

## 4 CV OF THE EXPERIENCED RESEARCHER

**Overview:** Luca Chirolli is an experienced researcher in the field of Theoretical Condensed Matter Physics. He got his PhD in 2010 under the supervision of G. Burkard in the Physics Department of the University of Konstanz, Germany. He was a postdoc first at Scuola Normale Superiore in Pisa, Italy (2010-2012), with V. Giovannetti and R. Fazio, and then moved to Instituto de Ciencia de Materiales de Madrid, in Spain to work with F. Guinea (2013-2014), where he extended his stay moving at IMDEA Nanoscience Institute in Madrid (2014-present). A productive researcher, he has authored **25 peer-reviewed publications** in high-impact journals (12 of which as first author), including one in the prestigious **Nature Communications** (IF=13) and five in **Physical Review Letters** (IF=7.9), three as first author, a review in the prestigious **Advances in Physics** (IF=34.3) and one in the prestigious **Chemical Society Reviews** (IF=38.6). According to the Web of Science, his work has been cited a total of 291 times and he has **h-index = 10**.

### Curriculum Vitae

#### PERSONAL INFORMATION

Name: Luca

Family name: Chirolli

#### ACADEMIC CAREER PATH

- Postdoc position at IMDEA Nanoscience, Madrid (2014-present)
- Postdoc position at ICMM CSIC, Madrid (2013-2014)
- Postdoc position at Scuola Normale Superiore, Pisa (2010-2012)
- Ph.D. in Physics, University of Konstanz, Germany (2005-2009) – Supervisor: Prof. G. Burkard
- Diploma (Laurea) in Physics (1999-2005), Università di Bologna, Italy

#### RESEARCH VISITS

- Visiting the group of Prof. Rosario Fazio at Scuola Normale Superiore, Pisa (05/2008 - 05/2009), supported by the Ph.D. program in Konstanz.
- The Ph.D program with Guido Burkard took place in several Physics Departments:
  - 05/08 - 12/09 Department of Physics, University of Konstanz, Germany
  - 05/07 - 05/08 Department of Physics, RWTH Aachen, Germany
  - 09/05 - 05/07 Department of Physics, University of Basel, Switzerland

#### TEACHING EXPERIENCE

- Quantum Field Theory in Condensed Matter 2015 - ICMM, Madrid: course for graduate students
- Graphene Workshop 2014: Series of classes on *Edge states in graphene* - Al Jadida - Morocco
- Theory Seminar 2009: Classes on *Superconducting flux qubits* - Physics Department, Konstanz, DE
- Teaching Assistance - I semester 2007/2008 RWTH Aachen, DE  
Exercise class in: 'Introduction to theoretical physics' (course language: German)

- Teaching Assistance - I and II semester 2006/2007 Physics Department, Basel, CH  
Exercise class in: 'Solid State Theory' (course language: English)

