L'anno duemilasedici, addì **20 settembre** alle ore 15.30, a seguito di regolare convocazione trasmessa con nota prot. n. 0064182 del 15 settembre 2016, nell'Aula Organi Collegiali si é riunito il Senato Accademico per l'esame e la discussione degli argomenti iscritti al seguente ordine del giorno:

………………………………..o m i s s i s …………………………………

Sono presenti: il Rettore, prof. Eugenio Gaudio ed i componenti del Senato Accademico: prof. Renato Masiani, Pro Rettore Vicario, prof. Stefano Biagioni, prof.ssa Maria Rosaria Torrisi, prof.ssa Emma Baumgartner, prof. Davide Antonio Ragozzino, prof.ssa Alessandra Zicari, prof. Giorgio Graziani, prof. Giuseppe Piras, prof.ssa Stefania Portoghesi Tuzi, prof.ssa Beatrice Alfonzetti, prof.ssa Matilde Mastrangelo, prof. Alessandro Saggioro (entra alle ore 16.08), prof. Emanuele Caglioti, prof.ssa Maria Grazia Betti, prof. Felice Cerreto, prof. Giorgio De Toma (entra alle ore 17.08), prof.ssa Susanna Morano, prof. Marco Biffoni, prof. Giuseppe Santoro Passarelli, prof. Mauro Rota, i Rappresentanti del personale: Pietro Maioli, Roberto Ligia, Carlo D'Addio e i Rappresentanti degli studenti: Alessio Folchi, Alessandro Cofone (entra alle ore 16.16), Maria Giacinta Bianchi, Matteo Catananti, Francesco Mosca, Tiziano Pergolizzi.

Assistono: il Direttore Generale, Carlo Musto D'Amore, che assume le funzioni di Segretario, i Presidi: prof. Giuseppe Ciccarone, prof. Paolo Ridola, prof. Fabrizio Vestroni, prof. Anna Maria Giovenale, prof. Marco Listanti, prof. Vincenzo Nesi, prof. Stefano Pietro Luigi Asperti, prof.ssa Raffaella Messinetti, prof. Sebastiano Filetti, prof. Vincenzo Vullo, prof. Paolo Teofilatto, la prof.ssa Irene Bozzoni, Direttore della Scuola di Studi Avanzati, i Prorettori: Antonello Folco Biagini, Teodoro Valente, Gianni Orlandi, Mario Morcellini e Tiziana Pascucci.

Assenti giustificati: prof. Stefano Catucci, prof. Augusto D'Angelo, i Rappresentanti del personale Germani e Altezza.

Il Presidente, constatata l'esistenza del numero legale, dichiara l'adunanza validamente costituita ed apre la seduta.

………………………………..o m i s s i s …………………………………..

SAPIENZA
UNIVERSITÀ DI ROMA

Senato Accademico

Seduta del

20 SET. 2016

CHIAMATE DIRETTE DEL PERSONALE DOCENTE FFO 2016

Il Presidente ricorda che il Senato, nelle sedute del 05.07.2016 e del 19.07.2016, ha deliberato di esprimere parere favorevole in ordine all'inoltro al MIUR delle proposte di chiamata diretta fino ad allora pervenute dai Dipartimenti.

Il Presidente ricorda, inoltre, che con deliberazione del Consiglio di Amministrazione, seduta del 12.07.2016, è stato, tra l'altro, dato mandato al Rettore di destinare con proprio Decreto, dato sin d'ora per rato e fermo il disposto, i punti organico necessari per far fronte alle ulteriori proposte di chiamata diretta eventualmente pervenute dai Dipartimenti entro il 20 settembre 2016, subordinatamente al parere favorevole del Senato Accademico, per il successivo inoltro al MIUR fissato al 22 settembre 2016.

A tal riguardo si fa presente che è pervenuta al Settore competente un'ulteriore proposta di chiamata diretta da parte del Dipartimento di Fisica per il dott. Rinaldo Trotta, nel ruolo di PA, s.s.d. FIS/03 e che con Decreto saranno destinati, per far fronte alla suddetta proposta, 0,35 punti organico, con la conseguente inclusione delle suddette risorse nella Programmazione triennale del fabbisogno di Personale, subordinatamente al parere favorevole del Senato Accademico in ordine all'inoltro al MIUR della suddetta proposta di chiamata diretta.

Il Presidente comunica che la Commissione, cui è stato dato mandato dal Senato Accademico, nella seduta del 14.06.2016, di verificare, prima dell'inoltro al MIUR delle proposte di chiamata diretta, il possesso da parte dei candidati dei requisiti ANVUR, non ha avuto materialmente il tempo per riunirsi; tuttavia il Presidente, Prof. Renato Masiani, ha espresso il proprio parere favorevole, sostenuto anche da una consultazione telefonica informale con alcuni membri della Commissione stessa.

Alla luce di quanto sopra, il Senato Accademico è invitato a deliberare in merito alla proposta di chiamata diretta del docente sopra indicato.

Allegati parte integrante:

- CV TROTTA Rinaldo.

SAPIENZA UNIVERSITÀ DI ROMA
Area Risorse Umane
Il Direttore
Dr.ssa Daniela Cavallo

SAPIENZA UNIVERSITÀ DI ROMA
Area Risorse Umane
Ufficio Personale Docente e Collaborazioni Esterne
Il Capo Ufficio
Dott. Pierfrancesco Conversano

AREA RISORSE UMANE
Settore Collab. [illegible] Esterne
Il Capo Settore
Dr.ssa Giuliana De Martino Rosaroll

SAPIENZA
UNIVERSITÀ DI ROMA

Senato Accademico

Seduta del

20 SET. 2016

DELIBERAZIONE N. 233/16

IL SENATO ACCADEMICO

LETTA la relazione istruttoria;

VISTO lo Statuto dell'Università;

VISTO l'art. 1, comma 9 della Legge 230/2005 e successive modificazioni ed integrazioni;

VISTE le deliberazioni n. 201/16 del 05.07.2016 e n. 219/16 del 19.07.2016 del Senato;

VISTA la deliberazione n. 255/16 del 12.07.2016 del Consiglio di Amministrazione;

VISTA la proposta di chiamata diretta del dott. Rinaldo Trotta e il curriculum del predetto docente;

PRESO ATTO del parere favorevole espresso dal Presidente della Commissione istituita del delibera n. 192/16;

CONSIDERATA la rilevanza del programma di ricerca del candidato;

Presenti e votanti 29: con voto unanime espresso nelle forme di legge dal Rettore, dal Pro Rettore Vicario e dai Senatori: Biagioni, Torrisi, Baumgartner, Ragozzino, Zicari, Graziani, Piras Giuseppe, Portoghesi Tuzi, Alfonzetti, Mastrangelo, Saggioro, Caglioti, Betti, Cerreto, De Toma, Morano, Biffoni, Santoro Passarelli, Rota, Maioli, Ligia, D'Addio, Folchi, Catananti, Cofone, Mosca e Pergolizzi

DELIBERA

- di esprimere parere favorevole in ordine all'inoltro al MIUR della proposta di chiamata diretta del seguente docente:

Nominativo	Ruolo	Dipartimento proponente	S.S.D.	PO totali	PO a carico MIUR	PO a carico università
TROTTA Rinaldo	PA	Fisica	FIS/03	0,70	0,35	0,35

- di conteggiare la quota di cofinanziamento della chiamata diretta nello "storico" del Dipartimento beneficiario a titolo di anticipo delle risorse che saranno assegnate in sede di programmazione.

Letto e approvato seduta stante per la sola parte dispositiva.

IL SEGRETARIO
Carlo Musto D'Amore

IL PRESIDENTE
Eugenio Gaudio

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RINALDO TROTTA

Curriculum Vitae

Full Name	Rinaldo Trotta
Date of Birth	16.08.1981
Place of Birth	Tivoli (Roma)
Citizenship	Italian
Permanent Address	Johann-Wilhelm-Klein Strasse n. 42, 4040 Linz, Austria
Work Address	Institute of Semiconductor and Solid State Physics, Johannes Kepler University Altenbergerstr. 69, 4040 Linz, Austria
Phone number (office)	+43 732 2468 9599
Mobile Phone Number	+43 6606390717
E-mail	rinaldo.trotta@jku.at
Spoken Languages	Italian (mother tongue), English (fluent, written and oral), German (basics)

Present position:

Assistant Professor at the Institute of Semiconductor and Solid State Physics, Johannes Kepler University (JKU) of Linz, Altenbergerstrasse 69 A-4040 Linz, Austria.

