

# Curriculum vitae for Christoph Vannahme

## Contact data

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## Education

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2012 – 2013	<b>Education in University Teaching at DTU, UDTU</b>
2008 – 2011	Karlsruhe Institute of Technology, Karlsruhe, Germany <b>Ph.D. (Dr.-Ing., mechanical engineering), grade “summa cum laude”</b> Thesis on integration of photonic crystal dye lasers into plastic labs-on-a-chip Member of the elite graduate school <b>Karlsruhe School of Optics &amp; Photonics (KSOP)</b>
2002 – 2007	University of Paderborn, Paderborn, Germany <b>B.Sc. and M.Sc. (physics), both grades “with distinction”</b> Theses on integrated optical Ti:LiNbO <sub>3</sub> ring resonator gyroscope

## Academic awards and scholarships

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- **Sapere Aude: DFF Ung Eliteforsker 2013** by **The Danish Council for Independent Research | Technology and Production Sciences**
- **Individual Postdoctoral Grant** (2012 – 2015) by **The Danish Council for Independent Research | Technology and Production Sciences**
- **Hans Christian Ørsted Postdoctoral Scholarship** (2011 – 2013)
- **Karlsruhe School of Optics & Photonics (KSOP) Publication Award** for the paper “Plastic lab-on-a-chip for fluorescence excitation with integrated organic semiconductor lasers,” Opt. Express 19, 8179 – 8186 (2011)
- **Karlsruhe House of Young Scientists (KHYS) Research Travel Scholarship**  
Exchange Ph.D. student at DTU Nanotech (08/2009 – 01/2010)
- **Young Researcher Best Paper Award** for the paper “Integrated optical Ti:LiNbO<sub>3</sub> ring resonator for rotation rate sensing,” at European Conference on Integrated Optics (2007)

## Scientific focus areas

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<b>Photonics</b>	Optical sensors, imaging refractometry, dye based photonic crystal lasers, optofluidic dye lasers, polymer waveguides, integrated optical ring resonators
<b>Micro- and nanofabrication</b>	Polymer micro- and nanofabrication, nanoimprint lithography, foil nanoimprint, thermal bonding, DUV lithography

