Curriculum Vitae

Giuseppe Caire, Ph.D.

Professor

Faculty IV (Electrical Engineering and Computer Science)

Department of Communication Systems

Technische Universität Berlin

August 2022

1 Education

1. *Politecnico di Torino*, Turin (Italy),
   Doctorate of Philosophy, Electrical Engineering (September, 1994)

2. *Princeton University*, Princeton NJ (USA),
   Master of Science, Electrical Engineering (May, 1992)

3. *Politecnico di Torino*, Turin (Italy),
   Bachelor of Science, Electrical Engineering (*summa cum laude*) (February, 1990)

2 Employment History

1. Full Professor (W3)
   Chair of Communications and Information Theory
   Technische Universität Berlin, Germany (April 2014 – present)

2. Adjunct Research Professor
   University of Southern California, Los Angeles, CA (June 2016 – present)

3. Full Professor (tenure)
   University of Southern California, Los Angeles, CA (August 2005 – May 2016)

4. Professor
   Eurecom Institute, Sophia-Antipolis (France) (August 1998 – July 2005)

5. Associate Professor,
   University of Parma, Parma (Italy) (1997 – 1998)

6. Assistant Professor
   Politecnico di Torino, Turin (Italy) (1995 – 1997)

7. Young Graduate Trainee (Post-Doc)
   European Space Agency ESTEC, Noordwijk (The Netherlands) (1994 – 1995)

8. Research and Teaching Assistant
   Politecnico di Torino, Turin (Italy) (1992 – 1994)

3 Visiting Appointments

1. Visiting Professor, University of Parma, Information Technology Department, (October 2017 – July 2021)

2. Visiting *Directeur de Recherche*, LSS Laboratory
   CNRS, Gif-sur-Yvette, France, (September 2011 – August 2012)

3. Visiting Professor, EE Department
   University of Sydney, Sydney (Australia) (July – September, 2000)

4. Visiting Research Fellow, EE Department
   Princeton University, Princeton NJ (USA) (July - December 1997)

5. Visiting Research Fellow, Mobile Communications Department
   Eurecom Institute, Sophia-Antipolis (France) (September – December 1996)

4   Major Honors, and Awards

1. 2022, **Elected member of the Berlin Brandenburg Akademie der Wissenschaften (BBAW)**.

2. 2021, **Gottfried Wilhelm Leibniz-Preis of the DFG (Deutsche Forschungsgemeinschaft)**.

3. 2020, **IEEE Communications Society Edwin Howard Armstrong Achievement Award**.

4. 2019, **Leonard G. Abraham Prize for best IEEE JSAC paper**, for the paper

   • Ji, M., Caire, G. and Molisch, A.F., "Wireless device-to-device caching networks: Basic principles and system performance," *IEEE Journal on Selected Areas in Communications*, 34(1), pp.176-189, 2015.

5. 2018, **ERC Advanced Grant** (start date: October 1st, 2018).

6. 2015, **Vodafone Innovation Prize** (awarded by the Vodafone-Stiftung für Forschung in der Mobilkommunikation, Germany).

7. 2015, *Best paper award* of the Ad Hoc and Sensor Networking symposium at ICC 2015 for the paper

   • Sang-Woon Jeon, Song-Nam Hong, Mingyue Ji and Giuseppe Caire, "Caching in Wireless Multihop Device-to-Device Networks," *IEEE Int. Conf. on Commun.* ICC 2015, London, UK.

8. 2013, **Alexander von Humboldt Professorship** (Research Grant of 3.5 Millions of Euros, awarded by the Alexander von Humboldt Foundation, to develop a 5-years research program in Germany).

9. 2011, *Joint IEEE Information Theory and IEEE Communications Society Best Paper Award*, for the paper

   • Caire, G.; Jindal, N.; Kobayashi, M.; Ravindran, N.; "Multiuser MIMO Achievable Rates With Downlink Training and Channel State Feedback," *IEEE Transactions on Information Theory*, Volume: 56 , Issue: 6, Page(s): 2845 - 2866, Year: 2010.

10. 2011, recipient of the **Marie Curie Fellowship** of the EU, FP7-PEOPLE-2010-International Incoming Fellows.

11. 2006, recipient of the **Okawa Foundation Research Award**.

12. 2005 Elected IEEE Fellow.

13. 2004 *Young Authors Award,* at EUSIPCO with Ph.D. student Albert Guillen i Fabregas, for the paper

    • A. Guillen i Fabregas and G. Caire "Impact of Signal Constellation Expansion on Achievable Diversity in Quasistatic Multiple Antenna Channels," EUSIPCO 2004, Vienna, Austria.

14. 2004 *Joint IEEE Information Theory and IEEE Communications Society Best Paper Award*, for the paper

    • G. Caire and S. Shamai, "On the achievable throughput of a multi-antenna Gaussian broadcast channel," *IEEE Trans. on Inform. Theory,* Vol. 49, No. 7, pp. 1691-1706, July 2003.

15. 2003 IEEE Vehicular Technology Society *Jack Neubauer Best System Paper Award*, for the paper

    • D. Boudreau, G. Caire, G. E. Corazza, R. De Gaudenzi, G. Gallinaro, M. Luglio, R. Lyons, J. Romero-Garcia, A. Vernucci, H. Widmer, "Wideband-CDMA for the UMTS/IMT-2000 satellite

16. **William Girling Watson** fellowship of the University of Sydney, 1999.

17. *Young Graduate Trainee Scholarship* of the **European Space Agency**, 1994.

5   Main Research Achievements

G. Caire's research focuses on Information Theory, Communication Theory, and Coding Theory, with special emphasis on wireless communication systems. His major scientific achievements are summarized in chronological order as follows.