Group Leader of the Nanophotonics Group at JKU Linz

(see, http://www.jku.at/hfp/content/e184015/e199854/e192995)

Education

Type	Year	Institution	Notes (Degree, Mark)
University graduation	September 2005	Sapienza University of Rome	"Laurea" in Physics (110 cum Laude)
PhD	December 2008	Sapienza University of Rome. Title: *"Hydrogen-assisted defect engineering in dilute nitride semiconductors"*. Supervisors: Prof. M. Capizzi and Prof. A. Polimeni	PhD in Material Science (awarded as the best Italian PhD thesis in materials science in 2009- Giuseppe Turilli Prize)

Appointments

Academic Appointments

Start	End	Institution	Position
11.13		Johannes Kepler University Linz (Austria)	Assistant Professor
06.12	11.13	Johannes Kepler University Linz (Austria)	University Assistant

Other Appointments

Start	End	Institution	Position
11.11	06.12	Institute for Integrative Nanoscience, IFW-Dresden (Germany)	Group Leader
03.10	11.11	Institute for Integrative Nanoscience, IFW-Dresden (Germany)	Post-doctoral research associate
01.09	03.10	Sapienza University of Rome	Post-doctoral research associate

Teaching experience (main courses)

Year	Institution	Lecture/Course
2016	Johannes Kepler University Linz (Austria)	Nano optics (teacher)
2015	Johannes Kepler University Linz (Austria)	Introduction to Quantum Optics (teacher)
2015	Johannes Kepler University Linz (Austria)	Fundamentals of Physics 2 (teaching assistant)
2014	Johannes Kepler University Linz (Austria)	Quantum optics and electronics (teacher)
2014	Johannes Kepler University Linz (Austria)	Nano optics (teacher)
2014	Johannes Kepler University Linz (Austria)	Seminars in Semiconductor Physics - Methods in Experimental Semiconductor Physics (teacher)

2013	Johannes Kepler University Linz (Austria)	Fundamentals of Physics 3 (teaching assistant)
2013	Johannes Kepler University Linz (Austria)	Nano-photonics with Quantum Dots (teacher)
2013	Johannes Kepler University Linz (Austria)	Fundamentals of Physics 4 (teaching assistant)
2012	Johannes Kepler University Linz (Austria)	Physics of low-dimensional systems (teaching assistant)
2009	Sapienza University of Rome	Condensed matter physics (teaching assistant)
2008	Sapienza University of Rome	Physics II – electromagnetism (teaching assistant)
2007	Sapienza University of Rome	Physics I – mechanics and thermodynamics (teaching assistant)

Leader of research groups

Since 2012	Leader of the Nanophotonics Group, see http://www.jku.at/hfp/content/e184015/e199854/e192995	Institute of Semiconductor and Solid State Physics, Johannes Kepler University Linz (Austria)
2011 - 2012	Leader of the Optics Group	Institute for Integrative Nanoscience, IFW-Dresden (Germany)

Supervision of students/postdocs (current group members are indicated with *)

Year	Name	Institution	Topic and level of supervision
2010-3	Santhosh Kumar	PhD student (IFW-Dresden and TU Chemnitz)	Strain engineering of GaAs nanomembranes. **Co-supervision at IFW.**
2011-5	Jiaxiang Zhang	PhD student (IFW-Dresden and TU Chemnitz)	Single and entangled photons from quantum dots. **Co-supervision at IFW.**
2012-	Bianca Hofer	PhD student (IFW-Dresden and TU Chemnitz)	Effect of strain and electric field in the recombination of carriers confined in quantum dots. **Co-supervision at IFW.**
2012-	Johannes Wildmann *	PhD student (JKU Linz)	Entangled photons from quantum dots and hybrid artificial-natural atomic interfaces. **Supervision at JKU.**
2015-	Marcus Reindl *	PhD student (JKU Linz)	Quantum interference between photons emitted by quantum dots. **Supervision at JKU.**

2014-	Huiying Huang *	PhD student (JKU Linz)	Slowing down photons from quantum dots using atomic vapours. **Supervision at JKU.**
2013	Javier Martin-Sanchez *	Postdoc (JKU Linz)	Full control of in-plane strain in semiconductor nanomembranes and fundamental studies of novel 2D semiconductors. **Supervision at JKU.**
2014-5	Daniel Huber *	PhD student (JKU Linz)	Two photon excitation spectroscopy in semiconductor quantum dots. **Supervision at JKU.**
2016	Christian Schimpf*	Master Student (JKU Linz)	Cleanroom processing of semiconductor-piezoelectric devices. **Supervision at JKU.**
2016	Johannes Aberl*	Master Student (JKU Linz)	Strain effects on the exciton dipole moment in quantum dots. **Supervision at JKU.**
2014	Mathias Gartner	Bachelor Student (JKU Linz)	Quantum state tomography: software development. **Supervision at JKU.**
2016	Florian Sipek	Bachelor Student (JKU Linz)	Spectral shaping of femto-second laser pulses. **Supervision at JKU.**

Funding Information

Year	Title	Role	Grant value
2016-2021	**ERC-STARTING-GRANT: SPQRel** *"Entanglement Distribution via Semiconductor-Piezoelectric Quantum-Dot Relays".*	**PI**	**1.500.000 €**
02.13-01.16	**EU**, STREP (FP7-ICT-2011-9). **HANAS:** *"Hybrid Artificial and Natural Atomic Systems"*. **PI: V. Zwiller, TU Delft**	**Co-PI** of the work package for JKU-Linz, (http://hanas.eu/).	**~ 480.000 €**
01.14-01.16	**AWS START**, for the execution of the patent: A. Rastelli, I. Daruka, and R. Trotta: *"Verfahren zur Durchstimmung der Verspannung in Dünnschichten"*. PI: A. Rastelli.	Scientific responsible for the practical execution of the task proposed in the project.	**~ 150.000 €**

Conception and set-up of laboratories

2012-2014	***Conception and set-up of two laboratories (from empty rooms)*** *for advanced optical spectroscopy (JKU-Linz), now belonging to the Nanophotonics Group*	Total budget: **~ 850.000 €**

Awards

2009	***"Giuseppe Turilli Prize 2009"***, awarded by the Institute for Magnetic and Electronic Materials (IMEM-CNR) for the **best Italian PhD thesis in Materials Science** (2009). (Only 1 prize awarded).

Current research topics

- Advanced quantum optics experiments with single and entangled photons emitted by single semiconductor nanostructures.
- Fundamental properties of novel 2-D semiconductors (mainly WSe_2 and $TiSe_2$).
- Study and fabrication of novel strain-tunable optoelectronic devices based on self-assembled quantum dots for applications in quantum information processing.
- Effect of external perturbations (stress, electric field, magnetic field) on the optical properties of semiconductor nanostructures.
- Experimental and theoretical study of hydrogen diffusion in semiconductors (mainly $GaAs_{1-x}N_x$).
- Study and fabrication of semiconductor nanostructures obtained by spatially selective hydrogenation of $GaAs_{1-x}N_x$.

Major Scientific Achievements

- Conception and development of novel sources of entangled photons based on semiconductor quantum dots.
- Development of novel semiconductor-piezoelectric optoelectronic devices (n-i-Schottky, p-i-n quantum light emitting diodes) containing semiconductor quantum dots.
- Development of novel semiconductor micro- and nano-structures obtained by spatially selective hydrogenation of $GaAs_{1-x}N_x$.
- Fundamental studies of the effect of hydrogen incorporation in semiconductors.

Technical expertise

Quantum optics	Quantum state tomography, photon correlation spectroscopy resolved in time and polarization.
Optical spectroscopy	Photoluminescence (PL); micro-PL; magneto-micro-PL; PL excitation (PLE); Raman scattering; time-resolved and polarization-resolved micro-PL; ellipsometry; Michelson Interferometry.
Semiconductor processing and device fabrication	clean room experience (optical lithography, wet chemical etching); processing of semiconductor nanomembranes; thin film deposition techniques (mainly thermal and e-beam evaporation); fabrication of hybrid semiconductor-piezoelectric devices containing quantum dots; thermo-compression-bonding techniques; hydrogen implantation in semiconductor heterostructures.
Theoretical modelling	Theoretical background: **Most of the experimental works are inspired by own theoretical ideas.** The theoretical models are mainly developed combining k·p theories with finite element calculations.
Software	Good knowledge of most packages for data analysis (mainly MatLab®, Mathematica) and for instrument interface (LabviewTM); good knowledge of packages for finite element calculations (mainly Comsol Multiphysics)

Other Professional Activities

Year	Description
2016-2017	**Expert evaluator for research project submitted to FET – OPEN – RIA (Eu)**
2015	**Reviewer of research projects for the Deutsche Forschungsgemeinschaft (DFG)**
2015	**Organizer of the 3rd international workshop** on "Engineering of Quantum emitter emission properties", http://www.jku.at/hfp/content/e184015/e208420/e285053
2015	**Referee** for the "Prize of the Canada Centre", University of Innsbruck (Austria)
2013	**Organizer of the 1st international workshop** on "Engineering of Quantum Dot emission properties", http://www.jku.at/hfp/content/e184015/e208420/e221123/
2012	**Guest Editor for Nanoscale Research Letters** – Special issue: International Conference on Superlattices, Nanostructures, and Nanodevices (ICSNN).
Since 2009	**Reviewer for** Physical Review, Nano Letters, Applied Physics Letters, Physica E, Europhysics Letters, and Nanoscale Research Letters...

Visiting Professorship

November 2015	**Visiting professor** at the Central European Institute of Technology of Masaryk University (Czech Republic). **Lectures on "Quantum Optics with Semiconductor Quantum Dots" were given.**

Society memberships

2007	Member of the SIF (Italian physical society)
2009	Member of the COST action for the cooperation of European research groups. Action M08050 – Physics and application of dilute nitride semiconductors.
2016	Member of the COST action for the cooperation of European research groups. Action MP1403– Nanoscale Quantum Optics.

Additional research experience in national and international research institutes

Several short stays at the European Laboratory for Non-Linear Spectroscopy (LENS) in Florence (Italy), (collaboration with the group of Prof. Massimo Gurioli).
Visits at synchrotron radiation facilities in Trieste (collaboration with the group of Dr. Luca Gregoratti) and in Grenoble (collaboration with the group of Prof. J. Stangl and Dr. T. Shulli).
Short stay at the High Magnet Field Laboratory (HFML) in Nijmegen (The Netherlands) (collaboration with the group of Dr. P. C. M. Christianen).
Short stay at the Tyndall Institute in Cork (Ireland) (collaboration with the group of Dr. E. Pelucchi).
Short stay at the Kavli Intitute of Nanoscience at Delft University of Technology (The Netherlands) (collaboration with the group of Prof. V. Zwiller).
Short stay at the University of Innsbruck (Austria) (collaboration with the group of Prof. G. Weihs).

