Present**

- Experiment design and management
- New research project planning and research proposal preparation
- Undergraduate and Ph.D. student advising and mentoring
- Continuation of postdoctoral projects

Kansas State University Postdoctoral Associate
Department of Physics **2016 – 2018**

- Portable miniaturized digital holography experiment design and implementation
- Automatic image acquisition and characterization algorithm development for digital holography
- Theoretical and computational optical studies

Finnish Meteorological Institute Scientific Consultant
Radar and Space Technology Group **2016 – Present**

- Modeling, data analysis, data visualization, and software development consultation

Finnish Meteorological Institute Research Scientist
Radar and Space Technology Group **2011 – 2016**

- Computational light scattering model development, simulation, and data analysis
- Algorithm development, data processing, data analysis and operational support of NASA Mars Science Laboratory humidity and pressure sensors
- Radiative transfer and atmospheric modeling
- NASA Viking Lander meteorological data recovery and analysis

Finnish Meteorological Institute Research Assistant
Radar and Space Technology Group **2009 – 2011**

- Computational light scattering model development, simulation, and data analysis

- Algorithm development, data processing, data analysis and operational support of NASA Mars Science Laboratory humidity and pressure sensors
- Radiative transfer and atmospheric modeling
- NASA Viking Lander meteorological data recovery and analysis

Aalto University and ZenRobotics Ltd.

Research Assistant

*Department of Biomedical Engineering and
Computational Science*

2010

- Design, implementation, training and validation of a machine learning algorithm for a brain of an industrial robot for recognizing and avoiding “pain” caused by mechanical forces in real time

Awards and grants

- International Society for Atmospheric Research using Remotely piloted Aircraft, Early Career Scientist Travel Grant, (2018, \$1500)
- Electromagnetic and Light Scattering Conference and Flight Week, Early Career Scientist Travel Grant, (2018, \$1600)
- NASA Group Achievement Award, MSL Extended Mission-1 Science and Operations Team (2017)
- NASA Postdoctoral Program Fellowship (2016-2018, \$189,000, offer declined)
- Aalto University Foundation Dissertation Merit Scholarship (2016, 2000€)
- Finnish Meteorological Institute Earth Observation award for excellent scientific productivity (2015)
- NASA Group Achievement Award, MSL Prime Mission Science and Operations Team (2015)
- Magnus Ehrnrooth Foundation Graduate Student Scholarship (2015, 20,000€)
- Aalto University Foundation Publication Merit Scholarship (2014, 500€)
- NASA Group Achievement Award, REMS instrument on Mars Science Laboratory (2013)
- Magnus Ehrnrooth Foundation Travel Grant (2013, 1500€)
- Aalto University Foundation Coursework Merit Scholarship (2013, 500€)

Service

- Journal referee: Journal of Quantitative Spectroscopy and Radiative Transfer, Geophysical Research Letters, Journal of Geophysical Research: Atmospheres, Optics Express, Atmospheric Chemistry and Physics, Optics Letter, Computers and Electronics in Agricultures
- Invited reviewer of National Institute of Standards and Technology internal review process
- External Expert Committee member for Ph.D. thesis of M.Sc. Alvaro Vicente-Retortillo from Universidad Complutense de Madrid, Spain
- Students advised or co-advised: Mr. Tuomas Kynkaanniemi (Aalto University, Finland, 2016-2017), Mr. Andrew Frey (Kansas State University, 2017), Mr. Jesse Laning (Kansas State University, 2017-2018), Mr. Ryan Mersmann (Kansas State University, 2017-2018), Ms. Claudia Morello (Embry-Riddle Aeronautical University, 2017), M.S. Ramesh Giri (Kansas State University, 2017-2018)
- Research and the State judge (2017, Kansas State University), Outstanding Student Paper Award judge (2017, American Geophysical Union)

Publications

Total publications: 39, total citations: 3484 , h-index: 22, i10-index: 30 ([Google Scholar](#) as of 2018-09-30)

