# Biographical sketch of Habib Ammari

**Professor of Applied Mathematics**
Department of Mathematics, ETH Zürich

**Personal data**

Born June 28, 1969, in Eljem, Tunisia; married; one son; French-Tunisian citizen; Swiss permanent resident.

**Contact information**

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**Educational record**

Habilitation Degree, Mathematics, January 1999, University of Paris VI, France.

Doctor of Philosophy, Applied Mathematics, May 1995, Ecole Polytechnique, France.

Master of Science, Applied Mathematics, June 1993, Ecole Polytechnique, France.

Bachelor of Science, July 1992, Ecole Polytechnique, France.

Baccalaureate, June 1988, Tunisia, Presidential Prize.

**Research interests**

Physical applied mathematics, wave propagation in complex media, inverse problems and imaging, metamaterials, subwavelength physics, condensed matter physics.

**Awards and honors**

Senior Fellow of the Hong Kong Institute for Advanced Study, 2024-.

Principal lecturer, NSF-CBMS Regional Research Conference in the Mathematical Sciences 2024.

Fellow of the American Mathematical Society, Class 2022.

Member of the Academia Europaea, 2021–.

Member of the European Academy of Sciences, 2018–.

Highly Cited Researcher in Mathematics by Clarivate Analytics, 2016.

Member of the Tunisian Academy of Sciences, Letters, and Arts, 2015–.

Khwarizmi International Award 2015 in Basic Sciences.

Kuwait Prize 2013 in Basic Sciences.

European Research Council Advanced Investigator Grant 2010–2016.

**Professional experience**

Full Professor of Applied Mathematics, ETH Zürich, 2015–

Director of Research at the French National Center for Scientific Research (DR1), Department of Mathematics and Applications, Ecole Normale Supérieure, 2010-2015.

Director of Research at the French National Center for Scientific Research (DR2), Center of Applied Mathematics, Ecole Polytechnique, 2006-2010.

Adjunct Professor in Applied Mathematics at Ecole Polytechnique, 2005-2015.

Researcher at the French National Center for Scientific Research, 1997-2006.

Researcher at Ecole Polytechnique, 1995-1997.

**Books**

10 authored books (3 published by the American Mathematical Society, 1 published by Princeton Academic Press, 1 by World Scientific, 1 by De Gruyter, and 4 by Springer).

10 edited books (5 published by the American Mathematical Society, 3 by Springer, 1 by the French Society of Industrial and Applied Mathematics, and 1 by the French Mathematical Society).

**Publications**

More than 300 papers in leading international peer-reviewed journals (SIAM journals (about 100 papers), Trans. AMS, JEMS, Arch. Rat. Mech. Anal., Comm. Math. Phys., Math. of Comp., Num. Math., CPDE, Ann. Sci. Ecole Norm. Sup., J. Math. Pures Appl., Proc. AMS, Math. Ann., J. London Math. Soc., Proc. Natl. Acad. Sci. USA, . . . ).

**Publication citations**

MathSciNet: 7829 Sum of Times Cited by 2188 Authors in 2596 Publications;

GoogleScholar: 17246 sum of Times Cited; h-index: 67; i10 index: 290.

Top 5 most cited mathematicians graduated in 1995.

