

# Curriculum vitae

**Full name** Tom Aarne KUUSELA

**Date and place of birth** 22 October, 1960, Turku, Finland

**Marital status** Married

**Work address** Mail: Department of Physics and Astronomy, University of Turku  
FIN-20014 Turku, Finland  
Phone: +358-2-333 6398  
E-mail: tom.kuusela@utu.fi  
WWW: <http://www.physics.utu.fi>

**Home address** Mail: Korjasmäenkatu 16  
20360 Turku, Finland  
Phone: +358-40 548 5008

## Education

1979 High school graduation, Turku  
1983 B.Sc. degree, University of Turku  
1986 M.Sc. degree, University of Turku  
1990 Phil. Lic. degree in theoretical physics, University of Turku  
1992 Ph.D. degree in theoretical physics, University of Turku  
2004 Docent in theoretical physics, University of Turku

## Military service

1986 Anti-aircraft artillery, Turku, Finland

## Confidential posts

2005 - 2008 Shop Steward  
2010 - 2013 Collegiate Council Member, University of Turku  
2012 - 2017 Deputy Head of Department of  
Physics and Astronomy, University of Turku,  
2013 - 2018 Faculty of Mathematics and Natural Sciences Council Member,  
University of Turku

## Professional appointments

1.1.2014 - University Research Fellow, Department of Physics and Astronomy,  
Laboratory of Quantum Optics, University of Turku

1.8.2011 - University Research Fellow, Department of Physics and Astronomy,  
31.12.2013 Laboratory of Optics and Spectroscopy, University of Turku

- 1.8.2008 - 31.7.2011 Laboratory engineer, Department of Physics and Astronomy, Laboratory of Optics and Spectroscopy, University of Turku
- 29.9.2008 - 31.10.2008 Professor, Department of Physics and Astronomy, Laboratory of Optics and Spectroscopy, University of Turku
- 1.8.2008 - 28.9.2008 Laboratory engineer, Department of Physics and Astronomy, Laboratory of Optics and Spectroscopy, University of Turku
- 1.8.2007 - 31.7.2008 Professor, Department of Physics, Laboratory of Optics and Spectroscopy, University of Turku
- 1.12.2004 - 31.7.2007 Laboratory engineer, Department of Physics, Laboratory of Optics and Spectroscopy, University of Turku
- 1.8. - 30.11.2004 Senior assistant, Department of Physics, Laboratory of Theoretical Physics, University of Turku
- 1.8.1999 - 31.7.2004 Senior Research Fellow, Academy of Finland (*Mathematical analysis of nonlinear and non-stationary time series*), Department of Physics, Laboratory of Theoretical Physics, University of Turku
- 1.2. - 28.2.1999 Research Fellow, Department of Physics, Laboratory of Material Sciences, University of Turku
- 1.9. - 30.12.1998 Research Fellow, Department of Applied Mathematics, University of Turku
- 1.6. - 31.8.1998 Research associate, Department of Applied Physics, Laboratory of Electronics and Information Technology, University of Turku
- 1.1. - 30.5.1998 Research Fellow, Department of Physics, Laboratory of Theoretical Physics, University of Turku
- 1.8. - 30.12.1997 Research Fellow, Department of Applied Mathematics, University of Turku
- 1991 - 1997 Research associate, Department of Applied Physics, Laboratory of Electronics and Information Technology, University of Turku
- 1988 - 1990 Research associate, Department of Physical Sciences, University of Turku
- 1986 - 1987 Research associate, Wihuri Physical Laboratory, University of Turku

## Refereeing work

### Refereeing for journals:

American Journal of Medical Science  
Annals of Biomedical Engineering  
Applied Physics Letters  
Autonomic Neuroscience  
Clinical Physiology and Functional Imaging  
Dynamical Systems  
Europhysics Letters  
European Journal of Physics  
Evidence-Based Complementary and Alternative Medicine  
IEEE Transactions on Biomedical Engineering  
IEEE Transactions on Circuits and Systems  
ISRN Cardiology  
Journal of Applied Physics  
Journal of Cardiac Failure  
Journal of Mathematical Biology  
Journal of Physics A  
Medical & Biological Engineering & Computing.  
Nonlinearity  
Physica Scripta  
Physics Letters A  
Physical Review E  
Physical Review Letters  
Physiology & Behavior  
Vibrational Spectroscopy

### Refereeing for foundations:

National Science Foundation, Arlington, USA  
The Wellcome Trust, London, UK  
Maurice Allais Foundation, France

