

Tobias Koch—Curriculum Vitae

Universidad Carlos III de Madrid
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ACADEMIC BACKGROUND

- Oct'04–Jul'09 Ph.D. in Electrical Engineering, *ETH Zurich*, Switzerland
Dissertation: “On Heating Up and Fading in Communication Channels.”
Advisor: Prof. Amos Lapidoth
- Oct'98–Jun'04 M.Sc. in Electrical Engineering (with Distinction), *ETH Zurich*, Switzerland
Master's Thesis: “On the Asymptotic Capacity of Multiple-Input Single-Output Fading Channels with Memory.”
Thesis advisor: Prof. Amos Lapidoth

WORK EXPERIENCE

- since Apr'21 Profesor Titular de Universidad, *Universidad Carlos III de Madrid*, Spain
- Nov'15–Mar'21 Ramón y Cajal Research Fellow, *Universidad Carlos III de Madrid*, Spain
- Jun'13–Oct'15 Investigador Marie Curie, *Universidad Carlos III de Madrid*, Spain
- Jun'12–May'13 Profesor Visitante, *Universidad Carlos III de Madrid*, Spain
- Jun'10–May'12 Marie Curie Research Fellow, *University of Cambridge*, UK
- Oct'04–Oct'09 Research and Teaching Assistant, *ETH Zurich*, Switzerland
Ph.D. Advisor: Prof. Amos Lapidoth
- Apr'07–Jun'07 Internship, *Universitat Pompeu Fabra*, Barcelona, Spain
Advisor: Prof. Ezio Biglieri
- Aug'04–Oct'04 Internship, *Bell Laboratories*, Murray Hill, NJ, USA
Advisor: Prof. Gerhard Kramer
- Nov'02–Feb'03 Research Assistant, *ETH Zurich*, Switzerland

GRANTS & AWARDS

- 2018 Medalla *Agustín de Betancourt y Molina*, *Real Academia de Ingeniería (RAI)*
- 2017–2022 *ERC Starting Grant*
- 2015–2020 *Ramón y Cajal Research Fellowship*
- 2013–2017 *Marie Curie Career Integration Grant*
- 2013 Best Poster Award *Communication Theory Workshop (CTW)*
- 2010–2012 *Marie Curie Intra-European Fellowship for Career Development*
- 2009 *SNSF Fellowship for Prospective Researchers* (declined)

TEACHING EXPERIENCE

- since 2022 Linear Systems, *Universidad Carlos III de Madrid*, Spain
Graduate level.
- 2021 Digital Communications, *Universidad Carlos III de Madrid*, Spain
Graduate level.
- 2021 Sistemas de Telecomunicación, *Universidad Carlos III de Madrid*, Spain
Graduate level.
- since 2013 Information Theory, *Universidad Carlos III de Madrid*, Spain
Graduate level.
- 2013–2015 Communication Theory, *Universidad Carlos III de Madrid*, Spain
Undergraduate level.
- 2014–2015 Advanced Communications, *Universidad Carlos III de Madrid*, Spain
Graduate level. Taught together with P. M. Olmos.
- 2012 Linear Systems, *Universidad Carlos III de Madrid*, Spain
Undergraduate level. Taught together with F. Pérez-Cruz.
- 2011–2012 Advanced Wireless Communications, *University of Cambridge*, UK
Undergraduate level. Taught together with A. Guillén i Fàbregas (2011) and J. Sayir (2012).
- 2007 Topics in Multi-Terminal Information Theory, *ETH Zurich*, Switzerland
Graduate level. Taught together with A. Lapidoth, S. Tinguely, L. Wang, and M. Wigger.
- 2004–2009 Applied Digital Information Theory, *ETH Zurich*, Switzerland
Graduate level. Teaching assistant, taught by A. Lapidoth.
- 2005–2009 Information Transfer, *ETH Zurich*, Switzerland
Undergraduate level. Teaching assistant, taught by A. Lapidoth.