**List of PhD students and postdocs advised**

**PhD students**: N. Béreux (PhD 1998), C. Latiri-Grouz (PhD 1999), A. Khelifi (PhD 2002; Full Prof., Tunis), F. Triki (PhD 2002; Associate Prof., Grenoble), K. Touibi (PhD 2004), S. Soussi (PhD 2004), E. Iakovleva (PhD 2004; CEA Senior Researcher), H. Zribi (PhD 2005; Full Prof., Tunis), K. Laouti (PhD 2006), A. Dossevi (PhD 2007), A. Kozhemyak (PhD 2008), W.K. Park (PhD 2009; Full Prof., Seoul), P. Garapon (PhD 2009, Best Thesis Prize at Ecole Polytechnique), S. Khan (PhD 2010; Assistant Prof., Harvard), L. Guadarrama Bustos (PhD 2010; Associate Prof., Mexico), V. Jugnon (PhD 2010, Best Thesis Prize at Ecole Polytechnique), J.B. Bellet ((PhD 2010; Full Prof., Poitiers), A. Wahab (PhD 2011; Full Prof., Oman), T. Boulier (PhD 2013), L. Giovangigli (PhD 2014; Associate Prof., Paris), L. Seppecher (PhD 2014; Associate Prof., Lyon); P. Millien (PhD 2015; CNRS Researcher, Paris), M. Ruiz (PhD 2017; Lecturer, Leicester), T. Wintz (PhD 2017), W. Zhang (PhD 2017; Assistant Prof., Shenzhen), W. Wu (PhD 2018; Associate Prof., Jilin), F. Romero (PhD 2018), B. Fitzpatrick (PhD 2018), A. Dabrowski (PhD 2018; Industry), L. Baldassari (PhD 2021; Associated researcher, Basel), E. Orvehed Hiltunen (PhD 2021; Associate Prof., Oslo), B. Davies (PhD 2021; Lecturer, Warwick), K. Imeri (PhD 2021; Industry), A. Scapin (PhD 2021), J. Cao (PhD 2024), T. Kosche (PhD 2025; Industry), K. Alexopoulos (PhD 2024; postdoctoral researcher, Ecole Polytechnique), L. Rueff (PhD 2025; Industry), S. Barandun (PhD 2025; Research fellow, MIT), A. Uhlmann (PhD 2026; Research fellow, Cambridge), C. Thalhammer (2025–.), L. Vrabac (2026–), V. Galbiati (2026–), M. Melcher (2026–), and Y. Wang (2026–).

**Postdocs**: M. Lim (2003-2006; Full Prof., Daejeon), E. Kim (2005-2006), J.P. Groby (2006-2007; CNRS Senior Researcher, Le Mans), S. Gdoura (2009-2010), A. Rozanova (2006-2007; Associate Prof., Paris), C. Poignard (2006-2008; INRIA Senior Researcher, Bordeaux), H. Lee (2007-2008; Full Prof., Seoul), G. Ciraolo (2008-2009; Full Prof., Milan), K. Kalimeris (2009-2010; Senior Researcher, Athens), E. Bretin (2009-2011; Full Prof., Lyon), Y. Deng (2012-2013; Full Prof., Hunan), W. Jing (2011-2013; Associate Prof., Beijing), M.P. Tran (2012-2013; Associate Prof., Hanoi), L. Nguyen (2011-2013; Associate Prof., North Carolina), H. Wang (2011-2014; CEA Senior Researcher), A. Waters (2013-2015; Associate Prof., Hannover), G. Alberti (2014-2016; Associate Prof., Genova), H. Zhang (2013-2015; Associate Prof., Hong Kong), T. Widlack (2015-2016), G. Zheng (2015-2016), D. Gontier (2015-2016; Associate Prof., Paris), S. Yu (2015-2019; Associate Prof., Seoul), A. Vanel (2018-2021; CNRS Researcher, Marseille), F. Feppon (2020-2022; Assistant Prof., Louvain), P. Liu (2021-2024; Assistant Prof., Zhejiang), J. Nick (2023-2025; Assistant Prof., Birmingham), and J. Qiu (2025-.).

**Visiting professorships**

Mathematical Sciences Research Institute, Berkeley (2001), Institute of Pure and Applied Mathematics, UCLA (2003), Seoul National University (2006), Korean Institute of Advanced Science and Technology (2012), Yonsei University (2013, 2014, 2015).

**Honors awarded to associated people**

Ping Liu: Excellent Young Scientists Fund (Overseas), National Natural Science Foundation of China, 2025.

Silvio Barandun: ETH Medal for outstanding PhD thesis, 2026; Swiss National Science Foundation Fellowship, Massachusetts Institute of Technology, 09.2025–08.2027.

Clemens Thalhammer: ETH Medal for outstanding Master thesis, 2025.

Jinghao Cao: von Karman instructorship, California Institute of Technology, 09.2024–08.2026.

Erik O. Hiltunen: ETH Medal for outstanding PhD thesis, 2022; ECCOMAS PhD Award for the best PhD theses of 2021 on Computational Methods in Applied Science and Engineering; Gibbs assistant professorship, Yale University, 08.2021–07-2024.

Thea Kosche: ETH Medal for an outstanding Master thesis, 2022.

Bryn Davies: Marie Curie fellowship, Imperial College London, 08.2022–07.2024.