Invited Talks and Colloquia

#/Year	Title	Place
(1) / 2009	Hydrogen-assisted defect engineering in dilute nitride semiconductors	Laboratory for Photonics and Nanostructures, LPN-CNRS, Paris (France)
(2) / 2010	Hydrogen-assisted defect engineering in dilute nitride semiconductors	Institute for Magnetic and Electronic Materials (IMEM-CNR), Parma (Italy)
(3) / 2010	Hydrogen-mediated nanostructuring of dilute nitride semiconductors	Conference of the European Materials Research Society (E-MRS). Congress centre, Strasbourg, (France)
(4) / 2011	Strain-tuneable quantum-dot devices	CC3DMR Collaborative Conference on 3D & Materials Research, Jeju (Korea)
(5) / 2012	Electro-elastic control of excitons in self-assembled quantum dots	DFG (Deutsche Forschungsgemeinschaft) Conference, Berlin (Germany)
(6) / 2012	Controlling artificial atoms in nanomembranes by the simultaneous application of large strain and electric fields	ICSNN – International Conference on Superlattices, Nanostructures, and Nanodevices, Dresden (Germany)
(7) / 2013	High-fidelity entangled photons from strain-tunable optoelectronic devices	Institute for Physics, Augsburg (Germany)
(8) / 2013	Reshaping the optical properties of quantum dots via electro-elastic fields	Annual meeting of the Nanoscience Lab, University of Trento, Trento (Italy)
(9) / 2014	Strain-tunable quantum-dot devices	18th International Winterschool on New Developments in Solid State, Mauterndorf (Austria)
(10) / 2014	Semiconductor-Piezoelectric Quantum Dot Devices	Heriot-Watt University, Edinburgh (UK)
(11) / 2014	Semiconductor-Piezoelectric Quantum Dot Devices	Second International Conference of Young Researchers on Advanced Materials (IUMRS-ICYRAM 2014), Haikou (China)
(12) / 2014	Semiconductor-Piezoelectric Quantum Devices	Institute of Physics. The Chinese Academy of Sciences, Beijing (China)
(13) / 2014	Single and Entangled Photons from Semiconductor-Piezoelectric Quantum Dot Devices	2nd International Workshop on Engineering of Quantum Emitter Properties, Innsbruck University (Austria)
(14) / 2015	Single and Entangled Photons from Semiconductor Quantum Dots	Masaryk University BRNO (Czech Republic), 25.11.2015

(15) / 2015	Semiconductor-Piezoelectric Quantum-Dot Devices for Quantum Networking	Masaryk University BRNO (Czech Republic), 26.11.2015
(16) / 2015	Semiconductor-Piezoelectric Quantum Devices for Quantum Networking	University of Trento (Italy)
(17) / 2016	Single and Entangled Photons from Strain-Tunable Quantum Dot Devices	University of Basel (Switzerland)
(18) / 2016	Mechanical control of excitons in GaAs quantum dots	III International Workshop on Metal Droplet Epitaxy of Semiconductor Nanostructures (DeWork3), Jeju, Korea
(19) / 2016	Single and Entangled Photons from Semiconductor-Piezoelectric Quantum Dot Devices	MRS Meeting, Campinas (Brasil), 27.09.2016

In addition, more than 15 oral/poster presentations at international conferences and workshops (not invited) were given.

Work/Projects highlighted in the media

(1) Phys. Rev. Lett. 2012:
https://physics.aps.org/articles/v5/109

(2) Nature Comm. 2016:
http://digital.laserfocusworld.com/laserfocusworld/201604?=DA0416&pg=22#pg22

(3) Nature Nanotech. 2015:
http://www.nature.com/nnano/journal/v10/n6/full/nnano.2015.119.html?message-global=remove

(4) Nature Phys. 2014:
http://phys.org/news/2013-12-quantum-dots-confined-holes-applications.html

(5) Nano Letters 2014:
http://www.nachrichten.at/nachrichten/web/Linzer-Forscher-treiben-sichere-Datenuebertragung-voran;art122,1444016

(6) ERC:
http://www.nachrichten.at/oberoesterreich/Rinaldo-Trotta-Der-1-5-Millionen-Euro-Forscher;art4,2262486
https://science.apa.at/rubrik/natur_und_technik/1_5_Millionen_Euro_fuer_Quantenforschung_an_der_JKU/SCI_20160615_SCI39471352430322738

Summary of the scientific work

(see below for the full list of publications)

Total number of original scientific works (see A-E): **63**
(18 as first author and 2 as senior (last) author)

(A) Total number of international peer-reviewed papers: **44**

Impact factor	Number	Journals
Impact factor > **7.5**	**14**	**3** Physical Review Letters, **1** Nature Nanotechnology, **1** Nature Physics, **2** Nature Communication, **3** Nano Letters, **2** Advanced Materials, **1** Advanced Functional Materials, **1** Journal of the American Chemical Society
Impact factor < **7.5**	**30**	**15** Physical Review B, **7** Applied Physics Letters, **1** Physical Review Applied, **1** Advanced Optical Materials, **2** Journal of Applied Physics, **3** Physica Status Solidi, **1** Nanoscale Research Letters.

(B) Total number of manuscripts submitted/to be submitted and not yet published: **5**

(C) Total number of book chapters: **2**

Publisher	Authors	Book title
Springer (2015)	**R. Trotta** and A. Rastelli	Engineering the Atom-Photon Interaction. Controlling Fundamental Processes with Photons, Atoms and Solids
Pan Stanford (2015)	**R. Trotta** and M. Felici	Hydrogenated Dilute Nitride Semiconductors, Theory, Properties and Applications

(D) Patents **1**

A. Rastelli, I. Daruka, and **R. Trotta** " Verfahren zur Durchstimmung der Verspannung in Dünnschichten" (A method for controlling stress in thin films); **Patent Number: WO2015081361-A1(E)**

Total number of international conference proceedings: **11**

Summary of citations (from Google Scholar)

Total Citations	**669**
Hirsch (H) index	**15**

Summary of citations (from Web of Science)

Total Citations	**488**
Hirsch (H) index	**13**

Full list of publications

(in chronological order, † indicates corresponding authorship)

2016

[63] J. Aberl, P. Klenovsky, J. S. Wildmann, E. Zallo, O. G. Schmidt, T. Fromherz, J. Humlıcek, A. Rastelli, and **R. Trotta†**

"Inversion of permanent exciton dipole moment in self-assembled In(Ga)As quantum dots using the nonlinear "piezotronic" effect"

Submitted to Physical Review Letters

[62] B. Höfer, J. Zhang , J. S. Wildmann, E. Zallo, **R. Trotta†**, F. Ding, A. Rastelli, and O. G. Schmidt

"Independent tuning of emission energy and decay time in single semiconductor quantum dots"

Submitted to Applied Physics Letters

[61] H.M.G.A. Tholen, J.S. Wildmann, A. Rastelli, **R. Trotta**, C.E. Pryor, E. Zallo, O.G. Schmidt, P.M. Koenraad, and A.Yu. Silov

"Strain-induced g-factor tuning in single InGaAs/GaAs quantum dots"

Submitted to Physical Review B

[60] H. Huang, **R. Trotta†**, Y. Huo, T. Lettner, J. Martín-Sánchez, D. Huber, J. S. Wildmann, M. Reindl, J. Zhang, E. Zallo, O. G. Schmidt, and A. Rastelli

"Electrically-Pumped Wavelength-Tunable GaAs Quantum Dots Interfaced with Rubidium Atoms"

Submitted to Appl. Phys. Lett., see arXiv:1602.02122

[59] **R. Trotta†**, J. Martin-Sanchez, J. S Wildmann, G. Piredda, M. Reindl, C. Schimpf, E. Zallo, O. G. Schmidt, S.Stroj, J. Edlinger, and A. Rastelli

"Wavelength-tunable sources of entangled photons interfaced with atomic vapours"

Nature Communications **7**, 10375 (2016)

[58] J. Martín-Sánchez, **R. Trotta**, G. Piredda, C. Schimpf, S. Stroj, T. Lettner, M. Reindl, J. S. Wildmann, J. Edlinger, and A. Rastelli

"Reversible Control of In-Plane Elastic Stress Tensor in Nanomembranes"

Advanced Optical Materials **4**, 682 (2016)

2015

[57] J.-P. Jahn, M. Munsch, L. Béguin, A. V. Kuhlmann, M. Renggli, Y. Huo, F. Ding, **R. Trotta**, M. Reindl, O. G Schmidt, A. Rastelli, P. Treutlein, and R. J Warburton.

"An artificial Rb atom in a semiconductor with lifetime-limited linewidth"

Physical Review B **92**, 245439 (2015)

[56] J. S. Wildmann, **R. Trotta†**, J. Martín-Sánchez, E. Zallo, O. G. Schmidt, and A. Rastelli

"Atomic Clouds as Spectrally-Selective and Tunable Delay Lines for Single Photons from Quantum Dots"

Physical Review B **92**, 235306 (2015), selected as Editors' suggestion

[55] J. Zhang, J. S Wildmann, F. Ding, **R. Trotta†**, Y. Huo, E. Zallo, D. Huber, A. Rastelli, and O. G Schmidt

"High yield and ultrafast sources of electrically triggered entangled-photon pairs based on strain-tunable quantum dots"

Nature Communications **6**, 10067 (2015)

[54] F. J. R. Schülein, E. Zallo, P. Atkinson, O. G. Schmidt, **R. Trotta**, A. Rastelli, A. Wixforth, and H. J. Krenner

"Fourier synthesis of radiofrequency nanomechanical pulses with different shapes"

Nature Nanotechnology **10**, 512 (2015)

[53] **R. Trotta†**, J. Martín-Sánchez, I. Daruka, C. Ortix, and A. Rastelli

"Energy-tunable sources of entangled photons: a viable concept for solid-state quantum relays"

Physical Review Letters **114**, 150502 (2015)

2014

[52] M. Felici, S. Birindelli, **R. Trotta**, M. Francardi, A. Gerardino, A. Notargiacomo, S. Rubini, F. Martelli, M. Capizzi, and A. Polimeni.

"Nanoscale Tailoring of the Polarization Properties of Dilute-Nitride Semiconductors via H-Assisted Strain Engineering"

Physical Review Applied **2**, 065007 (2014)

[51] M. Sytnyk, E. D. Głowacki, S. Yakunin, G. Voss, W. Schöfberger, D. Kriegner, J. Stangl, **R. Trotta**, C. Gollner, S. Tollabimazraehno, G. Romanazzi, Z. Bozkurt, M. Havlicek, N. S. Sariciftci, and W. Heiss.

