



Institute for Lasers,
Life and Biophotonics

ANNUAL REPORT 2010

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1. PREFACE

This is the first annual report of LaserLaB Amsterdam, the interfacultair Onderzoeksinstituut of the VU University in collaboration with the VU medical Center, the University of Amsterdam and the Academic Medical Center. LaserLaB Amsterdam was established in the spring of 2010. The opening of LaserLaB Amsterdam was celebrated on October 22, 2011 with a symposium at the Koninklijke Nationale Academie voor Wetenschappen, Trippenhuis, Amsterdam.

In 2010, LaserLaB Amsterdam could celebrate the award of a prestigious ERC advanced grant (Prof van Grondelle) and an ERC starting grant (Prof Wuite) from the European Union. On the national level LaserLaB Amsterdam also performed exceptionally well. Within the Innovational Research Incentives Scheme (vernieuwingsimpuls), a VICI (Prof de Boer), and four VENI's (Rudy Berrera, Lieneke Snippen, Mattijs de Groot, Iddo Heller) were awarded to LaserLaB Amsterdam participants. LaserLaB Amsterdam continued to fare well within the national competition, with as highlights 2.9 M€ for the FOM-program "Broken Mirrors and Drifting Constants" under program leader and VU Professor dr. Wim Ubachs, and 2,6 M€ for the FOM program "the Thylakoid membrane - a dynamic switch" under program leader and VU professor dr. Rienk van Grondelle.

LaserLaB Amsterdam (LLAMS) is part of LASERLAB-Europe, an Integrated Infrastructure Initiative of the European Union, forming a consortium of the 27 major laser centers in Europe. Within LASERLAB-Europe LLAMS provides Transnational ACCESS to European scientists, who are welcome to use our advanced laser-based facilities. LASERLAB-Europe submitted its 5 year renewal proposal the past year, and the prospect of grant renewal looks excellent. Strategically, Laserlab Amsterdam is firmly embedded in the activities of LASERLAB-Europe, participating in the Innovative radiation sources at the extremes (INREX) and Laser and Photonics for Biology and Health (BIOPTICHAL) programs of the proposal.

In summary, we can look back at a very successful year.

Johannes F. de Boer
Director



LASERLAB-Europe: a consortium of the 27 major laser centers in Europe

2. DESCRIPTION OF THE LASERLAB AMSTERDAM

MISSION

The mission of LaserLaB Amsterdam is groundbreaking scientific research based on the interaction of light with matter, spanning from the research on atoms and molecules to the investigation of living cells and tissue and sustainable energy sources. Within LaserLaB, research is conducted in close collaboration between physicists, chemists, biologists and physicians. LaserLaB Amsterdam is hosted at the VU University, with participating research groups at the UvA, AMC and VUmc. LaserLaB is a founding partner of the new imaging center VU University medical imaging center. LaserLaB Amsterdam is part of LASERLAB-Europe, an Integrated Infrastructure Initiative of the European Union, forming a consortium of the 27 major laser centers in Europe.

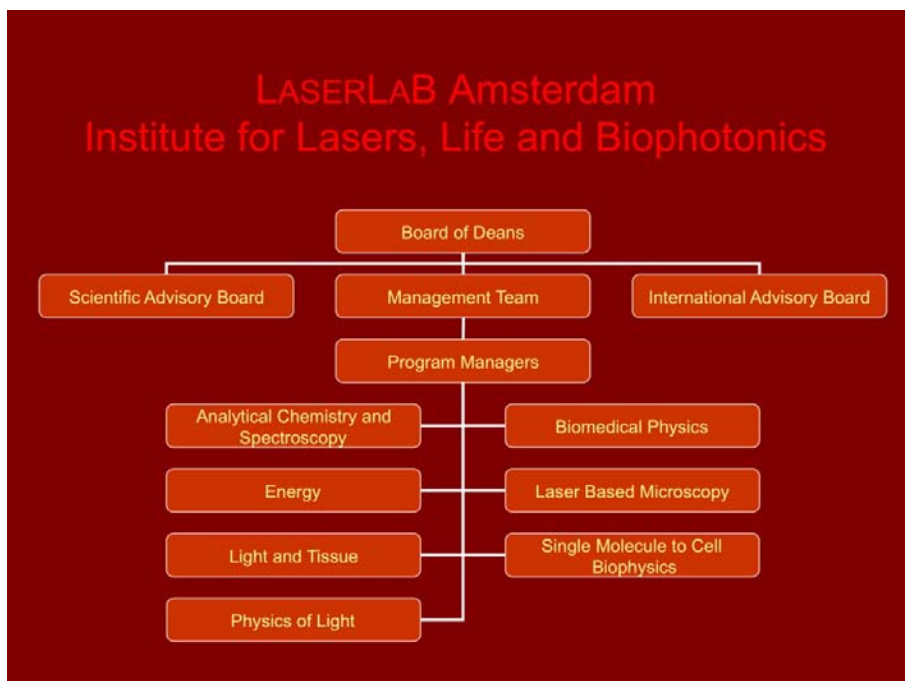
STRATEGY and FUTURE VISION

The increasing demand for health and longevity requires a better understanding of the basic processes of life. The LaserLaB research is focused on the development and application of novel optical methods, techniques and instruments to study the interaction between proteins, DNA, cells and tissue. This knowledge will lead to innovative diagnostic and therapeutic techniques.