## Memberships in scientific societies

Finnish Physical Society, 1986 -

### Research visits (one month or longer)

|                         |   |
|-------------------------|---|
| 10.6. - 12.7.1992       | Institute of Applied Physics, Nitzhi Novgorod, Russia   |
| 10.4. - 10.5.1998       | Medical College of Virginia, Richmond, Virginia, U.S.A. |
| 15.12.1998 - 30.1.1999  | Medical College of Virginia, Richmond, Virginia, U.S.A. |
| 27.12.1999 - 15.05.2000 | Fundacion Cardiovascular, Bucaramanga, Colombia         |
| 29.03.2002 - 25.04.2002 | Fundacion Cardiovascular, Bucaramanga, Colombia         |

## **Stipendiary support for research** (more than 10.000 FIM or 2.000 €)

Academy of Finland, 1991, 20.000 FIM (3.300€), *Effect of the solar eclipse on period of the torsion pendulum.*

Jenny and Antti Wihuri Foundation, 1996, 40.000 FIM (6.700 €), *Autonomic mechanisms during prolonged weightlessness.*

Helsingin Sanomain 100 Years Foundation, 1999, 60.000 FIM (10.000 €), *Finnish knowledge and technology in investigation of heart, circulation and respiration during space flights.*

Academy of Finland, 2000, 200.000 FIM (33.000 €), *Mathematical analysis of nonlinear and non-stationary time series.*

Instrumentarium Science Foundation, 2000, 30.000 FIM (5.000 €), *Monitoring system for anaesthesia depth based on multivariable analysis.*

Jenny and Antti Wihuri Foundation, 2005, 15.000 € *Gravitation anomalies during total solar eclipse (for the expedition in Turkey 2006).*

Finnish Cultural Foundation, 2006, 15.000 € *Casimir effect*

## **Participation in international research projects**

*Autonomic Mechanisms During Prolonged Weightlessness* (NASA-MIR space flight project)

in the period 1996 - 1998; multinational space medical research project

Principal Investigator: Professor Dwain L. Eckberg, M.D., Medical College of Virginia, Richmond, Virginia, U.S.A.

- co-investigator; time series analysis

*Autonomic Neuroplasticity in Weightlessness* (NASA-Neurolab space flight project)

in the period 1997 - 1998; multinational space medical research project

Principal Investigator: Professor Dwain L. Eckberg, M.D., Medical College of Virginia, Richmond, Virginia, U.S.A.

- co-investigator; the space shuttle data stream manipulation and time series analysis

*Neurocardiological Mechanisms in Pre-Eclampsia and in Normal Pregnancy*

in the period 1997 - 1999; multinational clinical research project

Principal Investigator: Dr. Helayne Silver, M.D., Women & Infants Hospital, Providence, Rhode Island, U.S.A.

- co-investigator; time series analysis

*Autonomic Modulation of Vasomotor Response in Humans*

in the period 1997 - 1999; multinational clinical research project

Principal Investigator: Professor Carlos A. Morillo, M.D., Fundacion

Cardiovascular Del Oriente Colombiano, Bucaramanga, Colombia, South America.

- co-investigator; time series analysis

*Cardiovascular Health Investigation from Colombia to Access the Markers and Outcomes of Chagas Disease (CHICAMOCHA)*

in the period 2000 - 2004; multinational clinical research project

Principal Investigator: Juan Carlos Villar, M.D., McMaster University, Division of Cardiology

Population Health Research Institute, Hamilton, Canada

- co-investigator; time series analysis

*Miniaturized photoacoustic gas sensor based on patented interferometric readout and novel photonic integration technologies (MINIGAS)*

in the period 2008-2012; 280.000€(total consortium 1850.000€)

Research project supported by European Union (FP7 - STREP)

- project executive (in the part of University of Turku)

*Drugs and precursors sensing by complementing low cost multiple techniques (CUSTOM)*

in the period 2010-2014; 200.000€(total consortium 3500.000€)

Research project supported by European Union (FP7 - SEC)

- project executive (in the part of University of Turku)

### **Participation in domestic research projects**

*Asynchronous Circuit Design: A Stepwise Refinement Approach (ACID-ASTRA)*

in the period 1994 - 1996

Research project supported by Academy of Finland

in co-operation with Åbo Akademi, Department of Computer Science

- co-investigator

*Effects of Betamimetic Drugs on Cardiopulmonary Neural Interactions in Children with Bronchial Asthma*

in the period 1996 - 1998

Principal Investigator: Professor Ilkka Välimäki, Turku University Hospital

- co-investigator

*Effects of Transdermal Scopolamine on Cardiopulmonary Neural Interactions in Essential Hypertension*

in the period 1996 - 1998

Principal Investigator: Dr. Ilkka M. Kantola, M.D., Turku University Hospital

- co-investigator

*Effects of Inhaled Salmeterol on Cardiopulmonary Neural Interactions*

in the period 1996 - 1998.