"Hydrogen-Bonded Organic Semiconductor Micro- And Nanocrystals: From Colloidal Syntheses to (Opto-) Electronic Devices"

Journal of the American Chemical Society **136**, 16522 (2014)

[50] E. Zallo, **R. Trotta**, V. Křápek, Y. H. Huo, P. Atkinson, F. Ding, T. Šikola, A. Rastelli, O. G. Schmidt

"Strain-induced active tuning of the coherent tunneling in quantum dot molecules"

Physical Review B **89**, 241303 (R) (2014)

[49] **R. Trotta**†, J. S. Wildmann, E. Zallo, O. G. Schmidt, and A. Rastelli.

"Highly entangled photons from hybrid piezoelectric-semiconductor quantum dot devices"

Nano Letters **14**, 3439 (2014)

[48] M. Gong, B. Hofer, E. Zallo, **R. Trotta**†, J. Luo, A. Zunger, O. G. Schmidt, and C. Zhang.

"Statistical Properties of Exciton Fine Structure Splitting and Polarization Angles in Quantum Dot Ensembles"

Physical Review B **89**, 205312 (2014)

[47] S. Kumar, E. Zallo, Y. H. Lin, **R. Trotta**, P. Atkinson, J. D. Plumhof, F. Ding, B. D. Gerardot, S. J. Cheng, A. Rastelli, and O. G. Schmidt.

"Anomalous anticrossing of neutral exciton states in GaAs/AlGaAs quantum dots"

Physical Review B **89**, 115309 (2014)

[46] S. Birindelli, M. Felici, J. S. Wildmann, A. Polimeni, M. Capizzi, A. Gerardino, S. Rubini, F. Martelli , A. Rastelli, and **R. Trotta**.

"Single Photons on Demand from Novel Site-Controlled GaAsN/GaAsN:H Quantum Dots"

Nano Letters, **14**, 1275 (2014)

[45] G. Pettinari, M. Felici, **R. Trotta**, M. Capizzi, and A. Polimeni.

"Hydrogen effects in dilute III-N-V alloys: From defect engineering to nanostructuring"

Journal of Applied Physics **115**, 012011 (2014)

[44] Y. H. Huo, B. J. Witek, S. Kumar, J. R. Cardenas, J. X. Zhang, N. Akopina, R. Singh, E. Zallo, R. Grifone, D. Kriegner, **R. Trotta**, F. Ding, J. Stangl, V. Zwiller, G. Bester, A. Rastelli, O. G. Schmidt

"A light-hole exciton in a quantum dot"

Nature Physics, **10**, 46 (2014)

2013

[43] Z. Jiaxiang, F. Ding, E. Zallo, **R. Trotta**, B. Hofer, H. Luyang, S. Kumar, H. Yongheng, , A. Rastelli, and O. G. Schmidt

"A Nanomembrane-Based Wavelength-Tunable High-Speed Single-Photon-Emitting Diode"

Nano Letters **13**, 5808 (2013)

[42] **R. Trotta**†, E. Zallo, E. Magerl, O. G. Schmidt, and A. Rastelli.

"Independent control of exciton and biexciton energies in single quantum dots via electroelastic fields"

Physical Review B **88**, 155312 (2013)

[41] J. D. Plumhof, **R. Trotta**, V. Krapek, E. Zallo, P. Atkinson, S. Kumar, A. Rastelli, and O. G. Schmidt

"Tuning of the valence band mixing of excitons confined in GaAs/AlGaAs quantum dots via piezoelectric-induced anisotropic strain"

Physical Review B **87**, 075311 (2013)

[40] N. Akopian, **R. Trotta**, E. Zallo, S. Kumar, P. Atkinson, A. Rastelli, O. G. Schmidt, and V. Zwiller.

"An artificial atom locked to natural atoms"

arXiv:1302.2005 (2013)

2012

[39] M. Geddo, E. Giulotto, M. Grandi, G. Guizzetti, **R. Trotta**, A. Polimeni, M. Capizzi, F. Martelli.

"An all optical mapping of the strain field in GaAsN/GaAsN:H wires"

Applied Physics Letters **101**, 191908 (2012)

[38] **R. Trotta**†, E. Zallo, C. Ortix, P. Atkinson, J. D. Plumhof, J. van den Brink, A. Rastelli, and O.G. Schmidt.

"Universal recovery of the energy-level degeneracy of bright excitons in InGaAs quantum dots without a structure symmetry"

Physical Review Letters **109**, 147401 (2012)

Editor's suggestion and highlighted in Physics, see Physics **5**, 109 (2012)

[37] S. Frabboni, , V. Grillo, G. C. Gazzadi, R. Balboni, **R. Trotta**, A. Polimeni, M. Capizzi, F. Martelli, S. Rubini, G. Guzzinati, F. Glas

"Convergent beam electron-diffraction investigation of lattice mismatch and static disorder in $GaAs/GaAs_{1-x}N_x$ intercalated $GaAs/GaAs_{1-x}N_x$:H heterostructures"

Applied Physics Letters **101**, 111912 (2012)

[36] L. Wen, M. Stavola, W. B. Fowler, **R. Trotta**, A. Polimeni, M. Capizzi, G. Bisognin, M. Berti, S. Rubini, F. Martelli.

"Microscopic origin of compressive strain in hydrogen-irradiated dilute $GaAs_{1-y}N_y$ alloys:

Role of N-Hn centers with n > 2 and their thermal stability"

Physical Review B **86**, 085206 (2012)

[35] J. D. Plumhof, **R. Trotta**, A. Rastelli, and O.G. Schmidt.

"Experimental methods of post-growth-tuning the excitonic fine structure splitting in semiconductor quantum dots"

Nanoscale Research Letters **7**, 336 (2012)

[34] **R. Trotta†**, P. Atkinson, J.D. Plumhof, E. Zallo, R. O. Rezaev, S. Kumar, S. Baunack, J. R. Schröetr, A. Rastelli, and O.G. Schmidt.

"Nanomembrane quantum-light emitting-diode integrated onto piezoelectric actuators"

Advanced Materials **24**, 2668 (2012)

[33] **R. Trotta**, A. Polimeni, and M. Capizzi.

"Hydrogen incorporation in III-N-V semiconductors: From macroscopic to nanometre control of the material physical properties"

Advanced Functional Materials **22**, 1782 (2012)

[32] A. Rastelli, F. Ding, J. D. Plumhof, S. Kumar, **R. Trotta**, T. Zander, P. Atkinson, E. Zallo, A. Herklotz, R. Singh, V. Křápek, J. R. Schröter, S. Kiravittaya, M. Benyoucef, R. Hafenbrak, K. D. Jöns, Ch. Deneke, D. J. Thurmer, G. Bester, K. Dörr, P. Michler, O. G. Schmidt.

"Controlling quantum dot emission by integration of semiconductor nanomembranes onto piezoelectric actuators"

Physica Status Solidi (b), **249**, 687 (2012)

2011

[31] S. Kumar, **R. Trotta†**, E. Zallo, J. D. Plumhof, P. Atkinson, A. Rastelli, and O.G. Schmidt.

"Strain-induced tuning of the emission wavelength of high quality GaAs/AlGaAs quantum dots in the spectral range of the ^{87}Rb D_2 lines"

Applied Physics Letters **99**, 161118 (2011)

[30] **R. Trotta**, A. Polimeni, F. Martelli, G. Pettinari, M. Capizzi, L. Felisari, S. Rubini, M. Francardi, A. Gerardino, P. C. M. Christianen, J. C. Maan.

"Fabrication of site-controlled quantum dots by spatially-selective incorporation of hydrogen in Ga(AsN)/GaAs heterostructures"

Advanced Materials **23**, 2706 (2011)

[29] M. Geddo, M. Patrini, G. Guizzetti, M. Galli, **R. Trotta**, A. Polimeni, M. Capizzi, F. Martelli and S. Rubini.

"Optical study of hydrogen-irradiated GaAsN/GaAs heterostructures"

Journal of Applied Physics **109**, 123511 (2011)

[28] J. Alvarez, J.-P. Kleider, **R. Trotta**, A. Polimeni, M. Capizzi, F. Martelli, and L. Mariucci.

"Giant and reversible enhancement of the electrical resistance of $GaAs_{1-x}N_x$ by hydrogen irradiation"

Physical Review B **84**, 085331 (2011)

[27] **R. Trotta**†, A. Polimeni, and M. Capizzi.

"Hydrogen-mediated nanostructuring of dilute nitride semiconductors"

Physica Status Solidi (b) **248**, No. 5, 1195-1202 (2011)

2010

[26] **R. Trotta**, L. Cavigli, L. Felisari, A. Polimeni, M. Gurioli, M. Capizzi, F. Martelli, S. Rubini, L. Mariucci, M. Francardi, and A. Gerardino.

"Quantum confinement effects in Hydrogen-intercalated GaAsN heterostructures investigated by photoluminescence"

Physical Review B **81**, 235327 (2010)

[25] G. Pettinari, A. Polimeni, J. H. Blokland, **R. Trotta**, P. C. M. Christianen, M. Capizzi, J. C. Maan, X. Lu, E. C. Young and T. Tiedje.

"Unusual compositional dependence of the exciton reduced mass in $GaAs_{1-x}Bi_x$ (x=0-10%)"

Physical Review B **81**, 235211 (2010)

[24] L. Wen, F. Bekisli, M. Stavola, W. B. Fowler, **R. Trotta**, A. Polimeni, M. Capizzi, S. Rubini, and F. Martelli.

"Detailed structure of the H-N-H center in $GaAs_yN_{1-y}$ revealed by vibrational spectroscopy under uniaxial stress"

Physical Review B **81**, 233201 (2010)

2009

[23] **R. Trotta**, D. Giubertoni A. Polimeni, M. Capizzi, M. Bersani, F. Martelli, and S. Rubini.