Energy production will play a crucial role in our future. The process of photosynthesis in plants serves as an example for renewable energy production. By studying this process, it is possible to develop more efficient solar cells or biofuels. The laser has made it possible to study the structure of living materials and matter and the chemical and physical processes that take place within them.

LaserLab will serve as a powerful multidisciplinary educational faculty, especially for national and international (Master's) students and will have a unique position in Europe.

3. STRUCTURE OF LASERLAB AMSTERDAM



The core of LaserLaB Amsterdam are the programs directed by the program leaders. Programs are centered on 7 themes that constitute the long term research mission of the institute.

1 Analytical Chemistry and Spectroscopy



Program manager: Dr. W.J. Buma

Both Amsterdam universities have a strong history and track record in the area of analytical chemistry and spectroscopy, in particular with respect to the application of laser-based research. Currently, three groups (one in analytical chemistry, two in fundamental spectroscopy) are active. The research theme comprises activities in Molecular spectroscopy (Buma/Brouwer/Woutersen/ Williams/Zhang UvA), Ultrafast photodynamics and spectroscopy in the gas phase (Janssen, VU), and Biomolecular (Analysis and) Spectroscopy (Gooijer/Ariese/van der Zwan, VU). Each of the three groups thus brings in complementary expertise that allows them to cover together the full range of chemical-spectroscopic research. Research in the area of analytical chemistry and spectroscopy is dedicated to both fundamental science and applications, with a close connection to industry.

2 Biomedical Physics



Program manager: Dr. J.F. de Boer

The long-term goal of the research program Biomedical Physics is to develop the next generation optical techniques for the diagnosis, understanding, and treatment of disease. In clinical medicine, significant progress in screening, diagnosis and treatment has been fuelled by the exact sciences and has for instance led to imaging techniques such as X-ray, MRI and PET imaging. Optical techniques have the advantages of using

non-ionizing radiation, being non- or minimally invasive with unprecedented resolution (down to molecular level), and having the capability of spectroscopic analysis of tissue. A main thrust of the research is in the area of Optical Coherence Tomography (OCT). OCT creates in-vivo cross-sectional images approaching the cellular level in a non-invasive or minimally invasive way. OCT can potentially provide “optical biopsies” for real time in-vivo diagnosis. Just as fluorescence has revolutionized cell biology, we expect minimally invasive imaging of targeted fluorophores to have a major impact in clinical medicine. Research is sponsored by FOM, NIH, and ZonMW through a VICI grant (Dr. de Boer).

3 Energy



Program manager: Dr. R. van Grondelle

Energy Research in LaserLaB Amsterdam is focused on the study of the fundamental events of the natural process of Photosynthesis. These include the capture of solar photons, the transfer of the electronic excitation to the photosynthetic reaction center where a charge separation is driven. All these events occur on a timescale of 10⁻¹⁵ to 10⁻⁹ seconds and are studied with ultrafast pulsed lasers using techniques such as pump-probe spectroscopy in the visible and mid-infrared, multi-dimensional photon echo, streak-camera detected fluorescence. Based on this knowledge artificial, bio-inspired photosynthetic systems are designed and studied using the same methods with the aim to develop a future ‘bio-solar cell’. A recent development is the study of anorganic catalytic crystals that are designed to oxidize water by light.

4 Laser-Based Microscopy



Program manager: Dr. M.L. Groot

Within this program we develop nonlinear and coherent microscopic tools for studies on cellular and tissue scale in the field of neurobiomedical research. The ability to look at living organisms with microscopic resolution has been of tremendous importance for understanding biological structure and function. Here, we develop nonlinear optical techniques to obtain images in deep-tissue with sub-cellular resolution, with and without external contrast agents (dyes, GFP). Label-free in-vivo images are obtained through third harmonic generation. Current research lines are the development of multipulse microscopies to obtain sub-diffraction resolution and the application of THG and digital holography in neuromedical research. This research is closely integrated with the Neuroscience Campus Amsterdam.