## PUBLICATIONS

- (P1) **L. Chirolli**, F. Guinea, *Magnetic Tilting and Majorana Spin Connection in Topological Superconductors*,  
Accepted for publication in Phys. Rev. B, arXiv:1806.05969 (2018)
- (P2) Á. Gutiérrez-Rubio, **L. Chirolli**, L. Martín-Moreno, F. J. García-Vidal, F. Guinea, *Polariton Anomalous Hall Effect in Transition-Metal Dichalcogenides*,  
Accepted for publication in Phys. Rev. Lett., arXiv:1802.02527 (2018)
- (P3) **L. Chirolli**, *Chiral Superconductivity in Thin Films of doped Bi<sub>2</sub>Se<sub>3</sub>*, Phys. Rev. B **98**, 014505 (2018).
- (P4) **L. Chirolli**, José Pablo Baltanás, Diego Frustaglia, *Chiral Majorana Interference as a Source of Quantum Entanglement*, Phys. Rev. B **97**, 155416 (2018).
- (P5) G. Széchenyi, **L. Chirolli**, A. Pályi, *Impurity-assisted electric control of spin-valley qubits in monolayer MoS<sub>2</sub>*, 2D Materials **5**, 035004 (2018).
- (P6) R. Roldán, **L. Chirolli**, E. Prada, J. A. Silva-Guillen, P. San-Jose, F. Guinea, *Theory of 2D crystals: graphene and beyond*, Chem. Soc. Rev. **46**, 4387 (2017).
- (P7) **L. Chirolli**, F. de Juan, F. Guinea, *Time-reversal and rotation symmetry breaking superconductivity in Dirac materials*, Phys. Rev. B (R) **95**, 201110 (2017).
- (P8) E. Navarro-Moratalla, J. O. Island, S. Mañas-Valero, E. Pinilla-Cienfuegos, A. Castellanos-Gomez, J. Quereda, G. Rubio-Bollinger, **L. Chirolli**, J. A. Silva-Guillén, N. Agraït, G. A. Steele, F. Guinea, H. S. J. van der Zant, E Coronado, *Enhanced superconductivity in atomically thin TaS<sub>2</sub>*, Nature Comm. **7**, 11043 (2016).
- (P9) B. Karmakar, D. Venturelli, **L. Chirolli**, V. Giovannetti, R. Fazio, S. Roddaro, L. N. Pfeiffer, K. W. West, F. Taddei, V. Pellegrini, *Nanoscale Mach-Zehnder interferometer with spin-resolved quantum Hall edge states*, Phys. Rev. B **92**, 195303 (2015).
- (P10) J. A. Galvis, **L. Chirolli**, I. Guillamon, S. Vieira, E. Navarro-Moratalla, E. Coronado, H. Suderow, F. Guinea, *Zero-bias conductance peak in detached flakes of superconducting 2H-TaS<sub>2</sub> probed by scanning tunneling spectroscopy*, Phys. Rev. B **89**, 224512 (2014).
- (P11) F. M. D. Pellegrino, **L. Chirolli**, R. Fazio, V. Giovannetti, M. Polini, *Theory of integer quantum Hall polaritons in graphene*, Phys. Rev. B **89**, 165406 (2014).
- (P12) **L. Chirolli**, F. Taddei, R. Fazio, and V. Giovannetti, *Interactions in electronic Mach-Zehnder interferometers with copropagating edge channels*, Phys. Rev. Lett. **111**, 036801 (2013).
- (P13) S. Roddaro, **L. Chirolli**, F. Taddei, M. Polini, and V. Giovannetti, *Coherent edge mixing and interferometry in quantum Hall bilayers* Phys. Rev. B **87**, 075321 (2013).
- (P14) B. Karmakar, D. Venturelli, **L. Chirolli**, F. Taddei, V. Giovannetti, R. Fazio, S. Roddaro, G. Biasiol, L. Sorba, L. N. Pfeiffer, K. W. West, V. Pellegrini, F. Beltram, *Towards an electronic interferometers based on spin-resolved quantum Hall edge states*, Journal of Physics: Conference Series **456**, 012019 (2013).
- (P15) **L. Chirolli**, M. Polini, V. Giovannetti, A. H. MacDonald, *Drude weight, cyclotron resonance, and the Dicke model of graphene cavity QED*, Phys. Rev. Lett. **109**, 267404 (2012).

- (P16) **L. Chirolli**, D. Venturelli, F. Taddei, R. Fazio, V. Giovannetti, *Proposal for a Datta-Das transistor in the quantum Hall regime*, Phys. Rev. B **85**, 155317 (2012).
- (P17) B. Karmakar, D. Venturelli, **L. Chirolli**, F. Taddei, V. Giovannetti, R. Fazio, S. Roddaro, G. Biasiol, L. Sorba, V. Pellegrini, F. Beltram, *Controlled coupling of spin-resolved quantum Hall edges*, Phys. Rev. Lett. **107**, 236804 (2011).
- (P18) **L. Chirolli**, V. Giovannetti, R. Fazio, V. Scarani, *Time-bin entanglement of quasi-particles in semiconductor devices*, Phys. Rev. B **84**, 195307 (2011).
- (P19) **L. Chirolli**, E. Strambini, V. Giovannetti, F. Taddei, V. Piazza, R. Fazio, F. Beltram, G. Burkard, *Electronic implementations of interaction-free measurements*, Phys. Rev. B **82**, 045403 (2010).
- (P20) **L. Chirolli**, G. Burkard, S. Kumar, D. P. DiVincenzo, *Superconducting resonators as beam splitters for linear-optics quantum computation*, Phys. Rev. Lett. **104**, 230502 (2010).
- (P21) E. Strambini, **L. Chirolli**, V. Giovannetti, F. Taddei, R. Fazio, V. Piazza, F. Beltram, *Coherent detection of electronic dephasing*, Phys. Rev. Lett. **104**, 170403 (2010).
- (P22) **L. Chirolli**, G. Burkard, *Quantum non-demolition measurement of a qubit coupled to a harmonic oscillator*, Phys. Rev. B **80**, 184509 (2009).
- (P23) **L. Chirolli**, G. Burkard, *Decoherence in Solid State Qubits*, Advances in Physics **57**, 225 (2008).
- (P24) M. Braun, **L. Chirolli**, G. Burkard, *Signature of chirality in scanning-probe imaging of charge flow in graphene*, Phys. Rev. B **77**, 115433 (2008).
- (P25) **L. Chirolli**, G. Burkard, *Full control of qubit rotations in a voltage-biased superconducting flux qubit*, Phys. Rev. B **74**, 174510 (2006).