"Hydrogen Diffusion in $GaAs_{1-x}N_x$"

Physical Review B **80**, 195206 (2009)

[22] **R. Trotta**, A. Polimeni, M. Capizzi, F. Martelli, S. Rubini, M. Francardi, A. Gerardino and L. Mariucci.

"Light polarization control in GaAsN/GaAsN:H heterostructures"

Applied Physics Letters **94**, 261905 (2009)

2008

[21] **R. Trotta**, A. Polimeni, M. Capizzi, D. Giubertoni, M. Bersani, G. Bisognin, M. Berti, S. Rubini, F. Martelli, L. Mariucci, M. Francardi, and A. Gerardino.

"Effect of hydrogen incorporation temperature in in-plane engineered GaAsN/GaAsN:H heterostructures"

Applied Physics Letters **92**, 221901 (2008)

[20] L. Felisari, V. Grillo, F. Martelli, **R. Trotta**, A. Polimeni, M. Capizzi, F. Jabeen, and L. Mariucci.

"In-plane band gap modulation investigated by secondary electron imaging of GaAsN/GaAsN:H heterostructures"

Applied Physics Letters **93**, 102116 (2008)

[19] A. Polimeni, F. Masia, G. Pettinari, **R. Trotta**, M. Felici, M. Capizzi, A. Lindsay, E. P. O'Reilly, T. Niebling, W. Stolz, and P. J. Klar.

"Role of strain and properties of N clusters at the onset of the alloy limit in $GaAs_{1-x}N_x$"

Physical Review B **77**, 155213 (2008)

[18] A. Polimeni, G. Pettinari, **R. Trotta**, F. Masia, M. Felici, M. Capizzi, A. Lindsay, E. P. O'Reilly, T. Niebling, W. Stolz, P. J. Klar, F. Martelli, and S. Rubini.

"Photoluminescence under magnetic field and hydrostatic pressure for probing the electronic properties of GaAsN"

Physica Status Solidi (a) **205**, No. 1, 107–113 (2008)

2007

[17] M. Geddo, T. Ciabattoni, G. Guizzetti, M. Galli, M. Patrini, A. Polimeni, **R. Trotta**, M. Capizzi, G. Bias, M. Piccin, S. Rubini, and A. Franciosi.

"Photoreflectance and reflectance investigation of deuterium-irradiated GaAsN"

Applied Physics Letters **90**, 091907 (2007)

[16] G. Pettinari, A. Polimeni, F. Masia, **R. Trotta**, M. Felici, M. Capizzi, T. Niebeling ,W. Stolz, and P.J. Klar.

"Electron effective mass in dilute nitrides and its anomalous dependence on hydrostatic pressure"

Physical Review Letters **98**, 146402 (2007)

2006

[15] M. Felici, **R. Trotta,** F. Masia, A. Polimeni, A. Miriametro, M. Capizzi, P.J. Klar, and W. Stolz.

"Compositional disorder in $GaAs_{1-x}N_x$:H investigated by photoluminescence"

Physical Review B **74**, 085203 (2006) –

BOOK CONTRIBUTIONS (Invited):

[14] **R. Trotta,** and A. Rastelli

"Engineering of quantum dot photon sources via electro-elastic fields"

in *"Engineering the atom-photon interaction"*

published by Springer, edited by A. Predojevic and M. W. Mitchell (2015)

see also arXiv:1503.00259

[13] **R. Trotta,** and M. Felici

"Technological applications of hydrogenated dilute nitrides and perspectives"

in "Hydrogenated Dilute Nitride Semiconductors: Theory, Properties, and Applications"

published by Springer, edited by G. Ciatto (2015)

CONFERENCE PROCEEDINGS

[12] A Gerardino, S Birindelli, JS Wildmann, G Pettinari, L Businaro, A Polimeni, M Capizzi, S Rubini, F Martelli, A Rastelli, **R Trotta**, and M Felici.

"Single photon emitters in dilute nitrides: Towards a determinist approach of quantum dot-photonic crystal nanocavity coupling"

ICTON-2015 Conf. Proc. DOI: 10.1109/ICTON.2015.7193631 (2015)

[11] N. Akopian, **R. Trotta**, E. Zallo, A. Rastelli, O. D. Schmidt, and V. Zwiller.

"Single quantum dot locked to atomic transition"

IPRM-2013 Conf. Proc. DOI: 10.1364/QELS.2012.QF1E.3 (2013)

[10] A. Rastelli, **R. Trotta**, E. Zallo, P. Atkinson, and O. G. Schmidt.

"Reshaping the optical properties of quantum dots via strain and electric fields"

IPRM-2013 Conf. Proc. DOI: 10.1109/ICIPRM.2013.6562563 (2013)

[9] **R. Trotta**, A. Polimeni, and M. Capizzi.

"Hydrogen-induced defect engineering in dilute nitride semiconductors"

Physica status solidi (c) **6**, No. 12, 2644–2648 (2009)

[8] L. Felisari, V. Grillo, S. Rubini, F. Martelli, **R. Trotta**, A. Polimeni, M. Capizzi, and L. Mariucci.

"Secondary Electrons Characterization of Hydrogenated Dilute Nitrides"

EMC Conf. Proc. **14**, 541 (2008).

[7] G. Pettinari, F. Masia, A. Polimeni, M. Felici, **R. Trotta**, M. Capizzi, T. Niebling, H. Gunther, P. J. Klar, W. Stolz, A. Lindsay, E. P. O'Reilly, M. Piccin, G. Bais, S. Rubini, F. Martelli, A. Franciosi.

"Photoluminescence under Magnetic Field and Hydrostatic Pressure in $GaAs_{1-x}N_x$ for Probing the Compositional Dependence of Carrier Effective Mass and Gyromagnetic Factor"

Epioptics-9 Conf. Proc. **1**, 156-159 (2007).

[6] **R. Trotta**, M. Felici, F. Masia, A. Polimeni, A. Miriametro, M. Capizzi.

"Investigation of compositional disorder in $GaAs_{1-x}N_x$:H"

Epioptics-9 Conf. Proc. **1**, 103-108 (2007)

[5] F. Masia, G. Pettinari, A. Polimeni, M. Felici, **R. Trotta**, M. Capizzi, T. Niebeling, H. Gunther, P. J. Klar, W. Stoltz, A. Lindsay, E.P. O' Reilly, M. Piccin, G. Bias, S. Rubini, F. Martelli, and A. Franciosi.

"Photoluminescence under magnetic field and hydrostatic pressure in $GaAs_{1-x}N_x$ for probing the compositional dependence of carrier effective mass and gyromagnetic ratio"

AIP Conf. Proc. **893**, 157 (2007)

[4] M. Felici, **R. Trotta**, F. Masia, A. Polimeni, A. Miriametro, M. Capizzi, P.J. Klar, and W. Stolz.

"Investigation of compositional disorder in GaAsN:H"

AIP Conf. Proc. **893**, 313 (2007)

[3] M. Felici, A. Polimeni, F. Masia, **R. Trotta**, G. Pettinari, M. Capizzi, G. Salviati, L. Lazzarini, M. Piccin, G. Bias, F. Martelli, S. Rubini, A. Franciosi, and L. Mariucci.

"In-plane band gap engineering by hydrogenation of dilute nitrides semiconductor"

AIP Conf. Proc. **893**, 31 (2007)

[2] **R. Trotta**, A. Polimeni, M. Felici, G. Pettinari, M. Capizzi, A. Frova, G. Salviati, L. Lazzarini, N. Armani, L. Mariucci, G. Bias, F. Martelli, and S. Rubini.

"Hydogen-induced nitrogen passivation in dilute nitrides: a novel approach to defect engineering"

Mater. Res. Soc. Proc. Vol. **994**, F02-08 (2007)

PATENTS

[1] A. Rastelli, I. Daruka, and **R. Trotta.**

" Verfahren zur Durchstimmung der Verspannung in Dünnschichten" (A method for controlling stress in thin films). **Patent Number: WO2015081361-A1**

RESEARCH PLAN RELATED TO THE **ERC STARTING GRANT 679183 -TROTTA**

SPQRel

"Entanglement distribution via Semiconductor-Piezoelectric Quantum-Dot Relays"

BACKGROUND AND MOTIVATION

Quantum communication deals with the transfer of quantum states from a place to another.[1] One of its applications, quantum key distribution, promises secure data transmission by encoding "bits", e.g., in the polarization state of single photons. However, unavoidable losses in the transmission channel limits the reachable distances to a few hundred of km. One elegant solution to this problem is the use of *quantum repeaters*,[2] often referred to as the quantum analogue of classical amplifiers. The idea behind quantum repeaters is to mitigate losses via *quantum relays* (QRs), *i.e.*, quantum devices capable to teleport or swap entanglement between distant nodes. A single QR (see Fig. 1a) consists of two entanglement resources (ERs) emitting pairs of entangled photons. A Bell-state measurement (BSM) between photons stemming from the two remote ERs allows entanglement to be distributed over distant nodes. A partial BSM can be obtained by Hong-Ou-Mandel (HOM) type two-photon interference[3]. This quantum-mechanical phenomenon consisting in the coalescence of two single-photon states into a two-photon collective state has been employed in the first demonstration of entanglement swapping[4] and has been implemented using dissimilar quantum emitters, including semiconductor quantum dots (QDs)[5].