1. Timothy H. McConnochie, Michael D. Smith, Michael J. Wolff, Steve Bender, Mark Lemmon, Roger C. Wiens, Sylvestre Maurice, Olivier Gasnault, Jeremie Lasue, Pierre-Yves Meslin, Ari-Matti Harri, Maria Genzer, Osku Kempainen, Germn M. Martnez, Lauren DeFlores, Diana Blaney, Jeffrey R. Johnson, James F. Bell: Retrieval of water vapor column abundance and aerosol properties from ChemCam passive sky spectroscopy, Icarus (2018) [cited by 2]
2. Stephen Holler, Matthew J. Berg, Osku Kempainen, Yuli W. Heinson: Two-dimensional scattering and digital holography from isolated aerosol particles, Proc.SPIE (2018) [cited by 0]
3. Berg, Matthew J, Heinson, Yuli W, Kempainen, Osku, Holler, Stephen: Solving the inverse problem for coarse-mode aerosol particle morphology with digital holography, Scientific Reports (2017) [cited by 1]

4. Kynkaanniemi, Tuomas, Kempainen, Osku, Harri, Ari-Matti, Schmidt, Walter: Wind reconstruction algorithm for Viking Lander 1, *Geoscientific Instrumentation, Methods and Data Systems* (2017) [cited by 0]
5. Martinez, GM, Newman, CN, De Vicente-Retortillo, A, Fischer, E, Renno, NO, Richardson, MI, Fairen, AG, Genzer, M, Guzewich, SD, Haberle, RM et al.: The Modern Near-Surface Martian Climate: A Review of In-situ Meteorological Data from Viking to Curiosity, *Space Science Reviews* (2017) [cited by 16]
6. Kempainen, Osku, Heinson, Yuli, Berg, Matthew: Quasi-three-dimensional particle imaging with digital holography, *Applied Optics* (2017) [cited by 8]
7. Harri, Ari-Matti, Pichkadze, Konstantin, Zeleny, Lev, Vazquez, Luis, Schmidt, Walter, Alexashkin, Sergey, Korablev, Oleg, Guerrero, Hector, Heilimo, Jyri, Uspensky, Mikhail et al.: The MetNet vehicle: a lander to deploy environmental stations for local and global investigations of Mars, *Geoscientific Instrumentation, Methods and Data Systems* (2017) [cited by 2]
8. Paton, MD, Harri, A-M, Savijarvi, H, Makinen, T, Hagermann, A, Kempainen, O, Johnston, A: Thermal and microstructural properties of fine-grained material at the Viking Lander 1 site, *Icarus* (2016) [cited by 6]
9. Jeong, Gi Young, Park, Mi Yeon, Kandler, Konrad, Nousiainen, Timo, Kempainen, Osku: Mineralogical properties and internal structures of individual fine particles of Saharan dust, *Atmospheric Chemistry and Physics* (2016) [cited by 6]
10. Savijarvi, Hannu, Harri, Ari-Matti, Kempainen, Osku: The diurnal water cycle at Curiosity: Role of exchange with the regolith, *Icarus* (2016) [cited by 16]
11. Jarvinen, E, Kempainen, O, Nousiainen, T, Kociok, T, Mohler, O, Leisner, T, Schnaiter, M: Laboratory investigations of mineral dust near-backscattering depolarization ratios, *Journal of Quantitative Spectroscopy and Radiative Transfer* (2016) [cited by 14]
12. Martinez, GM, Fischer, E, Renno, NO, Sebastian, E, Kempainen, O, Bridges, N, Borlina, CS, Meslin, P-Y, Genzer, M, Harri, A-H et al.: Likely frost events at Gale crater: Analysis from MSL/REMS measurements, *Icarus* (2016) [cited by 20]
13. Mahaffy, PR, Webster, CR, Stern, JC, Brunner, AE, Atreya, SK, Conrad, PG, Domagal-Goldman, S, Eigenbrode, JL, Flesch, Gregory J, Christensen, Lance E et al.: The imprint of atmospheric evolution in the D/H of Hesperian clay minerals on Mars, *Science* (2015) [cited by 56]
14. Moores, John E, Lemmon, Mark T, Rafkin, Scot CR, Francis, Raymond, Pla-Garcia, Jorge, De La Torre Juarez, Manuel, Bean, Keri, Kass, David, Haberle, Robert, Newman, Claire et al.: Atmospheric movies acquired at the Mars Science Laboratory landing site: Cloud morphology, frequency and significance to the Gale Crater water cycle and Phoenix mission results, *Advances in Space Research* (2015) [cited by 13]
15. Kempainen, O, Nousiainen, T, Merikallio, S, Raisanen, P: Retrieving microphysical properties of dust-like particles using ellipsoids: the case of refractive index, *Atmospheric Chemistry and Physics* (2015) [cited by 14]
16. Kempainen, O, Nousiainen, T, Jeong, GY: Effects of dust particle internal structure on light scattering, *Atmospheric Chemistry and Physics* (2015) [cited by 14]
17. Savijarvi, HI, Harri, A-M, Kempainen, O: Mars Science Laboratory diurnal moisture observations and column simulations, *Journal of Geophysical Research: Planets* (2015) [cited by 14]
18. Webster, Christopher R, Mahaffy, Paul R, Atreya, Sushil K, Flesch, Gregory J, Mischna, Michael A, Meslin, Pierre-Yves, Farley, Kenneth A, Conrad, Pamela G, Christensen, Lance E, Pavlov, Alexander A et al.: Mars methane detection and variability at Gale crater, *Science* (2015) [cited by 219]