## PREPRINTS

- (Pp1) **L. Chirolli**, F. Guinea, *Orbital Magnetic Response of Class DIII Topological Superconductors*, arXiv:1802.09204 (2018)

## PARTICIPATION IN FUNDED PROJECTS

1. "Propiedades Fundamentales y Aplicaciones del Grafeno y otros Materiales Bidimensionales" 2014-2018. IMDEA Nanoscience PI : Francisco Guinea. S2013/MIT-3007 Comunidad de Madrid.
2. "Novel uses for graphene" 2012-2017. PI: Francisco Guinea. ERC-2011-ADG 20110209
3. "Entanglement e statistica in Interferometria Quantistica" FIRB-IDEAS 2009-2014. PI: Prof. Vittorio Giovannetti. MIUR - Italian Ministry of University and Research.

## INVITED TALKS

- (T1) Quantum Designer Physics Conference, San Sebastian, Spain, **Invited talk**: "Orbital magnetic response of class DIII topological superconductors". Organizer: D. Loss (15/07/2018)
- (T2) Workshop on the interaction of light with quantum and topological materials, ICFO Barcelona, Spain, **Invited talk**: "Polariton Hall effect in transition-metal dichalcogenides". Organizer: F. Koppens (21/06/2018)
- (T3) Conference on Weyl Fermions and Materials, ICTP Trieste, **Invited talk**: "Time-reversal and rotation symmetry breaking superconductivity in Dirac materials". Organizer: F. Taddei (24/10/2017)
- (T4) European Conference on Nanofilms, UPV/EHU Bilbao, **Invited talk**: "Odd-parity time-reversal invariant superconductor in magnetic field". Organizer: M. Ugeda (20/10/2016)

- (T5) Spinograph Workshop 2016: New trends in 2D materials, IMDEA Nanoscience Madrid, **Invited talk:** "Odd-parity time-reversal invariant superconductor in magnetic field" Organizer: J. Fernandez Rossier, Spinograph ITN (24/02/2016)
- (T6) Workshop NanoSC2014: Advances in nanostructured superconductors, La Cristalera, Madrid, **Invited talk:** "Odd-parity superconductivity in detached flakes of TaS<sub>2</sub>". Organizer: I. Guillamon, COST actions (05/05/2014)
- (T7) Seminar in the ICMM-CSIC Madrid", **Invited talk:** "Time-reversal symmetry breaking superconductivity in Dirac materials". Organizer: R. Roldan (11/2016)
- (T8) Seminar at ICFO, Barcelona, Spain, **Invited talk:** "Theory of integer quantum Hall polaritons in graphene". Organizer: M. Lewenstein, (04/2014)
- (T9) Seminar at ICMM-CSIC, Madrid, Spain, **Invited talk:** "Electronic Mach-Zehnder interferometry with copropagating spin-resolved edge states in the quantum Hall regime". Organizer: L. Bascones (03/2013)