1st breakthrough: *Bit-Interleaved Coded Modulation* (*Trans. on IT* 1998, 3189 citations). This modulation scheme has become the de-facto standard for spectrally efficient modulation in fading wireless channels and it is used in WiFi and LTE. Its acronym, BICM, is now a standard term in many textbooks and technical standard document.

2nd breakthrough: *Information theory of power control in fading channels* within the framework of "channels with state information" (*Trans on IT* 1999 with Biglieri and Taricco, and 1999 with Shamai, 879 and 584 citations, respectively).

3rd breakthrough: *Solution of the "diversity–multiplexing tradeoff" problem* of space-time coding by discovering the first constructive family of tradeoff-optimal space-time codes and their efficient lattice decoding (*Trans. on IT* 2004, and *Trans. on IT* 2003, 353 and 1331 citations, respectively).

4th breakthrough: *Fundamental understanding of the capacity of the MIMO vector broadcast channel* (*Trans. on IT* 2003, and *Trans. on IT* 2011, 2998 and 634 citations, respectively, both recipient of the **Joint best paper award of the IEEE ITsoc and Comsoc**). This theory lays the foundation of multiuser MIMO, including CoMP, C-RAN, and massive MIMO.

5th breakthrough: *Joint Space-Division and Multiplexing (JSDM)* (*Trans. on IT 2014*, 1117 citations). JSDM represents the theoretical foundation of hybrid digital-analog beamforming, and it is widely referenced now in the context of mmWave system design for 5G.

6th breakthrough: *Pioneering work on wireless caching* (aka, "FemtoCaching") and the characterization of scaling laws of wireless networks with caching at the nodes (sequence of papers starting with *INFOCOM* 2012 to present, collecting more than 5000 citations). Wireless edge caching has recently gained enormous traction, and the PI's recent results (since 2012) are at the basis of his ERC Advacnced Grant Project. Recently, his JSAC paper on device-to-device wireless caching received the 2019 Leonard G. Abraham Prize for best IEEE JSAC paper.

7th breakthrough: *Pioneering work on information theoretic privacy in coded caching systems* (*Trans. on IT* 2020 and 2022. These pioneering works open a very rich research field that now counts hundreds of publications from several groups around the world.

6   Mentoring of junior scientists

6.1   Ph.D. Students (selected list)

1. **Daniela Tuninetti (F)**, (now: full professor at the University of Illinois, Chicago);

2. **Albert Guillen i Fabregas**, (now: professor at Cambridge University, Cambridge, UK);

3. **Alessandro Nordio**, (now: research director at the National Research Council (CNR), Torino Italy);

4. **Mari Kobayashi (F)**, (now: full professor at Centrale-Supelec, Paris, France);

5. **Raj K. Kumar**, (now: Qualcomm India, Bangalore);

6. **Stefania Sesia (F)**, (now: Ericsson, Sophia Antipolis, France);

7. **Ozgun Bursalioglu (F)**, (now: Google-X research , Mountain View, CA);

8. **Hooman Shirani-Mehr**, (now: Intel Wireless Networks, Oregon);

9. **Hoon Huh**, (now: Samsung, Korea).

10. **Song-Nam Hong** (now: assistant professor at Andong National University, Korea);

11. **Ansuman Adhikary** (now: Qualcomm, Bangalore).

12. **Mingyue Ji** (now: assistant professor at the University of Utah).

13. **Vasileios Ntranos** (now: assistant professor in the Pathology and Laboratory Medicine, University of Pennsylvania Perelman School of Medicine, University of Pennsylvania).

14. **Andreas Benzin** (now: Post-Doc at Technische Universität Berlin).

15. **Xiaoshen Song (F)** (now: Qualcomm Sweden).

16. **Alexander Fengler** (now: recipient of a DAAD postdoctoral fellowship and research fellow at MIT with Prof. Yuri Polyanskiy)

17. **Mahdi Barzegar Khalilsarai** (now: Post-Doc at Technische Universität Berlin).

6.2   Recently supervised post-doctoral researchers

1. **Yinping Li** (now: assistant professor at Liverpool University, Liverpool, UK);

2. **Hamdi Joudeh** (now: assistant professor at the Technical University of Eindhoven, NL);

3. **Kai Wan** (now: associate professor at the department of Electronic information and Communications, Huazhong University of Science and Technology, PR China).

4. **Hao Xu** Humboldt Research Fellow at TU Berlin.

7   Major Grants and Funded Projects in the past 5 years

1. 6G Research Hub "6G-RIC", funded by the Bundesministerium für Bildung und Forschung (BMBF) with a total of 70 Millions of Euros for 5 years. The total funding for the CommIT group led by G. Caire in the 6G-RIC is 1.3 Millions.

2. Huawei – TU Berlin Joint Innovation Center, endowed by Huawei with 2.8 Millions of Euros over 5 years.

3. Leibniz Research Grant (connected with the Leibniz Preis, DFG): 2.5 Millions of Euros of unrestricted research funds.

4. ERC Advanced Grant CARENET, 2.5 Million of Euros over 5 years for research on coded caching.

5. DFG Project *SENCOM: Sensing und Kommunikation in Netzwerken mit hoher Mobilität und hoher Richtwirkung* (international collaboration program with University of Luxembourg). The funding for G. Caire amounts to ≈ 300 Keuros in 3 years.

6. DFG Project *Informationstheorie und Wellenformen für die gemeinsame Kanalschätzung und Kommunikation in mobilitätsorientierten Netzwerken.* Single PI grant, with funding of $\approx 300,000$

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