SUPERVISION

Ph.D. Students

- Nov'14–Jun'19 Alejandro Lancho, "Fundamental limits of short-packet wireless communications," *Universidad Carlos III de Madrid*, Spain. *Role:* Main advisor.
- Jan'14–Apr'19 Grace Silvana Villacrés Estrada, "Capacity limits of bursty interference channels," *Universidad Carlos III de Madrid*, Spain. *Role:* Main advisor.
- Oct'14–Jan'19 Yanfang Liu, "On generalized LDPC codes for ultra reliable communication," *Universidad Carlos III de Madrid*, Spain. *Role:* Co-advisor (together with P. M. Olmos).
- Jun'10–Feb'12 Taufiq Asyhari, "Nearest neighbour decoding for fading channels," *University of Cambridge*, UK. *Role:* Co-advisor (together with A. Guillén i Fàbregas).

Master's Theses

- Sep'06–Mar'07 Georg Böcherer, "The discrete noiseless channel," *ETH Zurich*, Switzerland.
- Oct'05–Apr'06 Ligong Wang, "On fading channels at low SNR," *ETH Zurich*, Switzerland.

Undergraduate Projects & Internships

- Sep'11–Dec'11 David Sutter, "On the cut-off rate of the Gaussian channel with one-bit output quantization," *University of Cambridge*, UK.
- Nov'05–Jan'05 Oliver Nagy, "Numerical techniques for computing mutual information rates of channels with memory," *ETH Zurich*, Switzerland.
- Apr'05–Jul'05 Wenjie Xu, "Firm lower bounds on the capacity of non-coherent fading channels," *ETH Zurich*, Switzerland.

RESEARCH FUNDING & PROJECT PARTICIPATION

Principal Investigator in Research Projects

- Oct'21–Sep'24 **Marie Skłodowska-Curie Individual Fellowships**, European Commission
Title: “An Information-Theoretic Perspective on Massive Asynchronous Connectivity”
Fellow: Alejandro Lancho Serrano (UC3M)
- Sep'21–Aug'25 **Proyectos I+D Generación de Conocimiento**, Spanish Ministry of Science and Innovation
Title: “Generalized and Refined Asymptotics in Finite-Blocklength Information Theory”
Co-PI: Gonzalo Vazquez-Vilar (UC3M)
- Mar'17–Feb'22 **ERC Starting Grant**, European Research Council
Title: “Information Theory for Low-Latency Wireless Communications”
Amount: € 1'424'000
- Jan'14–Dec'16 **Proyecto I+D+i «Retos Investigación»**, Spanish Ministry of Economy & Competitiveness
Title: “Overhead-Throughput-Optimal Signaling Schemes for Next-Generation Wireless Networks”
- Jun'13–Jun'17 **Marie Curie Career Integration Grant**, European Commission
Title: “Towards an Efficient Mobile Internet”
- Jun'10–Jun'12 **Marie Curie Intra-European Research Fellowship**, European Commission
Title: “Reliable Communication in Integrated Circuits”