# Publication list for Christoph Vannahme

**Peer reviewed journal publications: 31**

**Patents and patent applications: 4**

**Personally given conference and summer school presentations: 21**

**Articles in conference proceedings: 10**

**Researcher ID: B-3284-2011**

**H-index: 11 (ISI), 14 (Google scholar)**

## Peer reviewed journal publications

- P. G. Hermannsson, **C. Vannahme**, C. L. C. Smith, K. T. Sørensen, and A. Kristensen, "Refractive index dispersion sensing using an array of photonic crystal resonant reflectors," *Appl. Phys. Lett.* 107, 061101 (2015).
- P. G. Hermannsson, K. T. Sørensen, **C. Vannahme**, C. L. C. Smith, J. J. Klein, M.-M. Russew, G. Grützner, and A. Kristensen, "All-polymer photonic crystal slab sensor," *Opt. Express* 23, 16529-16539 (2015).
- **C. Vannahme**, K. Tølbøl Sørensen, C. Gade, M. Dufva, and A. Kristensen, "Refractometric monitoring of dissolution and fluid flow with distributed feedback dye laser sensor," *Opt. Express* 23, 6562-6568 (2015).
- **C. Vannahme**, M. Dufva, and A. Kristensen, "High frame rate multi-resonance imaging refractometry with distributed feedback dye laser sensor," *Light: Science & Applications* 4, e269; doi: 10.1038/lsci.2015.42 (2015).
- S. Krämer, **C. Vannahme**, C. L. C. Smith, T. Grossmann, M. Jenne, S. Schierle, L. Jørgensen, I. S. Chronakis, A. Kristensen, and H. Kalt, "Random-cavity lasing from electrospun polymer fiber networks," *Adv. Mat.* 26 (48), 8096-8100 (2014).
- P. G. Hermannsson, **C. Vannahme**, C. L. C. Smith, and A. Kristensen, "Absolute analytical prediction of photonic crystal guided mode resonance wavelengths," *Appl. Phys. Lett.* 105, 071103 (2014).
- M. Khouri, **C. Vannahme**, K. T. Sørensen, A. Kristensen, and K. Berg-Sørensen, "Monolithic integration of DUV-induced waveguides into plastic microfluidic chip for optical manipulation," *Microelectron. Eng.* 121, 5-9 (2014).
- X. Liu, S. Prinz, H. Besser, W. Pfleging, M. Wissmann, **C. Vannahme**, M. Guttmann, T. Mappes, S. Koeber, C. Koos, and U. Lemmer, "Organic semiconductor distributed feedback laser pixels for lab-on-a-chip applications fabricated by laser-assisted replication," *Faraday Discuss.* 174, 153-164 (2014).
- C. L. C. Smith, A. Haraksingh Thilsted, C. E. Garcia-Ortiz, I. P. Radko, R. Marie, C. Jeppesen, **C. Vannahme**, S. I. Bozhevolnyi, and A. Kristensen, "Efficient excitation of channel plasmons in tailored, UV-lithography-defined V-grooves," *Nano Lett.* 14, 1659-1664 (2014).  
Highlighted by *Nature Photonics*: D. Pile, "Exciting channels," *Nat. Photonics* 8, 350-351 (2014).
- X. Liu, S. Klinkhammer, Z. Wang, T. Wienhold, **C. Vannahme**, P.-J. Jakobs, A. Bacher, A. Muslija, T. Mappes, and U. Lemmer, "Pump spot size dependent lasing threshold in organic semiconductor DFB lasers fabricated via nanograting transfer," *Opt. Express* 21, 27697-27706 (2013).
- **C. Vannahme**, M. C. Leung, F. Richter, C. L. C. Smith, P. G. Hermannsson, and A. Kristensen, "Nanoimprinted distributed feedback lasers comprising TiO<sub>2</sub> thin films: Design guidelines for high performance sensing," *Laser Photonics Rev.* 7, 1036-1042 (2013).
- **C. Vannahme**, F. Maier-Flaig, U. Lemmer, and A. Kristensen, "Single-mode biological distributed feedback laser," *Lab Chip* 13, 2675-2678 (2013).  
Highlighted by *Nature Photonics*: S. Pleasants, "Biological lasers," *Nat. Photonics* 7, 584 (2013).
- **C. Vannahme**, C. L. C. Smith, M. B. Christiansen, and A. Kristensen, "Emission wavelength of multilayer distributed feedback dye lasers," *Appl. Phys. Lett.* 101, 151123 (2012).
- T. Wienhold, F. Breithaupt, **C. Vannahme**, M. B. Christiansen, W. Doerfler, A. Kristensen, and T. Mappes, "Diffusion driven optofluidic dye lasers encapsulated into polymer chips," *Lab Chip* 12, 3734-3739 (2012).
- X. Liu, S. Klinkhammer, K. Sudau, N. Mechau, **C. Vannahme**, J. Kaschke, T. Mappes, M. Wegener, and U. Lemmer, "Ink-jet-printed organic semiconductor distributed feedback laser," *Appl. Phys. Express* 5, 072101 (2012).
- S. Klinkhammer, X. Liu, K. Huska, Y. Shen, S. Valouch, **C. Vannahme**, S. Braese, U. Lemmer, "Continuously tunable solution-processed organic semiconductor DFB lasers pumped by laser diode," *Opt. Express* 20, 5748-5751 (2012).

