

VILLUM FONDEN



Annual report template 2017

The annual report is used by VILLUM FONDEN to monitor the progress of grant holders' research results, the project organisations and other issues related to their projects. Furthermore, the report provides VILLUM FONDEN with information on how the terms and conditions of the programmes work in general.

Annual reporting on grants within the area of Technical and Natural Sciences is made up of three parts.

1. Submission of scientific output in Researchfish¹
2. Submission of accounts and a revised budget by e-mail to VILLUM FONDEN²
3. Submission of a brief written annual report by e-mail to VILLUM FONDEN³.

This template outlines how to write the annual report. The report will be evaluated by the secretariat and the board of VILLUM FONDEN; thus it is important that the report is written for non-specialists within the field of research. Annual reports from VILLUM Young Investigator (YIP) grantees will also be included in workshops at the YIP seminar.

The above-mentioned three parts form the basis for the annual payment from the grant.

Details

Grant number: VKR023372
Project title: QUSCOPE, Quantum Scale Optical Processes
Name: Klaus Mølmer
University/institution: Aarhus University
Department/section: Physics and Astronomy
ORCID:
Grant received in year: 2014

People

Accumulated list of staff employed on the grant; include yourself (PI) and VIP (academic staff): professor, professor mso, associate professor, assistant professor, senior researcher, postdoc, PhD students, research assistants, etc. BSc and master students are excluded. The purpose for VILLUM FONDEN is to get an overview of the number of staff funded by the grant.

Name	Position	Number of months employed (e.g. 12 months)	Funded by VILLUM FONDEN (%)	Nationality (e.g. American)	Gender (M/F)
Klaus Mølmer	Professor	47	0	Danish	M
Lars Bojer Madsen	Professor	47	0	Danish	M

¹ If you have not received an invitation to sign up for Researchfish, please contact VILLUM FONDEN

² Please e-mail your contact in VILLUM FONDEN

³ Please e-mail your contact in VILLUM FONDEN

Thomas Garm Pedersen	Professor	47	0	Danish	M
Malte C. Tichy	Postdoc	6	100	German	M
Haruhide Miyagi	Postdoc	34	0	Japanese	M
Durga B. Dasari	Postdoc	12	0	Indian	M
Siddharta Chattopadhyay	Postdoc	24	0	Indian	M
Juan Omiste	Postdoc	24	96	Spanish	M
Qing Xu	Postdoc	15	0	Chinese	M
Camille Lévêque	Postdoc	24	100	French	M
Mads L. Trolle	Postdoc	13	100	Danish	M
Ralf Blattmann	Postdoc	24	54	German	M
Stephen R. Power	Postdoc	7	0	Irish	M
Daniel Reich	Postdoc	12	20	German	M
Tarek Elsayed	Postdoc	24	100	Egyptian	M
Darko Dimitrovski	Postdoc	24	100	Macedonian	M
Yuan Zhang	Postdoc	16	100	Chinese	M
Felix Motzoi	Postdoc	20	75	Canadian	M
Lukas Buchmann	Postdoc	36	0	Swiss	M
Andrew Wade	Postdoc	3	0	New Zealand	M
Hector C. Mera	Postdoc	8	0	Spanish	M
Christian Kraglund Andersen	Postdoc	2	100	Danish	M
Alireza Taghizadeh	Postdoc	8	100	Iranian	M
Yuxiang Zhang	Postdoc	10,5	0	Chinese	M
Itzik Cohen	Postdoc	3,5	0	Israeli	M
Fabio Hipolito	Postdoc	11	100	Portuguese	M
Eliska Greplova	Research Assistant	2	100	Czech	
Kamanasish Debnath	Research Assistant	1	0	Indian	M
Christian Kraglund Andersen	PhD Student	29	0	Danish	M
Andrew Wade	PhD Student	16,5	0	New Zealand	M
Yao-Chung Tsao	PhD Student	4	0	Taiwanese	
Jens Bækthøj	PhD Student	30	0	Danish	M
Jens Svensmark	PhD Student	30	0	Danish	M
Lun Yue	PhD Student	24	0	Danish	M
Søren Bruun	PhD Student	30	0	Danish	M
Morten R. Thomsen	PhD Student	30	0	Danish	M
Kenneth Hansen	PhD Student	39	100	Danish	M
Mads Trolle	PhD Student	11,5	0	Danish	M
Chuan Yu	PhD Student	36	100	Chinese	M
Alexander Holm Kiilerich	PhD Student	41	100	Danish	M