19. Stern, Jennifer C, Sutter, Brad, Freissinet, Caroline, Navarro-Gonzalez, Rafael, McKay, Christopher P, Archer, P Douglas, Buch, Arnaud, Brunner, Anna E, Coll, Patrice, Eigenbrode, Jennifer L et al.:Evidence for indigenous nitrogen in sedimentary and aeolian deposits from the Curiosity rover investigations at Gale crater, Mars, *Proceedings of the National Academy of Sciences* (2015) [cited by 53]
20. Kemppinen, Osku, Nousiainen, Timo, Lindqvist, Hannakaisa:The impact of surface roughness on scattering by realistically shaped wavelength-scale dust particles, *Journal of Quantitative Spectroscopy and Radiative Transfer* (2015) [cited by 23]
21. Moores, John E, Lemmon, Mark T, Kahanpaa, Henrik, Rafkin, Scot CR, Francis, Raymond, Plaga-Garcia, Jorge, Bean, Keri, Haberle, Robert, Newman, Claire, Mischna, Michael et al.:Observational evidence of a suppressed planetary boundary layer in northern Gale Crater, Mars as seen by the Navcam instrument onboard the Mars Science Laboratory rover, *Icarus* (2015) [cited by 33]
22. Martin-Torres, F Javier, Zorzano, Maria-Paz, Valentin-Serrano, Patricia, Harri, Ari-Matti, Genzer, Maria, Kemppinen, Osku, Rivera-Valentin, Edgard G, Jun, Insoo, Wray, James, Madsen, Morten Bo et al.:Transient liquid water and water activity at Gale crater on Mars, *Nature Geoscience* (2015) [cited by 155]
23. McLennan, Scott M, Anderson, RB, Bell, JF, Bridges, JC, Calef, F, Campbell, John L, Clark, BC, Clegg, S, Conrad, P, Cousin, A et al.:Elemental geochemistry of sedimentary rocks at Yellowknife Bay, Gale crater, Mars, *Science* (2014) [cited by 174]
24. Ming, Douglas W, Archer, PD, Glavin, DP, Eigenbrode, JL, Franz, HB, Sutter, B, Brunner, AE, Stern, JC, Freissinet, C, McAdam, AC et al.:Volatile and organic compositions of sedimentary rocks in Yellowknife Bay, Gale Crater, Mars, *Science* (2014) [cited by 208]
25. Grotzinger, John P, Sumner, Do Y, Kah, LC, Stack, K, Gupta, S, Edgar, L, Rubin, D, Lewis, K, Schieber, J, Mangold, N et al.:A habitable fluvio-lacustrine environment at Yellowknife Bay, Gale Crater, Mars, *Science* (2014) [cited by 395]
26. Harri, A-M, Genzer, M, Kemppinen, O, Gomez-Elvira, J, Haberle, R, Polkko, J, Savijarvi, H, Renno, N, Rodriguez-Manfredi, JA, Schmidt, W et al.:Mars Science Laboratory relative humidity observations: Initial results, *Journal of Geophysical Research: Planets* (2014) [cited by 37]
27. Harri, A-M, Genzer, M, Kemppinen, O, Kahanpaa, H, Gomez-Elvira, Javier, Rodriguez-Manfredi, JA, Haberle, R, Polkko, J, Schmidt, W, Savijarvi, H et al.:Pressure observations by the Curiosity rover: Initial results, *Journal of Geophysical Research: Planets* (2014) [cited by 48]
28. Gomez-Elvira, Javier, Armiens, Carlos, Carrasco, Isaias, Genzer, Maria, Gomez, Felipe, Haberle, Robert, Hamilton, Victoria E, Harri, Ari-Matti, Kahanpaa, Henrik, Kemppinen, Osku et al.:Curiosity's rover environmental monitoring station: Overview of the first 100 sols, *Journal of Geophysical Research: Planets* (2014) [cited by 51]
29. Webster, Christopher R, Mahaffy, Paul R, Atreya, Sushil K, Flesch, Gregory J, Farley, Kenneth A et al.:Low upper limit to methane abundance on Mars, *Science* (2013) [cited by 94]
30. Stolper, EM, Baker, MB, Newcombe, ME, Schmidt, ME, Treiman, AH, Cousin, A, Dyar, MD, Fisk, MR, Gellert, Ralph, King, PL et al.:The petrochemistry of Jake_M: A Martian mugearite, *Science* (2013) [cited by 103]
31. Bish, David L, Blake, DF, Vaniman, DT, Chipera, SJ, Morris, RV, Ming, DW, Treiman, AH, Sarrazin, P, Morrison, SM, Downs, Robert T et al.:X-ray diffraction results from Mars Science Laboratory: Mineralogy of Rocknest at Gale crater, *Science* (2013) [cited by 171]
32. Meslin, P-Y, Gasnault, O, Forni, O, Schroder, S, Cousin, A, Berger, G, Clegg, SM, Lasue, J, Maurice, S, Sautter, V et al.:Soil diversity and hydration as observed by ChemCam at Gale Crater, Mars, *Science* (2013) [cited by 153]