Florian Feppon: Prix Paul Caseau 2020 from the French Academy of Technologies and EDF in the domain of numerical modeling and simulation; ECCOMAS PhD Award for the best PhD theses of 2019 on Computational Methods in Applied Science and Engineering.

Laurent Seppecher, Instructorship at MIT, 08.2014–08.2015.

Vincent Jugnon, Instructorship at MIT, 08.2011–07.2013; Best Thesis Prize, Ecole Polytechnique.

Pierre Garapon, Szegö assistant professorship, Stanford, 08.2009–07.2012; Best Thesis Prize, Ecole Polytechnique.

**Recent plenary addresses**

Intensive Lecture Series on *Localisation in Disordered Systems*, Hong Kong Institute for Advanced Study, April 2026.

Singular Interactions and Effective Models in Mathematical Physics, Como, July 2025. Waves and Imaging in Complex Media, Paris, June 2025.

Intensive Lecture Series on the *Mathematics of Subwavelength Physics*, Hong Kong Institute for Advanced Study, April 2025.

50 ans du CMAP, Paris, September 2024.

International Congress of Basic Science, Beijing, July 2024.

Recent Trends in Applied Mathematics and Machine Learning, Jilin, July 2024.

HKIAS International Conference on Mathematical Analysis and its Applications, Hong Kong, April 2024.

International Workshop on Computational Mathematics, Hangzhu, October 2023.

ENUMATH 2023, Lisbon, September 2023.

The Second HKSIAM Biennial Conference, Hong Kong, August 2023.

Neumann-Poincaré Operator, Layer Potential Theory, Plasmonics and Related Topics, Tokyo, August 2023.

Mathematical Aspects of Condensed Matter Physics, Zürich, July 2023.

Series of Lectures, CIME–EMS Summer School “Applied Mathematical Problems in Geophysics”, Cetraro, Italy, July 2019.

Distinguished Lecture Series, Institute of Advanced Studies, Hong Kong University of Science and Technology, July 2018.

Distinguished Lecture Series, Hong Kong Baptiste University, June 2017.

**Recent third-party funding**

Mathematics of nonlinear subwavelength physics and active metamaterials, Swiss National Foundation, project funding (01.09.2025–31.08.2029), 772'000 CHF.

Mathematics of dielectric artificial media, Swiss National Foundation, project funding (01.09.2021–31.08.2025), 667'928 CHF.

A biomimetic basis for visual processing and the perception of natural scenes, ETH Zürich, ETH Grants (01.09.2021–31.08.2024), 166'800 CHF.

Mathematics for bio-inspired imaging, Swiss National Foundation, project funding (01.09.2017–31.08.2021), 666'500 CHF.

Multi-Mathematics for Imaging and Optimal Design Under Uncertainty, ERC Advanced Grant, (01.04.2011–31.03.2016), 1'920'000€.

**Selected recent synergetic activities**

Editorial board member of the SIAM Journal on Applied Mathematics, SIAM Journal on Imaging Sciences, Journal of Computational Physics, Journal de l'Ecole Polytechnique (2013–2023), Mathematical Methods in the Applied Sciences (2004–2024), Inverse Problems and Imaging, and Zürich Lectures in Advanced Mathematics.

Member of the European Research Council Starting Grant Panel (PE1), 2013–2019 and Expert for Synergy Calls (2019–).

Member of the Maxwell Prize, ICIAM 2027, selection committee; member of the Peter Henrici Prize Committee 2019 and 2027; member of the Kuwait Prize in Basic Sciences Committee 2025; member of the Calderón Prize Committee 2013.

Member of the Scientific Review Panel, Hong Kong Laureate Forum 2021 and 2025.

Member of the Cancer Plan Panel of the French National Institute of Health and Medical Research, 2011–2014 and 2016.

Member of the evaluation panel of INRIA, France, 2018.

Co-organizer of CISM Course, Metamaterials in acoustics, electrodynamics and electromagnetism, Udine, 2021; CIME–EMS Summer School in Applied Mathematics, Cetraro, 2019; Optical Imaging and Inverse Problems, IMA, Minneapolis, 2017; Novel Optical Materials, IMA, Minneapolis, 2017; OSA 2016 Mathematics in Imaging; ICM 2014 Satellite Conference on Imaging, Multi-Scale and High Contrast PDE; CIMPA School 2013 on Mathematical and Statistical Tools for Imaging; Summer School 2012 on Mathematical and Statistical Methods for Imaging, Chinese Academy of Science.