Eliska Greplova	PhD Student	36	100	Czech	F
René Petersen	PhD Student	12	0	Danish	M
Farzad Bonabi	PhD Student	35	100	Iranian	M
Jinglei Zhang	PhD Student	32	100	Chinese	F
Qingli Jing	PhD Student	28	0	Chinese	F
Jørgen Johansen Rørstad	PhD Student	25	100	Norwegian	M
Jonas Have	PhD Student	17	100	Danish	M
Philip Blocher	PhD Student	16	100	Danish	M
Enok Skjølstrup	PhD Student	12	100	Danish	M
Rene Petersen	PhD Student	12	0	Danish	M
Martin Sørensen	PhD Student	1,5	100	Danish	M
Anders Larsen	PhD Student	5,5	100	Danish	M
Nikolaj Schrøder Wittig Ravn	PhD Student	5	0	Danish	M
Grete Flarup	Administration		50	Danish	F
Niels Carl Hansen	Systems administrator	47	25,5	Danish	M
					M
David Petrosian	Guest professor	3	50	Armenian	M
Liangyou Peng	Guest professor	2	0	Chinese	M
Hideo Mabuchi	Guest professor	2	0	American	M
Libo Zhao	Guest professor	6	0	Chinese	M
Mahmoud Abu-Samaha	Guest professor	3	0	Palestinian, Jordanian	M
Marco Mattioli	Guest PhD	5	0	Italian	M
Peng Xu	Guest PhD	12	0	Chinese	M
Tahereh Abad	Guest PhD	10	40	Iranian	F
Jiabao Chen	Guest PhD	6	0	Chinese	M

Educational activities

Please list educational activities that the above-mentioned 'People' have contributed to, including PhD courses, courses at master and bachelor levels. Also list summer schools and courses given abroad. Please state ECTS points (if possible) and length of the course (in hours).

Title of activity	ECTS	Length of course
Mekanik og Termodynamik	10	56 h
Atomic, Molecular and Optical Physics II	10	35 h
Quantum Mechanics I	5	48 h
Quantum Mechanics II	5	48 h
Nanoelectronics	5	48 h
Numerical Physics	4	70 h
Didactic Issues in Physics	5	48 h

2 x Atom og Molekylfysik	5	32 h
Numerisk fysik (Q3)	5	42 h
Numerisk fysik (Q1+Q2)	5	21 h
Statistik fysik (2015)	5	21 h
Statistik fysik (2016)	5	21 h
Videregående mekanik (2016)	5	28 h (2 groups)
Videregående mekanik (2017 spring)	5	28 h
Videregående mekanik (2017 autumn)	5	28 h (2 groups)
IFA Challenge track	0	8 h
Teaching: Electromagnetism (Q1 2017)	5	32 h
Teaching: Optics & Waves (Q2 2017)	5	32 h
Teaching: Quantum Mechanics I (Q3+Q4 2017)	10	56 h
Advanced Mechanics	5	28 h
Quantum Mechanics	10	56 h
Atomic and Molecular Physics	5	50 h

Please list the number of Master Graduates and Bachelor Graduates supervised.

Number of Master Graduates	Number of Bachelor Graduates
3	5

Project

(this part should not exceed 3 pages)

1) Project abstract (VILLUM Young Investigators only) in English

About 1/2 page in total. The abstract should be considered as an introduction to readers who are not familiar with your project or to non-specialists. The abstract of your application may be reused in a revised form, e.g. on our website. Please also describe the set-up (e.g. collaborations, recruitments, infrastructure) of the project.

2) Project status

Write a summary of the progress of the project based on the previous year. Please include project activities, recruitments and preliminary results.

- *Conclude by stating the most important results of the year, e.g. discoveries, publications, engagements activities, keynotes, awards, etc.*

QUSCOPE has made solid progress on all subprojects. As we are getting closer to the end of the project period and the first QUSCOPE funded PhD students obtain their degrees, we cannot accept new students on the QUSCOPE funding. The QUSCOPE members, however, keep attracting external funding which we direct to new student projects, and two international postdocs have obtained individual Marie Curie Fellowships and chosen to join the QUSCOPE Center of Excellence to carry out their research program with us. Together with strengthened collaborations

within the Physics Departments in Aarhus and Aalborg, these activities imply that we will be able to keep a high level of activity until and beyond the finishing of the center ultimo 2019.