- S. Klinkhammer, N. Heussner, K. Huska, T. Bocksrocker, F. Geislhoeringer, **C. Vannahme**, T. Mappes, and U. Lemmer, "Voltage-controlled tuning of an organic semiconductor distributed feedback laser using liquid crystals," *Appl. Phys. Lett.* 99, 023307 (2011).
- T. Grossmann, S. Klinkhammer, M. Hauser, D. Floess, T. Beck, **C. Vannahme**, T. Mappes, U. Lemmer, and H. Kalt, "Strongly confined, low-threshold laser modes in organic semiconductor microgoblets," *Opt. Express* 19, 10009-10016 (2011).
- **C. Vannahme**, S. Klinkhammer, U. Lemmer, and T. Mappes, "Plastic lab-on-a-chip for fluorescence excitation with integrated organic semiconductor lasers," *Opt. Express* 19, 8179-8186 (2011).
- Z. Wang, J. Hauss, **C. Vannahme**, U. Bog, S. Klinkhammer, D. Zhao, M. Gerken, T. Mappes, and U. Lemmer, "Nanograting transfer for light extraction in organic light-emitting devices," *Appl. Phys. Lett.* 98, 143105 (2011).
- S. Klinkhammer, T. Grossmann, K. Luell, M. Hauser, **C. Vannahme**, T. Mappes, H. Kalt, and U. Lemmer, "Diode-pumped organic semiconductor microcone laser," *IEEE Phot. Technol. Lett.* 23, 489-491 (2011).
- M. Schelb, **C. Vannahme**, A. Kolew, and T. Mappes, "Hot embossing of photonic crystal polymer structures with high aspect ratio," *J. Micromech. Microeng.* 21, 025017 (2011).
- **C. Vannahme**, S. Klinkhammer, M. B. Christiansen, A. Kolew, A. Kristensen, U. Lemmer, and T. Mappes, "All-polymer organic semiconductor laser chips: Parallel fabrication and encapsulation," *Opt. Express* 18, 24881-24887 (2010).
- T. Grossmann, S. Schleede, M. Hauser, M. B. Christiansen, **C. Vannahme**, C. Eschenbaum, S. Klinkhammer, T. Beck, J. Fuchs, G. U. Nienhaus, U. Lemmer, A. Kristensen, T. Mappes, and H. Kalt, "Low-threshold conical microcavity dye lasers," *Appl. Phys. Lett.* 97, 063304 (2010).
- M. Schelb, **C. Vannahme**, A. Welle, S. Lenhert, B. Ross, and T. Mappes, "Fluorescence excitation on monolithically integrated all polymer chips," *J. Biomed. Opt.* 15, 041517 (2010).
- **C. Vannahme**, M. B. Christiansen, T. Mappes, and A. Kristensen, "Optofluidic dye laser in a foil," *Opt. Express* 18, 9280-9285 (2010).
- S. Lenhert, F. Brinkmann, S. Walheim, T. Laue, **C. Vannahme**, S. Klinkhammer, S. Sekula, M. Xu, T. Mappes, T. Schimmel, and H. Fuchs, "Lipid multilayer gratings," *Nat. Nanotechnol.* 5, 275-279 (2010).
- T. Grossmann, M. Hauser, T. Beck, C. Gohn-Kreuz, M. Karl, H. Kalt, **C. Vannahme**, and T. Mappes, "High-Q conical polymeric microcavities," *Appl. Phys. Lett.* 96, 013303 (2010).
- **C. Vannahme**, S. Klinkhammer, A. Kolew, P.-J. Jakobs, M. Guttmann, S. Dehm, U. Lemmer, and T. Mappes, "Integration of organic semiconductor lasers and single-mode passive waveguides into a PMMA substrate," *Microelectron. Eng.* 87, 693-695 (2010).
- S. Klinkhammer, T. Woggon, U. Geyer, **C. Vannahme**, T. Mappes, S. Dehm, and U. Lemmer, "A continuously tunable low-threshold organic semiconductor distributed feedback laser fabricated by rotating shadow mask evaporation," *Appl. Phys. B* 97, 787-791 (2009).
- T. Mappes, **C. Vannahme**, M. Schelb, U. Lemmer, and J. Mohr, "Design for optimized coupling of organic semiconductor laser light into polymer waveguides for highly integrated bio-photonic sensors," *Microelectron. Eng.* 86, 1499-1501 (2009).

## Patents

- **C. Vannahme**, A. Kristensen, and M. Dufva, "A surface refractive index scanning system," European patent application no. 14167484.6 (May 8, 2014).
- A. Kristensen, P. G. Hermannsson, **C. Vannahme**, and C. L. C. Smith, "Method of and system for identification or estimation of a refractive index of a liquid," European patent application no. 14164354.4 (April 11, 2014).
- T. Grossmann, M. Hauser, T. Beck, H. Kalt, **C. Vannahme**, and T. Mappes, "Micro-optical element for coupling laser light at micro resonators, has wave guide for laser light and two micro resonators provided with side panels on substrate," EP2287592-A1, US2011044581-A1, US8358884-B2 (August 22, 2009).
- T. Mappes, **C. Vannahme**, and M. Schelb, "Optical element comprises substrate, passive waveguide disposed in substrate, and laser waveguide disposed in substrate," EP2154760-A2, US2010040324-A1, DE102008038993-A1, DE102008038993-B4, US8165430-B2 (August 13, 2008).