## SEMINARS

- (S1) "Time-reversal and rotation symmetry breaking superconductivity in Dirac materials", Seminar in the theory group of E. Ercolessi, Dipartimento di Fisica, Università di Bologna, Italy (11/2017)
- (S2) "Odd-parity time-reversal invariant superconductor in magnetic field", Seminar in the theory group of D. Frustaglia, Universidad de Sevilla, Spain (11/2016)
- (S3) "Odd-parity time-reversal invariant superconductor in magnetic field", Seminar in the experimental group of D. Zumbuhl, University of Basel, Switzerland (07/2016)
- (S4) "Enhancement of superconductivity in atomically thin TaS<sub>2</sub>", Seminar in the theory group of G. Blatter, ETH Zurich, Switzerland, (06/2015)
- (S5) "Enhancement of superconductivity in atomically thin TaS<sub>2</sub>", Seminar in the theory group of R. Fazio, SNS, Pisa, Italy, (06/2015)
- (S6) "Enhancement of superconductivity in atomically thin TaS<sub>2</sub>", Seminar in the theory group G. Burkard, University of Konstanz, (06/2015)
- (S7) "Interactions in electronic Mach-Zehnder interferometers with copropagating edge channels", Seminar in the theory group of R. Fazio at SNS, Pisa, Italy, (04/2013)
- (S8) "Datta-Das spin transistor in the IQHE", Seminar in the theory group of K. Flensberg, University of Copenhagen, Denmark (9/2012)
- (S9) "Proposal for a Datta Das transistor in the quantum Hall regime", Seminar in the group of S. Roche, Universidad Autonoma de Barcelona, Spain (06/2012)
- (S10) "Time-bin entanglement of quasiparticles in semiconductor devices", Seminar in the theory group of G. Burkard, Konstanz, Germany (2011)
- (S11) "QND measurement of superconducting flux qubit", Seminar in the theory group of R. Fazio, SNS Pisa, Italy, (2008)

## SCHOOLS AND CONFERENCES

- (C1) "Polariton Hall effect in transition-metal dichalcogenides" (25-29 June 2018) Novel 2D materials explored via scanning probe microscopy and spectroscopy, DIPIC San Sebastian, Spain. **Contributed talk**

- (C2) “Time-reversal and rotation symmetry breaking superconductivity in Dirac materials” (1-6 October 2017) Italian National Conference on the Physics of Matter, FisMat 2017, ICTP Trieste, Italy. **Contributed talk.**
- (C3) “Zero-bias conductance peak in detached layers of superconducting TaS<sub>2</sub>” (10 October 2014) Correlations, Criticality and Coherence in Quantum Systems, Evora, Lisboa, Portugal. **Contributed talk.**
- (C4) “Time-bin entanglement of quasiparticles in semiconductor devices” (5-9 September 2011) Quantum Information Processing and Communication QIPC 2011, ETH Zurich, Zurich, Switzerland. **Contributed talk.**
- (C5) “Time-bin entanglement of quasiparticles in semiconductor devices” (20-22 September 2011) Workshop on Entanglement in Solid State Systems, NanoWESSS 2011 Lecce, Italy. **Contributed talk.**
- (C6) “Coherent detection of electron dephasing” (11-14 October 2009) 50 years of the Aharonov-Bohm effect, Tel Aviv University, Tel Aviv, Israel. **Contributed talk**
- (C7) “QND measurement of superconducting flux qubit”, (2008) Deutsche Physikalische Gesellschaft DPG 2008, Dresden, Germany. **Contributed talk**
- (C8) “Signatures of chirality in scanning probe imaging of charge flow in graphene” (2008) Workshop on Nanoelectronics 2008 Aachen, RWTH Aachen, Germany. **Contributed talk**
- (C9) “The voltage-controlled superconducting flux qubit” (March 2007), APS March Meeting 2007, Denver, Colorado, USA. **Contributed talk**

### REFEREEING ACTIVITY

Referee for the journals: *Phys. Rev. Lett.*, *Phys. Rev. B*, Europhysics Letters.

### LANGUAGES

- Italian: Mother tongue
- English: Very good
- Spanish: very good
- German: Basic, written and spoken.

### OUTREACH EXPERINCE

- Superconductividad ICMM-CSIC (2014), Semana de la Ciencia 2014 en ICMM, Science for children, ICMM - CSIC Madrid, Spain.
- Superconductividad no convencional en un sistema bidimensional, GEFES, División de Física de la Materia Condensada (26/10/2014)  
<https://gefes-rsef.org/2014/10/26/superconductividad-no-convencional-en-un-sistema-bidimensional/>
- Four popular science articles in the Italian journal: L'Arengo del Viaggiatore,  
<http://www.larengodelviaggiatore.info>
- Participation in the Italian radio program Radio Arengo about "Scientific activity abroad" (spring 2016) on Radio Citta' Fujiko 103.1 FM <http://www.radiocittafujiko.it>