Often referred to as "artificial atoms", QDs are nanostructures capable of deterministic generation of single[6] and entangled[7] photons and, unlike their natural counterpart, QDs can be easily integrated into well-established optoelectronic devices,[8] making them very attractive ERs. Fig. 1b sketches

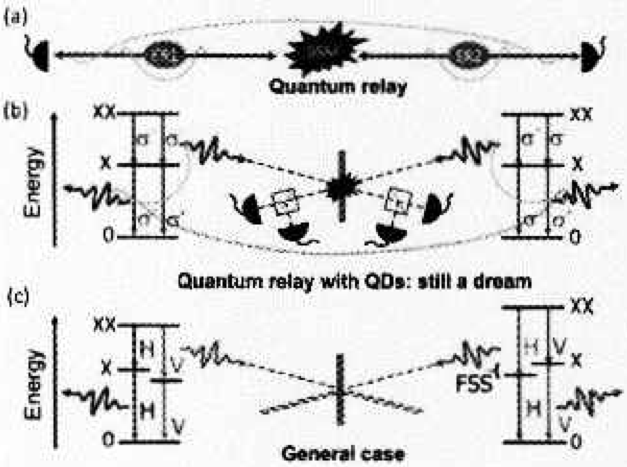

Figure 1. (a) Sketch of a QR. Yellow lines represent entanglement. Detectors are in black. (b) QR with two identical QDs using the XX-X-0 cascade. σ+ (σ-) indicates right (left) circularly-polarized photons. A partial BSM is performed via HOM interference at the beamsplitter followed by polarization-resolved detection. (c) Realistic situation for two QDs. H (V) indicates horizontally (vertically) polarized photons.

[1] N. Gisin, and R. Thew, Nature Photon. **1**, 165 (2007).
[2] L.-M. Duan, *et al.*, Nature **414**, 413 (2001).
[3] C. K. Hong, *et al.*, Phys. Rev. Lett. **59**, 2044 (1987).
[4] J.-W. Pan, D. Bouwmeester, A. Zeilinger, Phys. Rev. Lett. **80**, 3891 (1998).
[5] R. B. Patel, *et al.*, Phys. Rev. Lett. **104**, 137401 (2010); E. B. Flagg, *et al.*, Phys. Rev. Lett. **104**, 137401 (2010).
[6] P. Michler, *et al.*, Science **290**, 2282 (2000).
[7] N. Akopian, *et al.*, Phys. Rev. Lett. **96**, 130501(2006).
[8] C. L. Salter, *et al.*, Nature **465**, 594 (2010).

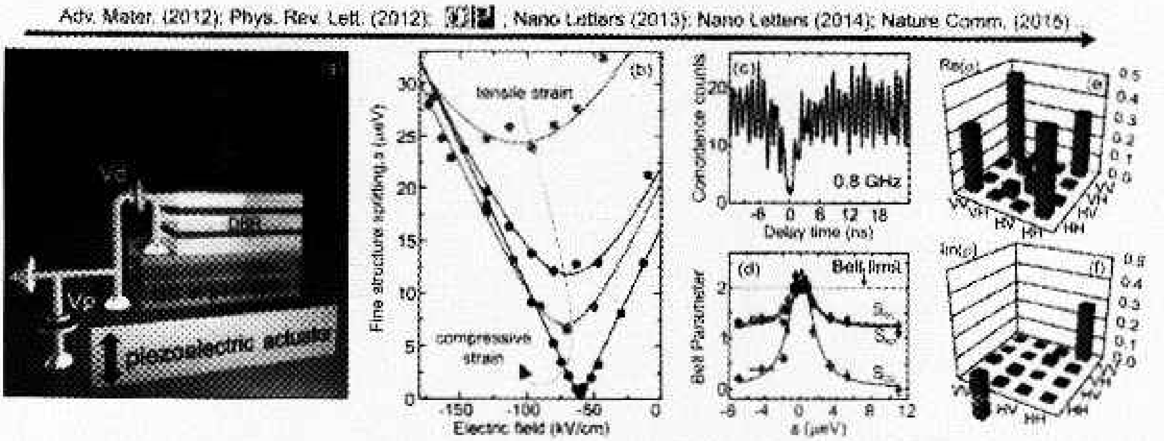

Figure 2. (a) Sketch of the strain-tunable device I and my team developed. (b). Conquering the exciton fine structure splitting (FSS, *s*) via strain and electric fields. (c). Autocorrelation measurements performed to demonstrate high-speed single photon emission. (d). Violation of Bell's inequalities at low FSS. Real (e) and imaginary (f) part of the two-photon density matrix used to determine the degree of entanglement of the source. The black line on the top of the figure shows the scientific papers I have recently published and of relevance for the research outlined below.

the scheme usually employed for the generation of polarization-entangled photon-pairs during the cascade of a biexciton (XX) to the exciton (X) to the ground state (0).[9] With such a scheme in mind, one could dream to build-up a QR using two identical QDs and use HOM interference of the XX photons to entangle the X photons (see Fig. 1b). This simple scheme, however, requires a number of extraordinary challenges to be overcome. Problems related to the need of Fourier-limited,[10] bright,[11] and site-controlled[12] entanglement resources have been recently addressed. There is another issue, however, which is still open: different from real atoms, each QD possesses its own size, shape, and composition and, as a consequence, unique emission spectrum. This hurdle has a dramatic impact on the scheme for QRs (see Fig. 1c). First, there are no identical QDs in reality. Considering that the inhomogeneous broadening of QD emission is ~ tens of meV, the probability of finding two QDs with XX (or X) emission at the same energy within typical radiative-limited linewidth (~μeV) is $<10^{-4}$. This eventually hinders BSM, because the colour difference between the photons prevents their interaction at the beam splitter. Second, the anisotropic electron-hole exchange interaction,[13] which generally leads to the appearance of a fine-structure-splitting (FSS, *s*) between the two X states (see Fig. 1c), limits the capability of a QD to generate photon-pairs featuring high entanglement degree, high enough to violate Bell's inequalities without temporal or spectral filtering techniques. Recent theoretical calculations[14] show that a very low portion of as-grown QDs are free of these asymmetries (1 over 1000) and the numbers increase little if sophisticated growth protocols are employed.[12] Therefore, the probability of finding two as-grown QDs for a single QR is $\sim 10^{-9}$ or less. Researchers worldwide are thus realizing that the possibility of using QDs in quantum communication critically depends on our capability to control their emission properties, within tolerances that are too small to be met even by the most refined fabrication methods. For this reason, the idea of post-growth tuning of the QD emission via the application of external perturbations, such as strain, electric or magnetic fields has been explored. It turns out that even with the aid of external "knobs" it is extremely difficult to implement the scheme of Fig. 1b and the interest for QDs as scalable sources of entanglement is dwindling. Overcoming these hurdles, however, it is worth the efforts since the realization of scalable entanglement-based technologies for quantum communication will be revolutionary.

After my PhD work – ***in which I invented one of the few existing methods to fabricate site-controlled nanostructures capable of deterministic generation of non-classical light***[15,16,17] – I decided to expand my scientific knowledge and skills by switching research area and moving deep into the field of advanced

[9] O. Benson, *et al.*, Phys. Rev. Lett. **84**, 2513 (2000).
[10] M. Müller, *et al.*, Nature Phot. **8**, 224 (2014).
[11] A. Dousse, *et al.*, Nature **466**, 217 (2010).
[12] G. Juska, *et al.*, Nature Phot. 7, 527 (2013).
[13] M. Bayer *et al.*, Phys. Rev. B **65**, 195315 (2002).
[14] M. Gong, B. Hofer, E. Zallo, **R. Trotta**, *et al.*, Phyis. Rev.B **89**, 205312 (2014).
[15] **R. Trotta**, *et al.*, Adv. Mater. **23**, 2706 (2011).
[16] **R. Trotta**, *et al.*, Adv. Funct. Mater. **22**, 1782 (2012).
[17] S. Birindelli, [...], and **R. Trotta**, Nano Lett. **14**, 1275 (2014).

quantum optics with conventional epitaxial QDs. During this time, ***I conceived and developed a novel class of hybrid quantum devices*** where strain and electric fields – provided by diode-like nanomembranes integrated onto piezoelectric actuators – are combined to reshape the QD electronic structure. ***I demonstrated the first all-electrically controlled, wavelength-tunable, frequency stabilized, high-speed source of single photons[18,19] and – most importantly – I have invented a universal method to suppress the FSS and to tune any arbitrary QD for the generation of photon pairs featuring the highest degree of entanglement ever reported so far using QDs[20,21]***(see Fig. 2), ***even during the electrical-injection operation of light emitting diodes[22]***. It is clear that the dual-knob device already developed opens up new frontiers for using QDs in advanced quantum optics experiments. At this point, a natural question arises: is the achieved degree of control sufficient to implement the QR shown in Fig. 1b? Unfortunately the general answer is that the realization of QRs is at present out of reach: While it is possible to tune any arbitrary QD for entangled photon generation, the energy of the emitted photons will be generally different and any modification of the magnitude of the external fields aiming at achieving colour coincidence for BSM restores the FSS and spoils entanglement. To date, no concrete solution to this roadblock exists.

PROPOSED RESEARCH

My vision is to build up a hybrid quantum network where quantum entanglement is distributed over distant parties using semiconductor-piezoelectric QD devices interfaced with warm atomic vapours.

By using an innovative wavelength-tunable source of entangled photons I have conceived[23] and very recently developed[24], I aim to attempt entanglement teleportation (or swapping) among distant QDs (quantum relay), and to build up a quantum network where entangled photons from different quantum relays are interfaced with ensemble of natural atoms. To achieve these ambitious goals, my team will address all aspects, from novel device fabrication to advanced quantum optics experiments involving dissimilar QDs and ensemble of natural atoms. The objectives of my main research interest are summarized below.

1) The "perfect" source of entangled photons: A bright six-legged strain-tensor-tunable diode.