5 Light and Tissue



Program manager: Dr. T.G. van Leeuwen

The research activities in the program “Light and Tissue” at the Academic Medical Center focus on the physics of the interaction of light with tissue, and to use that knowledge for the development, introduction and clinical evaluation of (newly developed) optical imaging techniques for gathering quantitative functional and molecular information of tissue. Within our group, we focus on optical techniques as optical coherence tomography (OCT), spectrographic monitoring and imaging, photo-acoustic and fluorescence imaging, along the following research lines:

1. Functional imaging and forensic applications: VIDI grant of Dr Aalders, in cooperation with Neonatology, Ophthalmology and the Netherlands Forensic Institute.
2. Molecular imaging: VENI grant of Dr Faber, with clinical spin-offs towards Ophthalmology and Urology and the NKI.

3. Integration and combination of different imaging technologies, (“from cleanroom to clinic”) in cooperation with TU/e, UT, gastro-enterology and experimental clinical chemistry.

6 Single Molecule to Cell Biophysics



Program manager: Dr. G. Wuite

The research in this program focuses on exploring biophysical questions on the level from single molecules to cells. A central question is how protein and DNA structural dynamics are related to their function. The aim is to work with increasingly complex assemblies of biomolecules in order to investigate the emergent properties from these systems. This approach bridges experimental systems biology and single-molecule manipulation techniques. We are also focusing more and more on single-biomolecule dynamics in living cells or organisms. We use a variety of optical techniques such as super-resolution fluorescence microscopy, single-molecule fluorescence spectroscopy, optical tweezers, tethered particle motion, AFM, as well as combinations of these techniques. The data obtained are related to biochemical studies and used for theoretical modeling

7 Physics of Light and Matter



Program manager: Dr. K.S.E. Eikema

The research activities carried out in the program “Physics of Light and Matter” concentrate on performing ultra-precision experiments, which includes the development of advanced lasers sources (such as frequency comb lasers, ultra-stable lasers, extreme ultraviolet lasers and TeraWatt short pulse lasers) and spectroscopic methods to cool, manipulate and trap atoms, molecules and ions. The exciting possibilities due to advanced lasers and methods to control matter are explored in two major themes. One is “Fundamental physics at the atomic scale”, which includes searching for a possible variation of fundamental constants, testing quantum-electrodynamic theory in atoms and small molecules, and studying matter at ultra-low temperatures. The other theme is “Applied Laser Spectroscopies” which ranges from spectroscopy of astrophysically relevant gas-phase species, sensitive detection of molecules in liquids and mono-layer surfaces, light scattering studies, development of miniature lasers for length measurement, to imaging with ultrafast X-rays at a sub-cellular level.

4. SWOT ANALYSIS

Strength

The strength of LaserLaB Amsterdam is its faculty. Hiring within the LaserLaB Programs and the Dept of Physics has been based for a long time on potential earning capacity of faculty candidates. The strong performance in ERC (EU), Innovational Research Incentives Scheme (vernieuwingsimpuls), and national Program and project grants is a result of this policy. LaserLaB Europe provides a strong platform for international visibility and exchange of scientists through the access program. Within the VU University, LaserLaB Amsterdam is considered a research crown jewel with the largest number of NWO-scholarships (Veni, Vidi, Vici) on VU-campus. Research cores are well positioned to participate in regional and national funding initiatives. Neuroscience campus, the institute AIMMS and the VU medical Imaging center provide an excellent environment for cross disciplinary collaborations on the campus

Weakness

LaserLaB Amsterdam has three main research cores, Physics of Light and Matter, Sustainable Earth/Energy/Environment, and Life & Health. The latter two are firmly embedded within the focus areas of the campus, while Physics of Light and Matter forms a foundation for the two other core activities through the development of advanced (laser)techniques. Each of the themes has not yet enough mass to achieve an agenda setting position within the national or European research agenda. Mass has to be generated by strategic alliances within the regional and national setting.

Opportunities

Within the Life & Health research core, LaserLaB has a strategic alliance with the UvA (Buma) and the AMC (van Leeuwen) as participants. The topsector area plans for Life Sciences and Health provides a strong opportunity to expand the research. The Innovative Medical Device Initiative (IMDI) is mentioned at several occasions in the Life Sciences and Health topsectorplan. LaserLaB participates in the institute Quantivision (iQ) which is a joint initiative of the VUmc, VU, NKI, UvA and AMC and one of the eight cores of excellence of the IMDI initiative. iQ provides the critical mass within the Amsterdam regio to achieve an agenda setting research program. LaserLaB also participates in the VU Medical imaging center to shape the life and health research agenda.