33. Hassler, Donald M, Zeitlin, Cary, Wimmer-Schweingruber, Robert F, Ehresmann, Bent, Rafkin, Scot, Eigenbrode, Jennifer L, Brinza, David E, Weigle, Gerald, Bottcher, Stephan, Bohm, Eckart et al.:Mars' surface radiation environment measured with the Mars Science Laboratory's Curiosity rover, *Science* (2013) [cited by 205]
34. Blake, David F, Morris, Richard V, Kocurek, G, Morrison, SM, Downs, Robert T, Bish, D, Ming, DW, Edgett, KS, Rubin, D, Goetz, W et al.:Curiosity at Gale crater, Mars: Characterization and analysis of the Rocknest sand shadow, *Science* (2013) [cited by 179]
35. Mahaffy, Paul R, Webster, Christopher R, Atreya, Sushil K, Franz, Heather, Wong, Michael, Conrad, Pamela G, Harpold, Dan, Jones, John J, Leshin, Laurie A, Manning, Heidi et al.:Abundance and isotopic composition of gases in the martian atmosphere from the Curiosity rover, *Science* (2013) [cited by 215]
36. Williams, Rebecca ME, Grotzinger, John P, Dietrich, WE, Gupta, S, Sumner, DY, Wiens, RC, Mangold, N, Malin, MC, Edgett, KS, Maurice, S et al.:Martian fluvial conglomerates at Gale crater, *Science* (2013) [cited by 219]
37. Vaniman, DT, Bish, DL, Ming, DW, Bristow, TF, Morris, RV, Blake, DF, Chipera, SJ, Morrison, SM, Treiman, AH, Rampe, EB et al.:Mineralogy of a mudstone at Yellowknife Bay, Gale crater, Mars, *Science* (2013) [cited by 282]
38. Leshin, LA, Mahaffy, PR, Webster, CR, Cabane, Michel, Coll, Patrice, Conrad, PG, Archer, PD, Atreya, SK, Brunner, AE, Buch, A et al.:Volatile, isotope, and organic analysis of martian fines with the Mars Curiosity rover, *Science* (2013) [cited by 259]
39. Kempainen, O, Tillman, JE, Schmidt, W, Harri, A-M:New analysis software for Viking Lander meteorological data, *Geoscientific Instrumentation, Methods and Data Systems* (2013) [cited by 6]