As mentioned above, scalable QD-based QRs require the energy of the entangled photons to be modified without affecting the FSS. I have recently performed a detailed theoretical investigation of this problem and discovered that full control of the in-plane strain tensor would allow for the development of wavelength-tunable sources of entangled photons. In order to concisely explain this important finding, it is sufficient to consider that three external fields are required to achieve this task: two fields are taken up to fulfil FSS=0 (as in ref. 20 and Fig. 2b), while the third is needed to control independently the X (or XX) energy. In-plane stress fields naturally offer *three* independent degrees of freedom, as they are characterized by three components of the stress tensor, σ_{xx}, σ_{xy}, σ_{yy}. The way how to

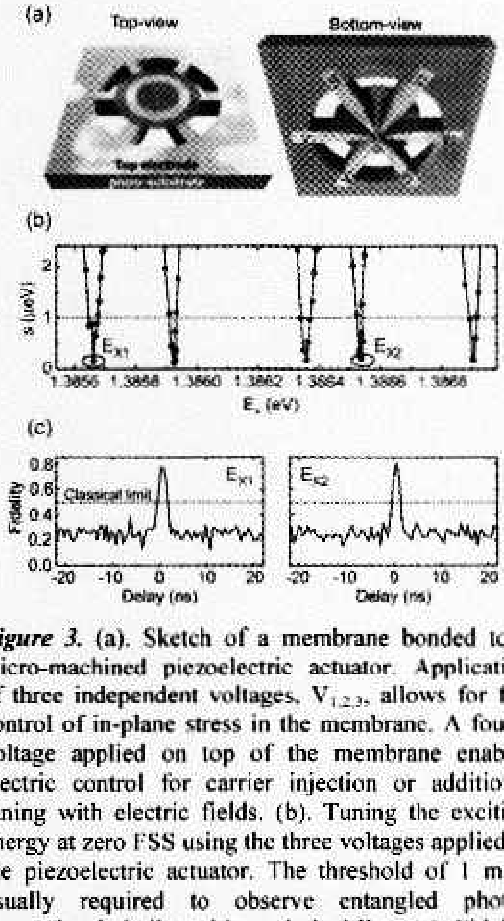

Figure 3. (a). Sketch of a membrane bonded to a micro-machined piezoelectric actuator. Application of three independent voltages, $V_{1,2,3}$, allows for full control of in-plane stress in the membrane. A fourth voltage applied on top of the membrane enables electric control for carrier injection or additional tuning with electric fields. (b). Tuning the exciton energy at zero FSS using the three voltages applied to the piezoelectric actuator. The threshold of 1 meV usually required to observe entangled photon generation is indicated by a dashed line. (c). Fidelity to the expected Bell state for two different exciton energies (see panel c). The classical limit is indicated by a dashed line.

[18] **R. Trotta***, *et al.*, Adv. Mat. **24**, 2668 (2012).
[19] J. Jiaxiang, F. Ding, E. Zallo, **R. Trotta**, *et al.*, Nano Lett. **13**, 5808 (2013).
[20] **R. Trotta***, *et al*, Phys. Rev. Lett. **109**, 147401 (2012), editor suggestion and highlighted in Physics
[21] **R. Trotta***, *et al.*, Nano Lett. **14** 3439 (2014).
[22] J. Jiaxiang, J. S. Wildmann, F. Ding, **R. Trotta***, *et al.*, Nature Comm., in press (see arXiv:1505.03026).

[23] **R. Trotta***, *et al.*, Phys. Rev. Lett. **114**, 150502 (2015)
[24] **R. Trotta***, *et al.*, Nature Comm., in press (see arXiv:1507.06612 (2015))

implement independent control of in-plane stress tensor in reality is not obvious. Experiments so far used either quasi-uniaxial stress provided by conventional lead-zirconate-titanate actuators (PZT),[25,26] or anisotropies on the (001) face of lead magnesium niobate-lead titanate actuators (PMN-PT)[18-21]. There is however no piezoelectric actuator providing independently tunable stresses along different directions. In the last year, **I have conceived a compact device**[23,27] that can do this. It consists of thin (Al)GaAs nanomembranes containing In(Ga)As QDs connected and suspended on a micro-machined single crystal PMN-PT featuring six legs aligned at a 60° angle with each other, see sketch of Fig. 3a. The geometry of the legs stems from the key idea that full control of the in-plane stress tensor can be obtained via the application of *three independent uniaxial stresses* in the nanomembrane plane. In the proposed device, quasi-uniaxial stresses are achieved by applying three independent voltages (V_1, V_2, V_3) on contacts defined at the bottom of the legs, while the top is electrically grounded. A realistic structure has been implemented in a finite-element simulation, which highlights that – potentially – the six-leg device allows for **full control of the in-plane strain tensor with strain magnitudes exceeding 2%**. Very recently[24], my group has shown the feasibility of this approach with preliminary experimental results. In particular, we have demonstrated for the first time that the energy of the **polarization-entangled photons emitted by QDs can be tuned** (in a range of ~ 10 meV) **without affecting the degree of entanglement of the quantum source** (see Fig. 3 b-c). Furthermore, we have interfaced for the first time one photon from the entangled photon-pair with clouds of atomic vapours, and **we have demonstrated slow-entangled-photons from a single quantum emitter.** In spite of these accomplishments, however, the ideal scenario of quantum communication with identical QDs (see Fig. 1b) still requires controlling the X-XX energy difference, i.e., the so called XX binding energy. Thus, the first step of my research plan is to further develop the hybrid technology I have pioneered by integrating diode-like structures in the device design of Fig. 3a. This provides with the additional possibility to control the electric field across the QDs via the application of a voltage on the top surfaced of the nanomembrane (see Fig. 3a), similar to what shown in my previous results with the "two-knob" devices[20].

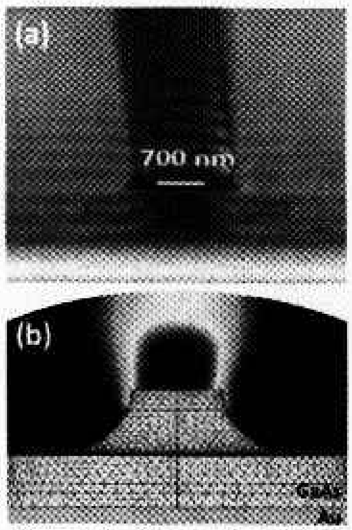

Figure 4. GaAs micro-lenses fabricated by wet chemical etching. (a). SEM image. (b). FEM simulation map for total emitted power in a novel micro-cavity. The QD emits at λ=900 nm and is placed 600 nm above the bottom gold mirror.

The final device will therefore feature 4-electrical knobs for unprecedented control over the QD emission properties. It is also worth noting that the electric field across the diode can be alternatively used to inject carriers electrically, as in light emitting diodes (LED)[8]. This paves the way towards the development of the first all-electrically controlled and tunable source of entangled photons, a major breakthrough for scalability. In the perspective of using the proposed device for the distribution of quantum entanglement in a quantum network, another technologically-challenging task needs to be overcome, that is, **boosting the flux of quantum dot photons**. Simple calculations – performed using standard planar cavity-design and conventional photon detectors – show that the coincidence counts per hour registered during envisioned entanglement-teleportation experiments (4-fold coincidences) are limited to ~ 50. Novel cavity-designs are therefore needed. Existing approaches demonstrating very high extraction efficiency are either not suitable here or difficult to implement in the device geometry shown in Figure 3a. On the one hand, the high quality factors of micropillar cavities (or photonic molecules[11]) do not meet the broad-band requirement of the proposed device. On the other hand, the integration of nanowire-like structures[28] that would instead allow for broad-band operation suffer from a reduced capability to transfer (and control) strains to the QD layers. For these reasons, I plan to develop **micro-cavities featuring novel GaAs micro-lenses** fabricated by dry etching (see Fig. 4) and promising extraction efficiency up to 60%, (an order of magnitude larger than in previous devices) with a Purcell enhancement factor > 2.

2: Entanglement teleportation with Quantum Dots: Quantum Relays

The distribution of entanglement among distant QDs strongly relies on the HOM two-photon interference (see Figure 1). Previous experiments[5] have highlighted that incoherent excitation (via above bandgap, wetting layer or p-shell pumping) leads to reduced photon coherence times (T_2). This effect, mainly ascribed

[25] S. Seidl *et al*. Appl. Phys. Lett. **88**, 203113 (2006).
[26] C. E.Kuklewicz *et al*., Nano Lett. **12**, 3761 (2012).
[27] A. Rastelli, I. Daruka, and **R. Trotta**, Austrian Patent, Patent Number: WO2015081361-A1
[28] M. Reimer, *et al*., Nature Comm. **3**, 737 (2014); J. Claudon, *et al*., Nature Photon. **4**, 174 (2010).

to phonon-induced dephasing and uncontrolled time jitter during carrier relaxation from the excited states to the ground state, has a dramatic impact on the indistinguishability of photons emitted by remote QDs, and in turn on the HOM visibility. Two-photon excitation schemes[16] to coherent populate the XX state have demonstrated that highly entangled (fidelity to the expected Bell state of 81%) and indistinguishable (non-post-selective visibilities of two-photon interference as high as 86%) photon pairs can be generated on demand (efficiency of photon pair generation of 86%). Coherent population of the XX state can be achieved with picosecond optical pulses following three different main strategies[29]: (i) two photon excitation with transform-limited pulses[10], (ii) excitation with chirped lasers[30] and (iii) photon-assisted excitation.[31] Very high fidelities (>70%) for the preparation of the XX state have been achieved with all the three schemes. For this reason, it is difficult to identify the optimal conditions to be used, also considering that generation of polarization-entangled photon has been demonstrated only with (i). Therefore, we will test all the different strategies by performing systematic measurements of the degree of entanglement (concurrence or tangle via reconstruction of the two-photon density matrix), of coherence time T_2 (via Michelson interferometry), of lifetime T_1 (via time resolved PL), and of visibility of two-photon interference (via HOM experiments with photons emitted by the same QD) of XX preparation fidelity and photon-pair generation efficiency (via power dependence measurements) to find the optimum conditions for our system. Considering the record level of entanglement I have already achieved under non-resonant pumping[21], two-

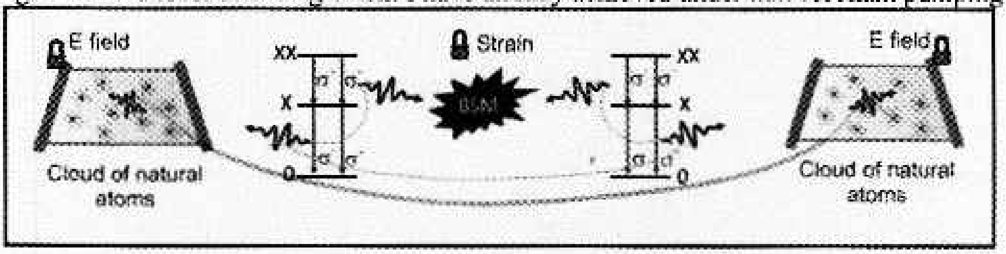

Figure 5. Illustration of the hybrid quantum relay. Two distant QDs are tuned via strain and electric fields so that a BSM of XX photons (frequency stabilized via closed-loop feedback on the piezo-actuator), entangles the X photons that are frequency-locked (via electric field) to double absorption resonances of Cs.

photon excitation with the strain-tenable device developed in (1) will allow for the generation of on-demand, indistinguishable, bright, wavelength-tunable, and maximally-entangled photon pairs. In other words, the device to be developed will fulfil all the points in the "wish-list" of the **perfect entangled photon source**[32] **with the additional advantage** that it will be scalable and it will allow the energy of the entangled photons to be controlled over a broad range.