Project Member/Co-Investigator in Research Projects

- Jan'17–Dec.'19 **Proyecto I+D+i «Retos Investigación»**, Spanish Ministry of Economy & Competitiveness
Title: “Decodificación Iterativa en Longitud Finita: Limites Fundamentales, Construcciones Prácticas e Inferencia”
Principal investigators: P. M. Olmos and G. Vazquez-Vilar, both UC3M
- Oct'14–Sep'16 **CAM I+D en Tecnologías**, Comunidad de Madrid
Title: “CASI-CAM-CM: Conceptos y Aplicaciones de los Sistemas Inteligentes”
Principal investigator: A. Figueiras Vidal, UC3M
- Jan'13–Jan'16 **Junior Researcher Grant**, Swedish Research Council
Title: “Fundamental Limits of User Cooperation in Wireless Networks”
Principal investigator: G. Durisi, Chalmers
- Jan'13–Dec'16 **Plan Nacional de I+D+i**, Spanish Ministry of Economy & Competitiveness
Title: “Avances en Aprendizaje Estadístico, Comunicaciones y Teoría de la Información”
Principal investigator: F. Perez Cruz, UC3M
- Jan'11–Dec'15 **ERC Starting Grant**, European Research Council
Title: “Finite-Length Information Theory”
Principal investigator: A. Guillén i Fàbregas, UPF/Cambridge
- Jun'12–Jan'13 **Plan Nacional de I+D+i**, Spanish Ministry of Science & Innovation
Title: “Distributed Learning in Communication and Information Processing”
Principal investigator: A. Artés Rodríguez, UC3M
- Jun'10–Dec'11 **Isaac Newton Trust**, Isaac Newton Trust
Title: “Information Role Models in Cooperative Wireless Communications”
Principal investigator: A. Guillén i Fàbregas, UPF/Cambridge
- Jun'10–Jan'11 **FP7 Network of Excellence in Wireless Communications**, European Commission
Title: “Network of Excellence in Wireless Communications (NEWCOM++)”
Scientific director: S. Benedetto, Politecnico di Torino
- Jun'12–Dec'13 **CONSOLIDER-INGENIO**, Spanish Ministry of Science & Innovation
Title: “Foundations and Methodologies for Future Communications and Sensor Networks”
Coordinator: J. R. Fonollosa, Universitat Polytècnica de Catalunya

CONFERENCE ORGANIZATION

Co-Chair in Conferences & Workshops

- 2017 *European School of Information Theory (ESIT)*
- 2014 *Joint IEEE-EURASIP Spain Seminar on Signal Processing, Communication and Information Theory*

Others

- 2018 *International Zurich Seminar on Communications (IZS)*
Role: Special Session Organizer
- 2016, 2024 *IEEE International Symposium on Information Theory (ISIT)*
Role: Publications Chair
- 2014 *11th International Symposium on Wireless Communication Systems (ISWCS)*
Role: Special Session Organizer

TECHNICAL PROGRAM COMMITTEES

- 2017–2023 *IEEE International Symposium on Information Theory (ISIT)*
- 2014–2022 *International Zurich Seminar on Communications (IZS)*
- 2018/2019 *International Conference on Telecommunications (ICT)*
- 2012 *23rd IEEE International Symposium on Personal Indoor and Mobile Radio Communications (PIMRC)*
- 2014 *11th International Symposium on Wireless Communication Systems (ISWCS)*

EDITORIAL COMMITTEES

- 2020–2023 Associate Editor for Communications, *IEEE Transactions on Information Theory*
- 2019–2020 Guest Editor, Special Issue “Information Theory for Communication Systems,” *Entropy*

REVIEWING ACTIVITIES

Journals & Books

- ➔ *Entropy*
- ➔ *Foundations and Trends in Communications and Information Theory*
- ➔ *IEEE Access*
- ➔ *IEEE Transactions on Information Theory*
- ➔ *IEEE Transactions on Communications*
(2018 Exemplary Reviewer)
- ➔ *IEEE Transactions on Wireless Communications*
- ➔ *IEEE Transactions on Signal Processing*
- ➔ *Transactions on Emerging Telecommunications Technologies*

Conferences

- ➔ *IEEE Information Theory Workshop (ITW)*
- ➔ *IEEE International Conference on Communications (ICC)*
- ➔ *IEEE International Symposium on Information Theory (ISIT)*
- ➔ *IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)*
- ➔ *International Symposium on Information Theory and its Applications (ISITA)*
- ➔ *International Symposium on Wireless Communication Systems (ISWCS)*
- ➔ *International Zurich Seminar on Communications (IZS)*

Evaluation of Research Projects

- 2018–2021 *The Israel Science Foundation, Israel*
Program: Individual Research Grants
- 2018 *Agencia Estatal de Investigación (AEI), Spain*
Convocatoria: Ayudas para contratación Ramón y Cajal 2017
- 2017 *Agencia Nacional de Evaluación y Prospectiva (ANEP), Spain*
Convocatoria: Plan Estatal Retos I+D B 2017