Within the Sustainable Earth/Energy/Environment research core both VU and UvA participate in the major initiative 'Fuels by Photosynthesis'. The initiative is based on the strong photosynthesis activity at VU and aims to establish a FOM/NWO focusgroup that will form the core of a joint VU-UvA Energy program including research in photosynthesis, catalysis, photoconversion & artificial photosynthesis, theoretical systems physics/biology, microbiology, theoretical chemistry and photochemistry. The program will include a VU-UvA Energy&Sustainability master teaching program.

Within the Physics of Light and Matter (PLM) core, LaserLaB provides a nucleus within the Netherlands for ultra-high precision tests of physics and development of techniques for controlling atomic, molecular, and ionic matter. Efforts are ongoing for ultraprecise optical clock dissemination on a European scale and for navigation of the future. The advanced laser techniques that are developed at the PLM core provide strong opportunities for collaborations with the two other core activities within LaserLaB Amsterdam and Laserlab Europe (JRA ALADIN2 and future JRA's: INREX and BIOPTICAL). PLM is well positioned through international collaborations with Fritz Haber Institute (G. Meijer, Berlin) and the ETH (F. Merkt, Zurich), and with companies such as Menlo and Toptica in Germany, and IMRA in the USA, and research groups worldwide for theoretical support.

Threats

The predominant threat to the Research Institute and academia in general is the downward pressure on budgets for investment in research and education. The strategy to counter this threat is excellence and relevance. LaserLaB Amsterdam strives for excellence, as is evident from the success in European and national competitions, and has focused its efforts on two of the major societal problems that will have a national and global impact: Energy and Life & Health.

5. GRANTS, NEWS AND HIGHLIGHTS OF THE YEAR 2010

In 2010 LaserLaB researchers received a prestigious ERC advanced grant and an ERC starting grant from the EU, 2 large program grants on the national level, a Vici and 4 Veni's, and a number of individual investigator grants.

Prestigious ERC Advanced Grant to Professor Rienk van Grondelle

The grant of almost 3 million euros will fund his research into the role chlorophyll-binding proteins play in determining the success of photosynthesis.

Prestigious ERC starting Grant to Professor Gijs Wuite

The grant of almost 1.5 million euros will fund his research into a physical investigation of DNA transactions in mitochondria

2,9 M€ for Atomic-, Molecule- and Laserphysics

FOM-program Broken Mirrors and Drifting Constants under programme leader Prof. Wim Ubachs receives a subsidy of 2.9 ME. This program will be carried out by the Group Atomic-, Molecule- and Laserphysics, by Wim Ubachs, Kjeld Eikema, Wim Vassen, Rick Bethlem and Jeroen Koelemeij in cooperation with the research group at KVI-Groningen (led by Prof. Klaus Jungmann).

2,6 M€ for the thylakoid membrane – a dynamic switch

FOM-program The thylakoid membrane – a dynamic switch, under program leader Prof. Rienk van Grondelle receives a subsidy of 2.6 ME. This program will be carried out by Prof. dr. R. van Grondelle, VU University, Amsterdam, Dr. J.P. Dekker, VU University, Amsterdam, Prof. dr. H. van Amerongen, Wageningen UR, Wageningen, Dr. H. Van As, Wageningen UR, Wageningen, Prof. dr. R. Croce, University of Groningen, Groningen, Prof. dr. E.J. Boekema, University of Groningen, Groningen, Prof. dr. S.-J. Marrink, University of Groningen, Groningen, Prof. dr. J.A. Killian, University of Utrecht, Utrecht.

VICI grant for Prof. dr. Johannes de Boer: Licht op ziekte

Veni grant for Rudi Berera: How light harvesting is regulated in photosynthesis

Veni grant for Lieneke van der Sneppen: Vroeg diagnosticeren van kanker met een eenvoudige optische sensor

Veni grant for Mattijs de Groot: Driedimensionale afbeelding van tumoren

Veni grant for Iddo Heller: Vingervlugge DNA-kopieerders betrapt

FOM grant to Rick Bethlem and Wim Ubachs

"Search for a variation of the proton-electron mass ratio in cold CO"

ECHO grant NWO-Chemical Sciences to John Kennis

Illuminating Biophotonic Switches

FOM grant to Davide Iannuzzi

Hunting for the chameleon: dark energy in a table-top experiment.

NWO Astrochemistry Program

Launch of NWO Astrochemistry Program with VU participants

NWO divisions CW (chemical sciences) and EW (exact sciences) have started a joint program on Astrochemistry with involvement of VU scientists (Prof. Wim Ubachs (VU Physics), Prof.

Matthias Bickelhaupt (VU Theoretical Chemistry), Prof. Harold Linnartz (Extraordinary professor at VU-FEW)).

Third time is a charm.

LASERLAB-EUROPE, the Integrated Initiative of European Laser Infrastructures, prepares for its third phase.