## Personally given conference and summer school presentations

- **C. Vannahme**, "Photonic crystals for high frame rate imaging refractometry," 8<sup>th</sup> International summer school, New Frontiers in Optical Technologies (Tampere, August 10-14, 2015). (**Invited lecture**)

- **C. Vannahme**, “Imaging refractometry enabled by photonic crystals,” PolyNano summer school (Copenhagen, August 10-28, 2015). (**Invited lecture**)
- **C. Vannahme**, K. T. Sørensen, C. Gade, P. G. Hermannsson, M. Dufva, and A. Kristensen, “Nanoimprinted distributed feedback dye laser sensors for high frame rate refractometric imaging of dissolution and fluid flow,” OSA Advanced Photonics Congress, (Boston, June 27 - July 1, 2015). (Talk)
- **C. Vannahme**, K. T. Sørensen, C. Gade, M. Jacobsen, M. Dufva, and A. Kristensen, “Refractometric dissolution imaging in 1D and 2D with nanoimprinted distributed feedback dye laser sensors,” 116<sup>th</sup> Annual Meeting of DGaO, (Brno, May 26-29, 2015). (Talk)
- **C. Vannahme**, “Photonic crystals for optofluidic imaging refractometry,” MF-6 Sixth Microfluidics Consortium meeting, (Copenhagen, April 23-24, 2015). (**Invited talk**)
- **C. Vannahme**, M. Dufva, and A. Kristensen, “Nanoimprinted distributed feedback dye laser sensor for real-time imaging of small molecule motion,” IEEE Sensors, (Valencia, November 2-5, 2014). (Talk)
- **C. Vannahme**, “Distributed feedback dye laser sensor for real-time imaging of small molecule motion,” MPNS COST Action 1205 Meeting: Advances in Optofluidics, (Ingelfingen, October 6-7, 2014). (Talk)
- **C. Vannahme**, C. Gade, J. S. Clausen, C. L. C. Smith, M. Dufva, and A. Kristensen, “Optimized distributed feedback dye laser sensor for real-time monitoring of small molecule flow,” ECIO-MOC, (Nice, June 24-27, 2014). (Poster)
- **C. Vannahme**, R. H. Pedersen, M. B. L. Mikkelsen, T. Buß, P. Bøggild, P. G. Hermannsson, F. Richter, H. Taylor, D. Mendels, and A. Kristensen, “Teaching and learning nanoimprint lithography at DTU,” NNT, (Barcelona, October 21-23, 2013). (Poster)
- M. Khouri, **C. Vannahme**, K. T. Sørensen, A. Kristensen, and K. Berg-Sørensen “Polymer optofluidic chip with DUV-induced waveguides for optical manipulation,” MNE, (London, September 17-19, 2013). (Talk)
- **C. Vannahme**, C. L. C. Smith, M. Leung, F. Richter, M. B. Christiansen, P. G. Hermannsson, and A. Kristensen, “Multilayer slab waveguide distributed feedback dye laser sensors,” PIERS, (Stockholm, August 12-15, 2013). (**Invited talk**)
- **C. Vannahme**, F. Maier-Flaig, U. Lemmer, and A. Kristensen, “Single-mode biological distributed feedback lasers based on vitamin B<sub>2</sub> doped gelatin,” 2<sup>nd</sup> EOS Conference on Optofluidics, (Munich, May 13-15, 2013). (Talk)
- **C. Vannahme**, C. L. C. Smith, M. Leung, F. Richter, M. B. Christiansen, and A. Kristensen, “Multilayer distributed feedback dye lasers: Enhanced emission wavelength and sensing,” CLEO Europe, (Munich, May 12-16, 2013). (Talk)
- **C. Vannahme**, T. Wienhold, F. Breithaupt, M. B. Christiansen, W. Dörfler, T. Mappes, and A. Kristensen, “Optofluidic dye lasers in a foil,” Northern Optics, (Snekkersten, November 19-21, 2012). (**Invited talk**)
- **C. Vannahme**, M. B. Christiansen, T. Mappes, and A. Kristensen, “High output pulse energy foil-based optofluidic dye lasers,” 1<sup>st</sup> EOS Conference on Optofluidics, (Munich, May 23-25, 2011). (Talk)
- **C. Vannahme**, S. Klinkhammer, U. Lemmer, and T. Mappes, “Integration of organic semiconductor lasers and waveguides into PMMA based microfluidic lab-on-a-chip systems,” CLEO Europe, (Munich, May 22-26, 2011). (Talk)
- **C. Vannahme**, S. Klinkhammer, M. B. Christiansen, F. Brinkmann, S. Lenhert, A. Kristensen, U. Lemmer, and T. Mappes, “Organic lasers for plastic lab-on-a-chip systems,” Winter School of Organic Electronics, (Heidelberg, December 9-12, 2010). (Talk)
- **C. Vannahme**, S. Klinkhammer, F. Brinkmann, S. Lenhert, T. Grossmann, U. Lemmer, and T. Mappes, „Highly integrated biophotonics towards all-organic lab-on-chip systems,” SPIE Photonics Europe, (Brussels, April 12-16, 2010). (Talk)
- **C. Vannahme**, S. Klinkhammer, A. Kolew, T. Woggon, T. Mappes, U. Lemmer, and J. Mohr, “Hot embossing of micro- and nanostructures for the integration of organic semiconductor lasers and deep UV induced waveguides towards a lab-on-chip system,” MNE, (Ghent, September 28 - October 1, 2009). (Poster)
- **C. Vannahme**, S. Klinkhammer, M. Schelb, U. Bog, and T. Mappes, “Microfluidic lab-on-chip made of PMMA with integrated organic lasers and waveguides for biophotonic applications,” COMS, (Copenhagen, August 30 - September 4, 2009). (Talk)
- **C. Vannahme**, H. Suche, S. Reza, R. Ricken, V. Quiring, and W. Sohler, “Integrated optical Ti:LiNbO<sub>3</sub> ring resonator for rotation rate sensing,” ECIO, (Copenhagen, April 25-27, 2007). (Talk, Young Researcher Best Paper)