Main QUSCOPE discoveries in 2017 include: a new method for record breaking microwave spin sensing (patent pending), new designs for superconducting quantum annealers, theory of the optical dispersion properties of layered Van der Waals crystals, theory for ultrashort, attosecond time-delays in photoionization, and joint work between Aarhus and Aalborg on semiconductor light interactions. Notably, these projects involve the participation of our students and young researchers, and in most cases, they also include external experimental partners. By contributing their ideas for new experimental directions and by getting personally acquainted with researchers in world leading experimental groups, we are certain to give our students and postdocs the best starting point for a future career in science. It is, indeed, a pleasure to see that many of our students and postdocs are successful in the competition for attractive positions and that they continue their work in prestigious research environments.

In terms of publications, 2017 has been the most productive year in QUSCOPE with 56 peer reviewed articles (46 in 2016, 42 in 2015). 19 QUSCOPE articles appeared in high impact journals: Scientific Reports, Physical Review Letters, Physical Review X, Nature Communications, Science Advances and Physical Review B, and 12 QUSCOPE articles were selected for special mentioning by the Editors or by other high ranking journals.

2017 also brought new and exciting outreach activities, including piano concerts with special Quantum Music at ArtsToday Festival in The Hague, Musikhuset, Aarhus and Det Kgl. Teater, Copenhagen; contributions to dance and theatre workshops in Copenhagen and Aarhus, multiple outreach presentations including a lecture on Quantum Computing, livestreamed to app. 5000 people in Denmark, and offered in English and French to 500 and 300 people audiences in Bergamo, Italy, and Paris, France, respectively. (See special Outreach page on the QUSCOPE website for more information).

3) Challenges in 2017

State scientific challenges or deviations from the projected plan and how that affects the research plan. You are also welcome to state any issues related to your host institution, HR, etc.

The QUSCOPE groups are busy and successful in their pursuit of collaboration with international partners, and while 2017 has presented the outcome of collaborations between the QUSCOPE partners, and more joint publications are underway in 2018, it continues to be a challenge to allocate time for joint projects between the groups. This does not affect the research goals accomplished within QUSCOPE, but it gives rise to fewer joint publications than anticipated when we began the collaboration. As we have already agreed with the Villum Foundation to not apply for extension of the joint center, we have decided to maintain our scientific discussions, that we genuinely enjoy, and to prioritize our expert focus on the research for the rest of the grant period.

The host institutions continue to provide professional services, HR, accounting etc., and minor adjustments to the budget and staff are smoothly accommodated.

4) Planned project activities in 2018

Please include expected research activities and recruitments. VILLUM Young Investigators only: List topics that the group discussion/feedback/knowledge sharing at the annual seminar should focus on.

The research plans for 2018 largely constitute the continuation and consolidation of the activities built up in 2017.

The AU Quantum Optics group is expanding its activities into solid state based quantum technologies leveraging the QUSCOPE efforts by joint applications to the European Quantum Technology Flagship with mainly experimental partners in the UK, France, Germany, Sweden and Spain.

The QUSCOPE activities of the AU Laser Physics group will involve a PhD student and a postdoc and focus on intense laser pulses interacting with finite systems, elucidating the transition from the single-system atomic response to the response of a condensed matter system. Collaboration with a theory group in Germany has been established.

The AAU Nano-optics group will expand and consolidate the work on strong field effects in solids including ionization (in collaboration with partners in Spain and elsewhere). Also, quantum effects in plasmonics and optics (linear and nonlinear) of low-dimensional materials will be extended in collaboration with external theoretical and experimental groups.

Our last two QUSCOPE postdoc employments of duration 12 and 15 months, respectively, begin in Aarhus in the spring of 2018, and our last QUSCOPE students will continue their studies into 2018 and 2019. While further recruitment is now only possible through other grants, new students and postdocs joining the research groups will still be incorporated in and contribute to the activities of the QUSCOPE Center of Excellence.

Contact at VILLUM FONDEN

Queries about annual reporting to: Senior Adviser Karen Skytte Larsen: ksl@veluxfoundations.dk