Research and publicity highlights of 2010

VU Physicist Jeroen Koelemeij participated in a project at NIST to build the world's most precise clock

Physicists at the National Institute of Standards and Technology (NIST) have built an enhanced version of an experimental atomic clock based on a single aluminum atom that is now the world's most precise clock, more than twice as precise as the previous pacesetter based on a mercury atom. The new aluminum clock would neither gain nor lose one second in about 3.7 billion years, according to measurements to be reported in Physical Review Letters.*

Dr. Kjeld Eikema appointed as Extraordinary Professor in Experimental Atomic Physics

Foundation Leonardo da Vinci has appointed dr. Kjeld Eikema as Extraordinary Professor in Experimental Atomic Physics at the Kernfysisch Versneller Instituut (KVI). His appointment is for 5 years starting 1st of May 2010.

Prof. Dr. Rienk van Grondelle gives Physica Lecture 2010

On April 23rd, Prof. Dr. Rienk van Grondelle has given the Physica Lecture "The Design of Photosynthesis" at Fysica 2010, organized by the Nederlandse Natuurkunde Vereniging and The Belgian Physical Society.

Dr Stefan Witte wins the Young Speaker Contest at Fysica 2010

Stefan Witte was voted the winner by the audience for his talk 'Shining light on the brain: high-resolution imaging of brain tissue using nonlinear microscopy'.

John Kennis and his team lead the way in improving the fluorescence qualities of phytochrome.

Prof.dr. Gijs Wuite has been chosen as the best MNS lecturer of 2010

Worldrecord in Spectroscopie

Prof.dr. Kjeld Eikema established a new world record in spectroscopy.

Rienk van Grondelle on the radio: VPRO program Noorderlicht

Prof. dr. Rienk van Grondelle talks about how he copies nature to generate energy out of artificial leaves as part of the European research program 'Towards Biosolar Cells'.

6. INPUT LASERLAB AMSTERDAM

*Preliminary numbers accumulated by Laserlab Staff.
Final numbers will be presented later*

Analytical Chemistry and Spectroscopy

- Total fte (including PhD students) / project: **23,86**
- Total fte PhD students / project: **12,80**

Biomedical Physics

- Total fte (including PhD students) / project: **3,37**
- Total fte PhD students / project: **1**

Energy

- Total fte (including PhD students) / project : **12,93**
- Total fte PhD students / project: **4,79**

Laser Based Microscopy

- Total fte (including PhD students) / project: **4,46**
- Total fte PhD students / project: **1**

Light and Tissue

- Total fte (including PhD students) / project:
- Total fte PhD students / project:

Single Molecule to Cell Biophysics

- Total fte (including PhD students) / project:
- Total fte PhD students / project:

Physics of Light

- Total fte (including PhD students) / project: **26,87**
- Total fte PhD students / project: **16,75**

7. OUTPUT RESEARCH INSTITUTE

a) Scientific Output

Analytical Chemistry and Spectroscopy

- Total number of theses: 5

Rutger L.A. Timmer

Molecular reorientation and transport in liquid water and ice

Promotor: prof. dr. H.J. Bakker

Defense: 26 January 2010

Pavol Bodis

Structure and dynamics of hydrogen-bonded systems

promotor: prof. dr. Wybren Jan Buma; co-promotor dr. Sander Woutersen

defense: 8 June 2010

Daniel Irimia

Femtosecond imaging and control of molecular photodynamics

promotor: prof. dr. M.H.M. Janssen

defense: 30 September 2010

Duygu Deniz Gunbas

Hydrogen-bonded rotaxanes

promotor: prof. dr. A.M. (Fred) Brouwer

defense: 12 October 2010

Joanna R. Siekierzycka

Applications of microspectroscopy

promotor: prof. dr. A.M. (Fred) Brouwer

defense: 2 November 2010

Dhiredj Jagesar

Intercomponent interactions and mobility in hydrogen-bonded rotaxanes

promotor: prof. dr. A.M. (Fred) Brouwer; co-promotor: prof. dr. Wybren Jan Buma

defense: 26 November 2010

Klaas-Jan Tielrooij

Molecular reorientation and transport in liquid water and ice

Promoter: prof. dr. H.J. Bakker

Defense: 15 December 2010

- Total number of scientific papers, refereed : **80**

Alexandre, M.T.A., Purcell, E.B., Grondelle, R. van, Robert, B., Kennis, J.T.M. & Crosson, S. (2010).

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Bakker, H.J. & Skinner, J.L. (2010).

Vibrational spectroscopy as a probe of structure and dynamics in liquid water. Chemical Reviews, 110(3), 1498-1517.

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Dreiöcker, F., Oomens, J., Meijer, A.J.H.M., Pickup, B.T., Jackson, R.F.W. & Schäfer, M. (2010). *Structure Elucidation of Dimethylformamide-Solvated Alkylzinc Cations in the Gas Phase.* Journal of Organic Chemistry, 75(4), 1203-1213.