Book Chapters

1. Jokinen O., Lindqvist H., Kandler K., Kempainen O., Nousiainen T. (2018) Stereogrammetric Shapes of Mineral Dust Particles. In: Kokhanovsky A. (eds) *Springer Series in Light Scattering*. Springer Series in Light Scattering. Springer, Cham

U.S. Patents

1. M. J. Berg, O. Kempainen, G. Videen, *Method and Apparatuses for Imaging of Aerosol Particles with Digital Holography from Mobile Platforms*, (disclosed 08/29/2017, pending).

Outreach

1. Popular science article, *Imaging aerosols with digital holography*, *Physics Today*, 71(3) March (2018)
2. Talk, *Global puzzles: Finland*, Guest Lecture for SOCIO 363, Department of Sociology, Anthropology, and Social Work, Kansas State University, Manhattan, Kansas, USA (2018)
3. Talk, *Global puzzles: Finland*, Guest Lecture for SOCIO 363, Department of Sociology, Anthropology, and Social Work, Kansas State University, Manhattan, Kansas, USA (2017)
4. Ask an Expert answer, *Color of the Martian sky*, Popular science magazine *Tähdet ja Avaruus* (English translation: *Stars and Space*) (2014)
5. Talk, *Mars research at Finnish Meteorological Institute* (original Finnish: *Marsin kaasukehän suomalaistieteen uusimpia tuulia*), Kuoppakangas Middle School, Varkaus, Finland (2012)
6. Talk, *From Mariner to Curiosity - 50 years of Mars investigation* (original Finnish: *Marinerista Curiosityyn - 50 vuotta Mars-tutkimusta*), Amateur astronomical society Kirkkonummen Komeetta, Kirkkonummi, Finland (2012)