Member of the Scientific Committees of the Applied and Inverse Problems Conferences 2013, 2017, and 2019.

10 hour course at CIMPA School on Mathematical Imaging, Bandung, Indonesia, August 2014; 10 hour course in an intensive lecture series on Mathematical Imaging, Chinese University of Hong Kong, July-August 2013; 18 hour course at the Summer School on Scientific Computing, The State Key Laboratory on Scientific Engineering Computing, Chinese Academy of Sciences, July-August 2012; 14 hour course in an intensive lecture series on Mathematical Imaging, Korean Advanced Institute of Science and Technology, August 2012; 6 hour course at Mathematical and Statistical Methods for Imaging, Korean National Institute of Mathematical Sciences, August 2010.

Organizer of Minicourse on Mathematics of Emerging Biomedical Imaging IV (March 24-26, 2010); III (February 4-6, 2009); II (February 11-13, 2008); I (March 21-23, 2007), Institut Henri Poincaré, Paris.

Lifetime member of the Swiss Mathematical Society, the European Mathematical Society, the American Mathematical Society and the Society for Industrial and Applied Mathematics (SIAM).

Co-organizer of ICM Satellite Conference on Imaging, Multi-Scale and High Contrast PDE, Seoul, August 7-9, 2014 (with Y. Capdeboscq and H. Kang); Workshop on Multi-Scale and High-Contrast PDE: from Modelling, to Mathematical Analysis, to Inversion, Oxford University, June 28-July 1, 2011 (with Y. Capdeboscq and H. Kang); Workshop on Imaging Microstructures: Mathematical and Computational Challenges, June 18-20, 2008, Institut Henri Poincaré, Paris (with H. Kang); Franco-Korean Days of Mathematical Analysis and Its Applications, February 14-15, 2008, Institut Henri Poincaré, Paris (with H. Kang); Workshop on Inverse Problems, Multi-Scale Analysis and Homogenization, Seoul, June 22-24, 2005 (with H. Kang).

# Major scientific achievements

- Development of new mathematical and numerical tools, frameworks, and inversion methods to address emerging modalities in nanophotonics and nanophononics, medical imaging, nondestructive testing, and environmental inverse problems;
- Synergy of asymptotic imaging, stochastic modelling, and analysis of both deterministic and stochastic wave propagation phenomena to solve challenging problems posed by new imaging modalities and new optical and acoustic materials;
- Development of efficient algorithms for various imaging paradigms with precise estimations of convergence, resolution, and stability properties:
    - Introduction of novel frameworks for the detection, localization, dictionary recognition and tracking of a target from wave measurements;
    - Introduction of the concept of generalized polarization tensors and analysis of their spectral properties;
    - Pioneering the rigorous use of random matrix theory in wave imaging;
    - Development of efficient numerical framework for eddy current imaging problems by extracting conductivity tensors from eddy current data and comparing them with precomputed ones at multiple frequencies, pioneering the use of classification approaches in imaging from induction data.
- Modeling of multi-wave imaging prototypes and *comprehensive treatment* on *super-resolution* biomedical imaging:
    - Introduction of the concept of using interior perturbations and modulations of the probed medium to achieve better image resolution and stability;
    - Development of scale separation techniques, dynamical separation techniques, spectral separation approaches, dictionary matching techniques, and resonant media to enhance the resolution and stability of image reconstructions.
- Development of a *unified mathematical theory* of *subwavelength physics* and metamaterials:
    - Introduction of the capacitance matrix formulation as a discrete approximation to the spectrum of continuous PDE wave models, valid in the high-contrast asymptotic limit;
    - Development of rigorous framework to explain the spectacular spectral and transport properties of metamaterials;
    - Design of structures whose localization, confinement, and guiding properties are robust with respect to imperfections;
    - Elucidation of wave localization and transport at subwavelength scales in disordered systems;

- Mathematical foundations of non-Hermitian skin effect and non-reciprocal wave propagation;
- Mathematical foundations of time-modulated systems of resonators;
- Transposition of well-known quantum phenomena to classical wave physics.