Dunbar, R.C., Steill, J.D. & Oomens, J. (2010). *Cationized phenylalanine conformations characterized by IRMPD and computation for singly and doubly charged ions.* PCCP. Physical Chemistry Chemical Physics, 12(41), 13383-13393.

Dunbar, R.C., Steill, J.D. & Oomens, J. (2010). *Conformations and vibrational spectroscopy of metalion/polyalanine complexes.* International Journal of Mass Spectrometry, 297(1-3), 107-115.

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Biomedical Physics

- Total number of scientific papers, refereed: 3

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Energy

- Total number of theses: 2

K. C. Toh

Light activation mechanisms of regulation of photosynthesis in bacteria
promotor: J. Kennis, R. van Grondelle
defence: 27 January 2010

Thomas Cohen-Stuart

Stalking Electrons in Demanding Environments
promotor: R. van Grondelle
defense: 3 December 2010

- Total number of scientific papers, refereed: 11

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Laser Based Microscopy

- Total number of theses: 1

Olga Sytina

Enzymatic activity and excited state processes in protochlorophyllide oxidoreductase

promotores: M.L. Groot, R. van Grondelle

defense: 9 February 2010

- Total number of scientific papers, refereed: 1

Sytina, O.A., Stokkum, I.H.M. van, Heyes, D.J., Hunter, C.N., Grondelle, R. van & Groot, M.L. (2010).

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- Total number of scientific papers, refereed: 12

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Cauberg ECC, de Bruin DM, Faber DJ, de Reijke TM, Visser M, de la Rosette JJMCH, van Leeuwen TG
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Van der Pol E, Hoekstra A, Sturk A, Otto C, van Leeuwen TG, Nieuwland R
Optical and non-optical methods for detection and characterisation of micro particles and exosomes, J Thromb Haemost 2010, 8:2596-2607

- Total number of conference proceedings: 9

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Pathil C, Kalkman J, Faber DJ, Penn JS, van Leeuwen TG, Mahadevan-Jansen A *Structural and biochemical characterization of the rat retina with combined Raman spectroscopy-spectral domain optical coherence tomography (RS-SDOCT)*. Proc. SPIE 7550, 75501B (2010), DOI:10.1117/12.843106

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Akca I, Ismail N, Sun F, Nguyen D, Kalkman J, van Leeuwen TG, Driessen A, Worhoff K, Pollnau M, de Ridder R *Integrated Arrayed Waveguide Grating Spectrometer for On-Chip Optical Coherence Tomography*, in Conference on Lasers and Electro-Optics, OSA Technical Digest (CD) (Optical Society of America, 2010), paper JWA66.

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Barwari K, Cauberg E, de Bruin DM, Faber DJ, van Leeuwen TG, Wijkstra H, de la Rosette J, Laguna MP *Differentiation between normal renal tissue and renal cell carcinoma (rcc) using OCT*, European Urology Supplements, 2010 Volume 9, Supplement 2: 120

Barwari K, Cauberg E, de Bruin DM, Faber DJ, van Leeuwen TG, Wijkstra H, de la Rosette J, Laguna MP *Optical Coherence tomography to differentiate malignant from normal renal tissue: a pilot study*. Journal of Endourology 2010, 24: p. A12-A12

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Single Molecule to Cell Biophysics

- Total number of theses: 1

Marcel van 't Hoff

Resolution And Contrast Enhancement In Evanescent Wave Imaging

promotor: prof.dr. H. Lill. copromotoren: dr. M. Oheim, dr. D. Bald, dr. V. Emiliani.

Defence: 21 June 2010

- Total number of scientific papers, refereed: **28**

Baclayon, M., Wuite, G.J.L. & Roos, W.H. (2010)
Imaging and manipulation of single viruses by atomic force microscopy. *Soft Matter*, 6(21), 5273-5285.

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Kasza, K. E., Broedersz, C.P., Koenderink, G.H., Lin, Y.C., Messner, W., Nakamura, F., Stossel, T. P., MacKintosh, F.C. & Weitz, D. A. (2010).