Presentations

1. **Invited talk:** *Lower Atmospheric Process Studies at Elevation - a Remotely-piloted Aircraft Team Experiment (LAPSE-RATE)*, Department of Physics seminar, Kansas State University, Manhattan, Kansas, USA (2018)
2. Poster: *In-situ atmospheric particle imaging with a portable digital holography instrument*, American Association for Aerosol Research, St. Louis, Missouri, USA (2018)
3. Poster: *Development and Field-Testing of Two Unmanned Aerial Vehicle Aerosol Particle Instruments*, International Society for Atmospheric Research using Remotely piloted Aircraft, Boulder, Colorado, USA (2018)
4. Talk: *In-situ atmospheric particle imaging with a portable digital holography instrument*, Electromagnetic and Light Scattering Conference, College Station, Texas, USA (2018)
5. Talk: *Airborne digital holography instrument design*, Department of Physics seminar, Kansas State University, Manhattan, Kansas, USA (2018)
6. Poster: *Depth Information in Digital Holography*, American Geophysical Union, New Orleans, Louisiana, USA (2017)
7. **Invited talk:** *In-situ measurement of large aerosols*, Department of Physics colloquium, Kansas State University, Manhattan, Kansas, USA (2017)
8. Talk: *Three-dimensionality of digital holography reconstructions*, Electromagnetic and Light Scattering Conference, College Park, Maryland, USA (2017)
9. Talk: *Depth information in Digital Holography*, Department of Physics seminar, Kansas State University, Manhattan, Kansas, USA (2017)
10. Talk: *Shape dependence of light scattering by dust*, Department of Physics seminar, Kansas State University, Manhattan, Kansas, USA (2016)
11. Talk: *Computational light scattering by atmospheric dust particles*, Public dissertation lecture, Aalto University, Espoo, Finland (2016)
12. Poster: *The effects of detailed dust particle morphology on light scattering*, American Geophysical Union, San Francisco, California, USA (2016)
13. Poster: *Retrieval of dust particle refractive index from scattering data using ellipsoid ensembles*, European Geosciences Union, Vienna, Austria (2016)
14. Poster: *The impact of dust particle morphological details on light scattering*, European Geosciences Union, Vienna, Austria (2016)
15. Talk: *Effects of different forms of inhomogeneity on light scattering by mineral dust particles*, Electromagnetic and Light Scattering Conference, Leipzig, Germany (2015)
16. Poster: *The impact of surface roughness on scattering by dust particles*, Electromagnetic and Light Scattering Conference, Leipzig, Germany (2015)
17. Poster: *Martian pressure cycle model driven by radiatively forced sublimation of polar CO₂*, European Planetary Science Congress, Cascais, Portugal (2014)
18. Poster: *Simulated Martian pressure cycle based on the sublimation and deposition of polar CO₂*, European Geosciences Union, Vienna, Austria (2014)
19. **Invited talk:** *Overview and recent developments of REMS-H data processing*, Rover Environmental Monitoring Station team meeting, Alcalá de Henares, Spain (2014)
20. Poster: *A latitude-based correction for the Martian harmonic pressure model*, European Geosciences Union, Vienna, Austria (2013)
21. Talk: *Retrieval of Martian dust properties by surface observations and radiative transfer models*, Finnish National Committee of COSPAR, Vantaa, Finland (2013)
22. Poster: *Retrieval of Martian dust properties by surface observations and radiative transfer models*, American Geophysical Union, San Francisco, California, USA (2013)

23. Poster: *Analysis of the re-processed high-resolution whole-mission meteorological data of the Viking Landers*, European Geosciences Union, Vienna, Austria (2012)
24. Poster: *A statistical look at the Viking Lander long-term meteorological data*, European Planetary Science Congress, Madrid, Spain (2012)
25. Talk: *Data archaeology of Viking landers*, Towards Mars! Europlanet workshop, Tallinn, Estonia (2012)
26. Talk: *Curiosity landing and early operations*, Finnish Meteorological Institute seminar, Helsinki, Finland (2012)
27. Talk: *Data archaeology of Viking landers*, Finnish Meteorological Institute seminar, Helsinki, Finland (2012)
28. Poster: *Viking Lander 1 wind data before and after the sensor failures*, European Planetary Science Congress, Nantes, France (2011)
29. Poster: *Analysis of Unpublished Mars Viking Lander Met-Data*, European Planetary Science Congress, Rome, Italy (2010)

Professional Societies

Member: American Association for Aerosol Research (AAAR), American Geophysical Union (AGU), International Society for Atmospheric Research using Remotely piloted Aircraft (ISARRA), Optical Society of America (OSA)