After successful implantation of the two-photon excitation in the six-legged tunable diode, my team will be in the position to demonstrate **the first QD-based quantum relay** (see central part of Fig. 5). Two high-quality and tunable QDs will be selected and the applied voltages will be chosen so as to drive the FSS to 0 and the XX transitions into energy coincidence. A partial BSM will be used to entangle the corresponding X photons and quantum state tomography measurements will be employed to estimate the degree of entanglement after the teleportation process, with the aim of violating Bell's inequality without the aid of inefficient temporal and spectral filtering techniques. It is important to mention that the two-photon excitation scheme detailed above combined with the capability of the device to control independently the XX binding energy (via electric field) will also open up the interesting possibility to generate **time-bin entangled photons**[33]. Performing this experiment in a QD with FSS=0 will then lead to the first demonstration of **hyper-entanglement** (entanglement in two different degrees of freedom) in QDs and, in turn, to perform a complete BSM.

3: Distributing entanglement in a hybrid artificial-natural quantum network.

The prospect of teleporting entanglement over the distant nodes of a **quantum network requires quantum interconnects with an absolute energy reference**. The broad-band tunability offered by our hybrid device allows entangled photons from QDs to be interfaced with double absorption resonances in warm atomic Vapours[34].

[29] D. E. Reiter, et al., J. Phys.: Condens. Matter **26**, 423203 (2014).
[30] Y.-Y. Mei, *et al.*, Nano Lett. **14**, 6515 (2014)
[31] P. L. Ardelt, *et al.*, Phys. Rev. B **90**, 241404(R) (2014)
[32] C.-Y. Lu, and J.-W. Pan., Nature Photon. **8**, 174 (2014)
[33] H. Jayakumar, *et al.*, Nature Comm. **5**, 4251 (2014)
[34] N. Akopian, *et al.*, Nature Photon. **5**, 230 (2011); N. Akopian, **R. Trotta**, *et al.*, arXiv:1302.2005; J. S. Wildmann, **R. Trotta***, *et al.*, Phys. Rev. B, in press (see, arXiv:1505.04071)

Considering that In(Ga)As QDs will be employed for this research activity, the absorption lines of the D1 hyper-fine structure of Cs are particularly suited for this purpose. On the one hand, this paves the way towards the creation of a delay line **in which a single photon of the entangled pair is stored by several time its temporal width in a cloud of natural atoms**.[31] On the other hand, the use of warm Cs vapours naturally offers an **absolute energy reference to interface the different nodes** of the quantum network. Preparatory studies (same as in the previous section) will be performed to understand how the degree of entanglement and the temporal extension of the photon wavepackets will change vs the storage time when the X energy is tuned to Cs while XX is flying. We will then use all the 4 tuning knobs of the six-legged tunable diode to build up a **hybrid artificial-natural quantum relay** (see Figure 5). In particular, the electric field across the diode will be first used to tune – and frequency-stabilize via closed-loop systems (see the lock "E field" in Fig 5) the X photons *of the two involved QDs* in the middle of the D1 lines of Cs. The three independent voltages applied to the two piezo-actuators are then fine-tuned via feedback-loops (see the lock "strain" in Fig 5) so that the FSS=0 condition is achieved at same XX target energy. This will be a key point to reach my vision, that is, to distribute quantum entanglement among chains of identical – in terms of X and XX energies – hybrid quantum relays. As the photons coming out of each quantum relay are all frequency-locked to Cs – i.e., have all the same energy – it is possible to use HOM interference to perform **multistage entanglement teleportation**, as sketched in Figure 6. Finally, different synchronization techniques and quantum-network protocols[35] will be tested to find the most efficient way to teleport quantum entanglement among the distant nodes. To the best of my knowledge no other group in the world is pursuing this approach to achieve these ambitious goals, which have the potential to completely revolutionize the field of quantum communication with solid state devices.

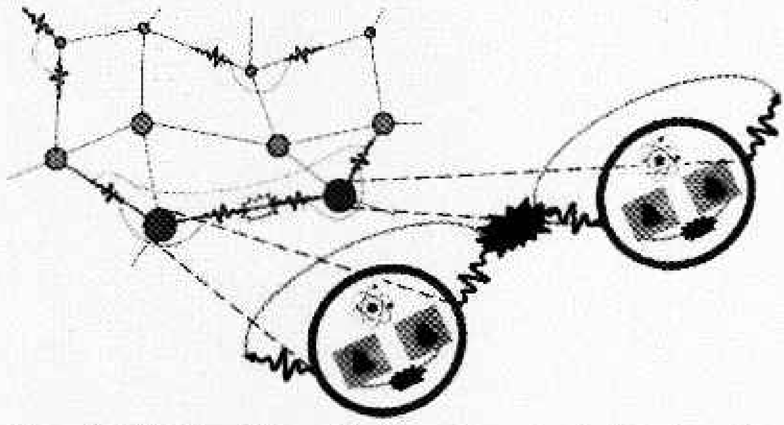

Figure 6. Illustration of the envisioned quantum network. Entanglement is distribute in a quantum network using HOM interference of the photons coming out of identical quantum relays made out of 2 QDs locked to atomic transitions.

[35] C. Jones, *et al.*, arXiv:1505.01536 (2015)

STRALCIO DEL
VERBALE DELLA SEDUTA DEL CONSIGLIO DI DIPARTIMENTO DI FISICA RISTRETTO AI DOCENTI DI I E II FASCIA DEL GIORNO 13 SETTEMBRE 2016

Oggi alle ore 16.00 nell'Aula Amaldi del Dipartimento di Fisica si è riunito il Consiglio di Dipartimento per discutere il seguente ordine del giorno:

1 "Procedure concorsuali per PA"

2 " Proposta di chiamata diretta a PA"

Professori ordinari
Sono presenti G.Bachelet, P.Bagnaia, P.Calvani, A.Capone, C.Castellani, C.Mariani, P.Mataloni, F. Mauri, G.Parisi, A.Pelissetto, L. Pietronero, G. Ruocco, P.Santini, M.Testa, A. Vulpiani.
Hanno giustificato l'assenza: P.De Bernardis, V.Ferrari, F. Ferroni, S. Gentile, E.Longo, V.Marinari, G.Martinelli, V. Parisi, F.Ricci, F.Sciortino, A.Tramontano.

Professori associati
Sono presenti, L.M.Barone, F.Bellini, M.G. Betti, C.Bini, S. Caprara,G. D'Agostini, D.Del Re, P. Dore, , R.Fastampa, S.Giagu, I Giardina, V.Loreto, F. Meddi, A.Nigro, , S. Petrarca, F. Piacentini, A.Polimeni C. Presilla, F.Ricci Tersenghi, F. Sciarrino,
Hanno giustificato l'assenza F.Bordi, R.Capuzzo Dolcetta, C. Conti, A. Crisanti, F. De Luca , A. Di Domenico, M.Grilli,, L. Gualtieri, C.Luci, S.Lupi, S.Masi, A. Melchiorri G. Organtini, A.D. Polosa, , P.Postorino, S. Rahatlou, T. Scopigno.
Non sono pervenute le giustificazioni: G. Amelino Camelia, M.Bruschi, C. Cosmelli, R. Faccini S. Frasca, F.Lacava, P. Rapagnani, N. Saini.

E' presente il RAD: L. Rubini

Presiede il Direttore Prof. Paolo Mataloni. Esercita le funzioni di Segretario il RAD, Dr.ssa Lisena Rubini.

Alle ore 16.05, constatata la presenza del numero legale, il Presidente dichiara aperta la seduta.

Si passa al primo punto all'ordine del giorno.

...OMISSIS...

2)PROPOSTA DI CHIAMATA DIRETTA A PA

Il Presidente ricorda che la delibera che segue deve essere approvata a maggioranza assoluta degli aventi diritto e sottopone all'approvazione del Consiglio la proposta di chiamata diretta a Professore di II Fascia del **Dr. Rinaldo Trotta,** SSD/SC FIS03-02B1.
La richiesta prende spunto dal recente Decreto Ministeriale dell'8 Agosto 2016 n. 635, art. 7 (Programmazione del personale docente), il quale sostituisce quanto enunciato nel Decreto

Ministeriale 963/2015 (art. 4, comma 1), aprendo la possibilità di chiamata diretta a Professore Associato ai vincitori di Starting Grant dell'European Research Council.
Il Presidente invita il Prof. Polimeni a presentare il candidato.
Il Prof. Polimeni illustra in maniera esaustiva il curriculum e l'attività scientifica del Dr Trotta.
Dopo ampia discussione, dalla quale emerge un giudizio concorde del Consiglio sulla rilevanza del programma di ricerca del candidato, si procede alla votazione per la proposta di chiamata Dr. Rinaldo Trotta a Professore di II Fascia.
Il Consiglio approva con un astenuto.

Alle ore 16.45 il Presidente chiude la seduta.

Per copia conforme

Il Segretario
Dr.ssa Lisena Rubini

Il Presidente
Prof. Paolo Mataloni