Principal Investigator: Dr. Yrjö Salorinne, M.D., Laakso Hospital

- co-investigator

*Electroluminescence in Si/SiO<sub>2</sub> Superlattices*

in the period 1998 - 2000

Technology project supported by TEKES

- principal investigator, project manager

*Human circulatory responses during exposure to radiofrequency electromagnetic fields emitted by 900 MHz and 1800 MHz mobile phones*

in the period 2000 - 2001

Research project supported by TEKES, Nokia, Sonera, Elisa

- co-investigator

*The cardiac pacemakers and cellular phones*

in the period 2001 - 2002

Research project supported by TEKES, Nokia, Sonera, Elisa

- co-investigator

*Effect of respiration on blood pressure regulation system*

in the period 2002 - 2003

Research project supported by Medical Research Fund of Tampere University Hospital,

- principal investigator, project manager

*Gravitation anomalies during solar eclipse (GRASE)*

in the period 2005 – 2006; 16.000 €

Research project supported by Jenny and Antti Wihuri Foundation,

- principal investigator, project manager

*Commercialising of research results in Laboratory of Optics and Spectroscopy (OLTUKA)*

in the period 2006-2007; 200.000€

Technology commercialising project supported by TEKES

- project executive

## **Educational merits**

### **Supervising for doctoral thesis**

|                        |  |
|------------------------|--|
| Lauri Heikkilä (2002)  | Electroluminescence in Si/SiO <sub>2</sub> layer structures  |
| Jaakko Lehtinen (2014) | Detection of illicit drugs and drug precursors with cantilever-enhanced photoacoustic spectroscopy |
| Tuomas Välikylä (2014) | Michelson interferometer with porch swing bearing for portable FTIR spectrometer                   |

### **Preliminary examination of doctoral thesis**

|                          |   |
|--------------------------|---|
| Mirja Peltola (2010)     | Analysis of heart rate variability from 24-hour ambulatory electrocardiographic recordings. Significance of preprocessing of R-R interval time series |
| Mari Karsikas (2011)     | New methods for vectorcardiographic signal processing   |
| Niko Penttinen (2015)    | Adsorption of particles in liquid: history, challenges, and photonic approaches   |
| Heikki Yli-Ollila (2017) | Methods to analyze longitudinal motion of the carotid wall  |
| Suvi Tiinanen (2017)     | Methods for assessment of autonomic nervous system activity from  |

**Supervising or reviewing for master's graduate thesis (in Finnish)**

|                              |   |
|------------------------------|---|
| Riihisaari, Tarja (1992)     | Tilastollisen prosessinohjauksen käyttöönotto Micronasin puolijohdetuotannossa                    |
| Plosila, Juha (1993)         | Hybridisalausjärjestelmän ohjelmallinen ja piiripohjainen toteutus                                |
| Helminen Juha (1994)         | Yksikkötestauksen käyttöönotto television ohjelmistonsuunnitteluun                                |
| Torsti, Ilari (1994)         | Yleiskäyttöisen mittausohjelman kehittäminen suurtaajuuslaitteiden teolliseen laadunvalvontaan    |
| Roos, Jari (1995)            | Digitaalipiirin käyttäytymiskuvauksen synteesi  |
| Arina, Savu-Tuokko (1995)    | Plasmaetsaus  |
| Varho, Susanna (1996)        | Antimateriaspektrometrissä käytettävä tietoliikennestandardi                                      |
| Haatainen, Tomi (1997)       | Piinanorakenteiden kuivaetsaus  |
| Alvesalo, Ossi (1998)        | Ohjelmistotyökalu sulautettujen järjestelmien kehitystyöhön                                       |
| Marttila, Jari (1998)        | Digitaal- ja analogiaosia sisältävän VLSI-piirin simuloiminen                                     |
| Juntunen, Teemu (1999)       | Moniulotteinen ennustusmenetelmä  |
| Rumpunen, Toni (2000)        | Plasman optisen emissiospektrin käyttö kuivasyövytyksen lopetuksessa                              |
| Porjo, Niko (2001)           | Superhilanäytteiden karakterisointi CCD-kameraa käyttäen  |
| Kärki, Olli-Juhani (2001)    | Kolmisolitoniratkaisun approksimoinnista Hirotan bilineaarimenetelmällä                           |
| Seppänen, Anne (2002)        | PET-kuvien fraktaalialalyysi  |
| Shepherd, Tony (2003)        | Stochastic model of time series (unfinished)  |
| Keto, Vesa (2004)            | Stokastisten prosessien spektraalitiheyden ja jaksollisuuden tunnistaminen RAR-suodattimilla      |
| Kokki, Tommi (2005)          | Stokastisen muuttujan ehdollisen todennäköisyysjakauman invarianssi Langevin differenssiyhtälössä |
| Härkönen, Kari (2005)        | Bosen-Einsteinin kondensaatin fotoassosiaatio STIRAP-menetelmällä                                 |
| Aittapelto, Suvi (2006)      | Lämpötilagradienttiin perustuva interferometrinen infrapunadetektori                              |
| Keskinen, Jukka-Pekka (2007) | Korteweg-de Vries –yhtälöön liittyvistä diskreeteistä solitonyhtälöistä                           |
| Kuivalainen Jani (2008)      | Kuvakohtainen liikekorjaus PET-kuvauksessa  |
| Levola Helena (2008)         | Glukoosikonsentraatioiden mittaaminen FTIR-spektroskopiolla ja fotoakustisella detektoinnilla     |
| Ville Huhta (2008)           | Mikrofonit  |
| Mikko Laine (2008)           | Korteweg-de Vries solitonyhtälön diskretointi- ja aikaintegrointi-menetelmien vertailua           |
| Ville Elomaa (2009)          | Kallistuman mittaaminen vaimennetulla heilurilla  |
| Joonatan Palmu (2009)        | Skyrme-mallin (2+1)-ulotteiset solitonimaiset ratkaisut ja niiden sironta                         |
| Janne Karhu (2010)           | Calogeron matriisidifferentiaaliyhtälön jaksollisten ratkaisujen tarkastelu                       |
| Jaakko Lehtinen (2010)       | Kiinteän aineen fotoakustiikka orgaanisille näytteille  |
| Sanni Pohjalainen (2010)     | Fotoakustisen mittalaitteen ja FTIR-spektrometrin vertailu  |
| Boris Zaprudin (2011)        | Infrapunasäteilyn sironta ilmakehän aerosolihiukkasista ja pilvipisaroista                        |