- Contributions to imaging and wave propagation in complex media to bridge the gap between mathematics, physics, and real-world applications, particularly in the fields of nanophotonics and phononics, medicine, and nondestructive testing.

### Major contributions to the early career of excellent researchers

- Exemplary mentoring of students and postdoctoral researchers from elite institutions (Ecole Polytechnique, Ecole Normale Supérieure, ETH Zürich, Cambridge, Oxford, Columbia, UCLA, Seoul National University, Chinese University of Hong Kong, Hong Kong University of Science and Technology, Tsinghua University, Peking University, Chinese Academy of Sciences, . . . ).

### Examples of leadership in industrial innovation or design

- Industrial partnerships with Thalès, the Nuclear Energy Agency (CEA), L'OREAL, and Schlumberger;
- Rapid transfer of mathematical tools for imaging from academia to industry;
- Former PhD students in high-tech companies.

## Recent representative work


1. H. Ammari, S. Barandun, J. Cao, B. Davies, E.O. Hiltunen, and P. Liu, The non-Hermitian skin effect with three-dimensional long-range coupling. Journal of the European Mathematical Society, DOI: 10.4171/JEMS/1685.
2. H. Ammari, B. Davies, and E.O. Hiltunen, Anderson localization in the subwavelength regime. Communications in Mathematical Physics, (2024) 405:1.
3. H. Ammari, S. Barandun, J. Cao, B. Davies, and E.O. Hiltunen, Mathematical foundations of the non-Hermitian skin effect. Archive for Rational Mechanics and Analysis, (2024), 248:33.
4. P. Liu and H. Ammari, A mathematical theory of super-resolution and diffraction limit. Forum of Mathematics Sigma, (2024), Vol. 12:e83 1–42.
5. H. Ammari, B. Li, and J. Zou, Mathematical analysis of electromagnetic scattering by dielectric nanoparticles with high refractive indices. Transactions of the American Mathematical Society, 376 (2023), no. 1, 39–90.
6. Ammari, Habib; Hiltunen, Erik Orvehed; Yu, Sanghyeon. Subwavelength guided modes for acoustic waves in bubbly crystals with a line defect. *J. Eur. Math. Soc. (JEMS)* 24 (2022), no.7, 2279–2313.
7. H. Ammari, E. Orvehed Hiltunen and S. Yu, A high-frequency homogenization approach near the Dirac points in bubbly honeycomb crystals. Archive on Rational Mechanics and Analysis, 238 (2020) 1559-1583.
8. S. Yu and H. Ammari, Hybridization of singular plasmons via transformation optics. Proceedings of the National Academy of Sciences of the United States of America, 116 (2019), 13785–13790.
9. S. Yu and H. Ammari, Plasmonic interaction between nanospheres. SIAM Review, 60 (2018), no. 2, 356–385.

10. Ammari, Habib; Millien, Pierre; Ruiz, Matias; Zhang, Hai. Mathematical analysis of plasmonic nanoparticles: the scalar case. *Arch. Ration. Mech. Anal.* 224 (2017), no.2, 597–658.

11. H. Ammari and H. Zhang, A mathematical theory of super-resolution by using a system of sub-wavelength Helmholtz resonators. Communications in Mathematical Physics, 337 (2015), 379–428.

12. H. Ammari, L. Nguyen and L. Seppecher, Reconstruction and stability in acousto-optic imaging for absorption maps with bounded variation. Journal of Functional Analysis, 267 (2014), 4361–4398.

13. H. Ammari, T. Boulier, J. Garnier, and H. Wang, Shape identification and classification in electrolocation. Proceedings of the National Academy of Sciences of the United States of America, 111 (2014), 11652–11657.

14. H. Ammari, G. Ciraolo, H. Kang, H. Lee, and G. Milton, Spectral analysis of a Neumann-Poincaré-type operator and analysis of cloaking due to anomalous localized resonance. Archive on Rational Mechanics and Analysis, 208 (2013), 667–692.

15. H. Ammari, G. Ciraolo, H. Kang, H. Lee, and K. Yun, Spectral analysis of the Neumann-Poincaré operator and characterization of the stress blow-up in anti-plane elasticity. Archive on Rational Mechanics and Analysis, 208 (2013), 275–304.