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Physics of Light

- Total number of theses: 2

Maria Ofelia Vieitez Hornos

XUV laser studies of Rydberg-valence states in N₂ and H+H⁻ heavy Rydberg states
http://www.nat.vu.nl/en/Images/Ofelia_Thesis_tcm69-164614.pdf
promotors: prof. dr. W. Ubachs, prof. dr. C. A. de Lange, dr. L. E. Berg; copromotor: dr. O. Launila
defence: 2 June 2010

Toncho Ivanov

XUV spectroscopy of highly excited states in H₂, HD and D₂
promotors: prof. dr. W. Ubachs, prof. dr. C. A. de Lange
defense: 7 December 2010

- Total number of scientific papers, refereed: 20

Bailly, D., Salumbides, E.J., Vervloet, M. & Ubachs, W.M.G. (2010).
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Ivanov, T.I., Dickenson, G.D., Roudjane, M., De Oliveira, N., Joyeux, D., Nahon, L., Tchang-Brillet, W.U.L. & Ubachs, W.M.G. (2010). *Fourier-transform spectroscopy of HD in the vacuum ultraviolet at $\lambda = 87-112$ nm.* Molecular Physics, 108, 771-786.

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Liu, J.J., Sprecher, D., Jungen, C., Ubachs, W.M.G. & Merkt, F. (2010). *Determination of ionization and dissociation energies of the deuterium molecule (D₂).* Journal of Chemical Physics, 132, 154301.

Malec, A.L., Buning, R., Murphy, M.T., Milutinovic, N., Ellison, S.L., Prochaska, X.L., Kaper, L., Tumlinson, J., Carswell, R.F. & Ubachs, W.M.G. (2010). *Keck telescope constraint on cosmological variation of the proton-to-electron mass ratio.* Monthly Notices of the Royal Astronomical Society, 403, 1541-1555.

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Tumlinson, J., Malec, A.L., Carswell, R.F., Murphy, M.T., Buning, R., Milutinovic, N., Ellison, S.L., Prochaska, X.L., Jorgenson, R.A., Ubachs, W.M.G. & Wolfe, A.M.

(2010). *Cosmological concordance or chemical coincidence? Deuterated molecular hydrogen abundances at high redshift*. *Astrophysical Journal Letters*, 718, L156.

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Witschas, B., Vieitez, M.O., van Duijn, E.-J., Reitebuch, O., Van de Water, W. & Ubachs, W.M.G. (2010). *Spontaneous Rayleigh-Brillouin scattering of ultraviolet light in nitrogen, dry and moist air*. *Applied Optics*, 49, 4217-4227.

Zieger, P.C., Meerakker, S.Y.T. van de, Heiner, C.E., Bethlem, H.L., Roij, A.J.A. van & Meijer, G. (2010). *Multiple Packets of Neutral Molecules Revolving for over a Mile*. *Physical Review Letters*, 105(17), 173001

- Total number of conference proceedings: 1

Rille, O., Straume, A.G., Vieitez, M.O., Ubachs, W.M.G., Witschas, B., Marseille, G.J., Kloe, J., Stoffelen, A., Houchi, K., Körnich, H. & Schyberg, H. (2010). *ESA's wind Lidar mission ADM-AEOLUS; on-going scientific activities related to calibration, retrieval and instrument operation*. In 25th International Lidar Radar Conference Proceedings. St. Petersburg.

b) Scientific Quality¹

Analytical Chemistry and Spectroscopy

- Total number of citations

	2010	Total
A.M. Brouwer	122	1476
W.J. Buma	113	1431
C. Gooijer	231	3566
M.H.M. Janssen	117	1363
F. Arise	231	2344
G. van der Zwan	96	597
S. Woutersen	263	2767
R.M. Williams	???	
H. Zhang	???	
- Mean H-index of tenured staff

A.M. Brouwer	21
W.J. Buma	22
C. Gooijer	28
M.H.M. Janssen	22
F. Arise	25
G. van der Zwan	14

¹For the calculation we have used the Web of Science

S. Woutersen	24
R.M. Williams	???
H. Zhang	???

Biomedical Physics

▪ Total number of citations	<u>2010</u>	<u>Total</u>
J.F. de Boer	569	4330
R.M. Verdaasdonk	31	518
▪ Mean H-index of tenured staff		
J.F. de Boer	39	
R.M. Verdaasdonk	15	

Energy

▪ Total number of citations	<u>2010</u>	<u>Total</u>
R. van Grondelle	886	6449
S. Volker	???	
J.P. Dekker	???	
J.T.M. Kennis	260	1581
I.H.M. van Stokkum	554	3482
▪ Mean H-index of tenured staff		
R. van Grondelle	45	
S. Volker		
J.P. Dekker		
J.T.M. Kennis	25	
I.H.M. van Stokkum	36	

Laser Based Microscopy

▪ Total number of citations	<u>2010</u>	<u>Total</u>
M.L. Groot	107	880
▪ Mean H-index of tenured staff		
M.L. Goot	19	

Light and Tissue

▪ Total number of citations	<u>2010</u>	<u>Total</u>
A.G.J.M. van Leeuwen	269	874
M.J.C. van Gemert	92	922
M.C.G. Aalders	84	458
D.J. Fabe	113	359
▪ Mean H-index of tenured staff		
A.G.J.M. van Leeuwen	21	
M.J.C. van Gemert	32	
M.C.G. Aalders	17	
D.J. Faber	11	