## Articles in conference proceedings

- **C. Vannahme**, M. Dufva, and A. Kristensen, “Nanoimprinted distributed feedback dye laser sensor for real-time imaging of small molecule diffusion,” Proc. IEEE Sensors, 1384-1386 (2014).

- P. G. Hermansson, **C. Vannahme**, C. L. C. Smith, and A. Kristensen, "Accurate wavelength prediction of photonic crystal resonant reflection and applications in refractive index measurement," Proc. IEEE Sensors, 1399-1402 (2014).
- T. Grossmann, S. Schleede, M. Hauser, M. Brøkner Christiansen, **C. Vannahme**, C. Eschenbaum, S. Klinkhammer, T. Beck, J. Fuchs, G. U. Nienhaus, U. Lemmer, A. Kristensen, T. Mappes, and H. Kalt, "Lasing in high-Q conical polymeric microcavities," Proc. SPIE 7913, 79130Y (2011).
- T. Beck, M. Hauser, T. Grossmann, S. Schleede, J. Fischer, H. Kalt, **C. Vannahme**, and T. Mappes, "PMMA-microcone resonators for biosensing applications," Proc. SPIE 7888, 78880A (2011).
- **C. Vannahme**, S. Klinkhammer, F. Brinkmann, S. Lenhert, T. Grossmann, U. Lemmer, T. Mappes, "Highly integrated biophotonics towards all-organic lab-on-chip systems", Proc. SPIE 7715, 77151H (2010).
- S. Klinkhammer, T. Woggon, **C. Vannahme**, T. Mappes, U. Lemmer, "Optical spectroscopy with organic semiconductor lasers," Proc. SPIE 7722, 77221I (2010).
- T. Mappes, **C. Vannahme**, S. Klinkhammer, U. Bog, M. Schelb, T. Grossmann, M. Hauser, H. Kalt, U. Lemmer, "Integrated photonic lab-on-chip systems for biomedical applications", Proc. SPIE 7716, 77160R (2010).
- T. Mappes, M. Schelb, **C. Vannahme**, S. Lenhert, B. Ross, A. Welle, "Biophotonic fluorescence excitation with integrated polymer waveguides", Proc. SPIE 7716, 77162A (2010).
- M. Hauser, T. Grossmann, S. Schleede, J. Fischer, T. Beck, **C. Vannahme**, T. Mappes, H. Kalt, "Fabrication and characterization of high-Q conical polymeric microcavities", Proc. SPIE 7716, 77161Z (2010).
- T. Mappes, **C. Vannahme**, S. Klinkhammer, T. Woggon, M. Schelb, S. Lenhert, J. Mohr, and U. Lemmer, "Polymer biophotonic lab-on-chip devices with integrated organic semiconductor lasers," Proc. SPIE 7418, 74180A (2009).

## Other selected publications

- T. Woggon, M. Punke, M. Stroisch, M. Bruendel, M. Schelb, **C. Vannahme**, T. Mappes, J. Mohr, and U. Lemmer, "Organic semiconductor lasers as integrated light sources for optical sensors," in *McGraw-Hill volume on Organic Electronics in Sensors and Biotechnology*, J. Shinar and R. Shinar, eds. (McGraw-Hill, New York 2009).
- W. Sohler, H. Hu, R. Ricken, V. Quiring, **C. Vannahme**, H. Herrmann, D. Buechter, S. Reza, W. Grundkoetter, S. Orlov, H. Suche, R. Nouroozi, and Y. H. Min, "Integrated optical devices in lithium niobate," Optics & Photonics News 19, 24-31 (2008).