|                         |   |
|-------------------------|---|
| Lauri Toikka (2011)     | The snaking instability of a ring dark soliton in a Bose-Einstein Condensate  |
| Jussi Hietapakka (2012) | Hapen konsentraation mittaus fotoakustisella menetelmällä   |
| Marko Mäenpää (2012)    | Piille integroidun mikromekaanisen mikrofoniin käyttö fotoakustisessa FTIR-spektroskopiassa   |
| Martti Montonen (2012)  | Oppijan palautteenantojärjestelmä fysiikan perusteiden kurssilla: opiskelijoiden näkemyksiä järjestelmän vaikutuksista motivaatioon |
| Petri Turunen (2013)    | Fotonilukumäärätilojen Wignerin funktion laskeminen ja kokeellinen määrittäminen  |
| Johannes Nokkala (2013) | Universal quantum cloning   |
| Pekko Lempiäinen (2015) | Wheelerin viivästetyn valinnan kokeet   |
| Olli Siltanen (2016)    | Polarisation heikko mittaus: Optiselta vorteksilta Blochin pallolle   |
| Antti Ylitepsa (2016)   | Casimirin ilmiö sähkömagneettiselle kentälle ja metamateriaalit   |
| Tomi Heikkinen (2017)   | Optisen kaviteetin dissipatiivisten rakenteiden numeerinen stabilisuusanalyysi  |
| Aleksi Laine (2018)     | The effect of gold nanorods on the photoinduced properties of polymer-azobenzene complex  |

### Courses lectured

Mikroprosessoriteknikka I (Microprocessor Technology) 1990 - 1997  
 Kaaoksen alkeet (Elements of Chaos) 1998 - 2012  
 Epälineaaristen systeemien aikasarja-analyysi (Time series analysis of nonlinear systems) 2004, 2009  
 Optiikka (Optics) 2005  
 Kvanttimekaniikka I (Quantum Mechanics I) 2007, 2009 - 2014  
 Infrapunaspektroskopia (Infrared Spectroscopy) 2008  
 Fysiikan harjoitustyöt II & III (Physics Laboratory Exercises) 2015-2018  
 Kvanttikokeet (Quantum Exercises) 2015-2018  
 Mekaniikka (Mechanics) 2016-2018

### Mathematical exercises lectured

Klassinen mekaniikka (Classical Mechanics)  
 Instrumentointi ja elektroniikka I (Instrumentation and Electronics I)  
 Mikroprosessoriteknikka I (Microprocessor Technology I)  
 Tehopuolijohteet (Power Semiconductors)  
 VLSI tekniikka (VLSI Technology)  
 Kaaoksen alkeet (Elements of Chaos)  
 Kvanttimekaniikka I (Quantum Mechanics I)

### Research interests

Nonlinear time series analysis of biosignals  
 Quantum optics  
 Photoacoustic gas detection

Nonlinear electrical circuits, especially chaotic  
Soliton systems, especially discrete ones  
Electroluminescent silicon/silicon dioxide superlattices  
Gravitation anomalies

### **Experience on following fields**

Photoacoustic trace gas detection  
Optical systems  
Time series analysis  
Programming  
Electronics  
Instrumentation  
Medical technology  
Vacuum technology  
Plasma etching  
Semiconductor lithography  
Prototype constructing  
ISO quality systems  
Semiconductor physics  
Material science