OTHERS

- since 2016 Senior Member of the IEEE
- 2020–2021 Chair of Spain Chapter, *IEEE Information Theory Society*
- 2013–2016 Vice Chair of Spain Chapter, *IEEE Information Theory Society*

SKILLS

- ➔ *Languages: German (native), English (fluent), Spanish (fluent), French (moderate).*
- ➔ *Programming: Matlab, C.*

INVITED TALKS

- “Second-order asymptotics of Hoeffding-like hypothesis tests,” ETH Zurich, Switzerland, September 9, 2022.
- “Finite-blocklength information theory for wireless communications,” ITN Windmill on Machine Learning for Wireless Communications, ETH Zurich, Switzerland, September 7, 2022.
- “Second-order asymptotics of Hoeffding-like hypothesis tests,” Télécom ParisTech, France, July 7, 2022.
- “Information Theory for Low-Latency Wireless Communications,” Jornada Investigación E.P.S., Universidad Carlos III de Madrid, Spain, May 8, 2019.
- “Rényi’s information dimension beyond i.i.d.,” Beyond I.I.D. in Information Theory, Isaac Newton Institute, UK, July 24, 2018.
- “Information theory for low-latency wireless communications,” Universidad Carlos III de Madrid, Spain, May 18, 2017.
- “Rate-distortion bounds via “duality” for entropy-constrained scalar quantization,” ETH Zurich, Switzerland, January 9, 2017.
- “On Shannon’s lower bound and Rényi’s information dimension,” ETH Zurich, Switzerland, July 29, 2015.
- “Fundamental limits of short-packet wireless communications,” NEWCOM# Workshop, University of Cambridge, UK, June 26, 2015.
- “Improved capacity lower bounds for fading channels with imperfect CSI using rate splitting,” Chalmers University of Technology, Gothenburg, Sweden, Sept. 5, 2014.
- “Diversity versus multiplexing at finite blocklength,” Int. Symp. on Wireless Comm. Systems (ISWCS), Aug. 29, 2014.
- “How I learned to stop worrying and love outage capacity,” Int. Workshop on Frontiers of Telecommunications & Coding (in honor of Ezio Biglieri’s 70th birthday), Feb. 14, 2014.
- “On the dither-quantized Gaussian channel at low SNR,” ITA Workshop, Feb. 11, 2014.
- “The capacity loss of dense constellations,” ETH Zurich, Switzerland, Jul. 11, 2012.
- “One-bit output quantization and the power loss of hard-decision decoding,” Chalmers University of Technology, Gothenburg, Sweden, Mar. 27, 2012.
- “Hard decisions do not cause a 2dB power loss,” COMONSENS PCC6 Meeting, Universidad Politécnica de Madrid (UPM), Madrid, Spain, Feb. 6, 2012.
- “At low SNR asymmetric quantizers are better,” Centre Tecnològic de Telecomunicacions de Catalunya (CTTC), Barcelona, Spain, Oct. 28, 2011.
- “On bandlimited fading channels at high SNR,” 4th Int. Symp. on Appl. Sciences in Biomed. and Comm. Techn. (ISABEL), Barcelona, Spain, Oct. 26, 2011.
- “At low SNR asymmetric quantizers are better,” Universitat Pompeu Fabra, Barcelona, Spain, Oct. 20, 2011.
- “Hard decisions do not cause a 2dB power loss,” ETH Zurich, Switzerland, July 13, 2011.
- “Hard decisions do not cause a 2dB power loss,” Universidad Carlos III de Madrid, Spain, May 12, 2011.
- “Is the assumption of perfect channel-state information in fading channels a good assumption?”, 2nd Int. Symp. on Appl. Sciences in Biomed. and Comm. Techn. (ISABEL), Bratislava, Slovak Republic, Nov. 26, 2009.