Single Molecule to Cell Biophysics

▪ Total number of citations	<u>2010</u>	<u>Total</u>
H. Lill	???	
F.C. MacKintosh	735	4890
G.J.L. Wuite	292	1412
J. Luirink	309	4049
E.J.G. Peterman	198	1529
D. Bald	83	913

Y.J.M. Bollen	29	162
P. van Ulsen	53	332

- Mean H-index of tenured staff

H. Lill	18
F.C. MacKintosh	36
G.J.L. Wuite	21
J. Luirink	39
E.J.G. Peterman	26
D. Bald	14
Y.J.M. Bollen	6
P. van Ulsen	10

Physics of Light

- Total number of citations

	<u>2010</u>	<u>Total</u>
T.D. Visser	128	1388
W.M.G. Ubachs	292	2678
H.L. Bethlem	157	1718
K.S.E. Eikema	114	804
D. Iannuzzi	???	
W.Vassen	104	1271

- Mean H-index of tenured staff

T.D. Visser	21
W.M.G. Ubachs	29
H.L. Bethlem	20
K.S.E. Eikema	17
D. Iannuzzi	
W.Vassen	20

c) Indicators of esteem

Analytical Chemistry and Spectroscopy

- Special professors
 - Prof. dr. H.J. Bakker
 - Prof. dr. W.L. Meerts
 - Prof. dr. W.M.A. Niessen
 - Prof. dr. J. Oomens

Biomedical Physics

- Prestigious grants
 - VICI: Prof. dr. Johannes de Boer
 - VENI: dr. Mattijs de Groot

Energy

- Prestigious grants
 - ERC: Prof. dr. Rienk van Grondelle
 - VIDI: dr. Raoul Frese
 - VENI: dr. Rudi Berera
- Special professors
 - Prof. dr. H.J. Hellingwerf

Light and Tissue

- Editorships: Journal of Biomedical Optics (van Leeuwen)

Single Molecule to Cell Biophysics

- Awards
 - Young Academy membership (KNAW): Prof. dr. ir. Gijs Wuite
- Prestigious grants
 - ERC: Prof. dr. ir. Gijs Wuite
 - VENI: Dr. Iddo Heller
- Special professors
 - Prof. dr. G.H. Koenderink

Physics of Light

- Prestigious grants
 - VIDI: dr. Steven Knoop
 - VENI: dr. Stefan Witte
 - NWO: Prof. dr. Wim Ubachs
 - NWO: Prof. dr. Harold Linnartz
- Special professors
 - Prof. dr. E.A.A. Aben
 - Prof. dr. L. Kaper
 - Prof. dr. H.V.J. Linnartz

d) Societal Impact

Technical or economic impact

Awarded Patents 2010

1. WO2010059050-A1 Iannuzzi, D; Petrusis, A, Rector, J.H.; Optical fiber for transmitting UV radiation for treating photoresist materials, comprises distal end provided with optical mask adapted to project predetermined pattern on target surface by radiation transmitted from distal end
2. US7797119 de Boer, J.F.; Tearney, G.J.; Bouma, B.E.; Apparatus and method for rangings and noise reduction of low coherence interferometry Ici and optical coherence tomography oct signals by parallel detection of spectral bands - Sep 14, 2010
3. US7782464 Mujat, M.; Chan, R.C.; de Boer, J.F.; Processes, arrangements and systems for providing a fiber layer thickness map based on optical coherence tomography images - Aug 24, 2010
4. US7742173 Yun, S.H.; de Boer, J.F.; Tearney, G.J.; Bouma, B.E.; Methods, arrangements and systems for polarization-sensitive optical frequency domain imaging of a sample - Jun 22, 2010
5. US7733497 Yun, S.H.; Bouma, B.E.; Tearney, G.J.; de Boer, J.F.; Method and apparatus for performing optical imaging using frequency-domain interferometry - 2010-06-08
6. US7724786 Bouma, B.E.; Yun, S.H.; Oh, W-Y.; de Boer, J.F.; Tearney, G.J.; Process and apparatus for a wavelength tuning source - May 25, 2010

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7. US7643153 de Boer, J.F.; Tearney, G.J.; Bouma, B.E.; Apparatus and method for ranging and noise reduction of low coherence interferometry lci and optical coherence tomography oct signals by parallel detection of spectral bands - Jan 05, 2010
 8. US7643152 de Boer, J.F.; Tearney, G.J.; Bouma, B.E.; Apparatus and method for ranging and noise reduction of low coherence interferometry lci and optical coherence tomography oct signals by parallel detection of spectral bands - Jan 05, 2010