

Guillaume Bal

Professor of Applied Mathematics
Departments of Statistics and Mathematics
Committee on Computational and Applied Mathematics (CCAM)
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Education

Ph.D. in Applied Mathematics, University of Paris VI, France - 1997
Diploma, Ecole Polytechnique, Paris, France - 1993

Professional Experience

- Professor, University of Chicago, 2017-present.
- Director, CCAM, University of Chicago, 2023-present.
- Founding Director, Masters on Computational and Applied Mathematics, 2018-present.
- Professor, Columbia University, 2008-2017.
- Associate Professor, Columbia University, 2003-2008.
- Visiting scholar, Institute for Pure and Applied Mathematics, UCLA campus, fall 2003.
- Assistant Professor, Columbia University, 2001-2003.
- L.E. Dickson Instructor, University of Chicago, 1999-2001.
- Postdoctoral research associate, Stanford University, 1997-1999.
- Research associate, Electricité de France, Clamart, France, 1994-1997. Preparation of Ph.D. thesis “Coupling of Equations and Homogenization in Neutron Transport”. Adviser: Professor Yvon Maday, Paris VI, France.

Research Interests

Partial Differential Equations.
Theoretical Inverse Problems and applications in medical and geophysical imaging.
Equations with random coefficients and propagation of stochasticity.
Topological phases of matter.

Awards

Calderón Prize 2011.
Alfred P. Sloan Fellow, September 2003.
NSF Grant DMS-0239097 “CAREER: Time Reversal and Inverse Problems in Wave and Particle Propagation” September 2003 - August 2008.
The Jean-Pierre Lepetit Prize 1998, best PhD thesis defended at the Direction des Etudes et Recherches d’Electricité de France (EDF), France.

Grants

NSF Grant DMS-2306411 “Forward and Inverse Problems for Topological Insulators and Kinetic Equations” August 2023- July 2026.

NSF Grant DMS-1908736 “From Topological Insulators to Hybrid Inverse Problems” August 2019 - July 2023.

ONR Grant N00014-17-1-2096 ”Laser propagation in heterogeneous media and applications to off-axis reconstructions” January 2017 - December 2019.

NSF Grant EFMA-1641100 “EFRI NewLAW: Novel Approaches to RF Non-Reciprocity in Semiconductor Systems”

NSF Grant DMS-1408867 “Propagation of Stochasticity in PDEs and Hybrid Inverse Problems” August 2014 - July 2017.

ONR Grant N00014-15-1-2679 ”Laser propagation in heterogeneous media and applications to off-axis reconstructions” July 2015 - June 2016.

NSF Grant DMS-1108608 “Equations with random coefficients and Inverse Problems” July 2011 - July 2014.

NASA Grant (JPL Subcontract, PI Anthony Davis) ”Fused Passive/Active 3D Tomography of the Earth’s Particulate Atmosphere Using Multi-Pixel/Multi-Angle Spectro-Polarimetric Techniques” July 2012 - July 2015.

AFOSR Grant NSSEFF- FA9550-10-1-0194 “Mathematical Modeling in Random media - From homogenization to Stochasticity” (PI Lenya Ryzhik, Stanford) May 2010 - May 2015.

DOE Grant DE-FG52-08NA28779 “Monte Carlo and Deterministic 3D radiative transfer” (co-I Anthony Davis, JPL) October 2008 - October 2011.

NSF Grant DMS-0804696 “Partial Differential Equations with random coefficients and Inverse Problems” July 2008 - July 2011.

NSF FRG Grant DMS-0554097 “Inverse Problems in Transport Theory” September 2006 - August 2009.

DARPA-ONR Grant N00014-04-1-0224 “Time reversal of Electromagnetic Waves” February 2004 - July 2008.

ONR Grant N00014-02-1-0089 “Time Reversal for Waves in Random Media” November 2001 - October 2004.

NSF Grant DMS-0072008 (renamed DMS-0233549) “Derivation and Simulation in Radiative Transfer Theory” July 2000 - July 2003.

Professional activities

AMS fellow

Associate Editor: Discrete and Continuous Dynamical Systems (DCDS-B) 2006-2011

Associate Editor: Kinetic & Related Models (KRM) 2007-

Associate Editor: Inverse Problems and Imaging (IPI) 2009-

Associate Editor: Computational and Mathematical Science (CMS) 2012-2017

Associate Editor: Multiscale Modeling and Simulation (MMS) 2012-2021

Associate Editor: Mathematical Control and Related Fields (MCRF) 2012-2019

Associate Editor: SMAI-JCM 2015-

Advisory Panel: Inverse Problems (IP) 2008-2017

Teaching and Mentoring Experience

University of Chicago (2017-present) & Columbia University (2001-2017): teaching of undergraduate and graduate courses in PDE's, functional analysis, numerical analysis, inverse problems, homogenization theory, waves in random media. University of Chicago (1999-2001): teaching of undergraduate courses in Complex variable theory, Vector field theory, Fourier methods, and introduction to ODE's and PDE's. Stanford University: Lectures on Transport Equations (graduate level), 1999. University of Paris VI: Lectures on numerical implementation in Pascal, course on Linear Algebra, licence of Applied Mathematics, 1995-1997.

Graduate Students:

Kui Ren, Graduated in Dec. 2005 (Professor Columbia University, NY).
Ramón Verástegui, Graduated in Dec. 2005 (Société Générale, New York).
Nick Hoell, Graduated in May 2011 (Deloitte, Toronto).
Wenjia Jing, Graduated in May 2011 (Associate Professor, Tsinghua University).
François Monard, Graduated in May 2012 (Associate Professor, UC Santa Cruz).
Ningyao Zhang, Graduated in June 2013 (JP Morgan, New York).
Will Martin, Graduated in May 2014 (primary advisor Brian Cairns, NASA GISS)
Yu Gu, Graduated in May 2014 (Associate Professor, University of Maryland).
Chenxi Guo, Graduated in May 2015 (Citadel, Hong Kong).
Hasan Cagan Ozen, Graduated in May 2017 (Morgan Stanley, New York).
Adrian Kirkeby, Jan. 2018-June 2018 (visiting from DTU).
Solomon Quinn. Graduated in May 2023 (Postdoctoral Researcher, UMN).
Binglu Chen. 2020- .
Jialiang Zhou. 2022- .

Postdoctoral researchers and postdoctoral mentoring:

Olivier Pinaud; Fall 2003- Fall 2005 (Professor CSU Fort Collins, CO).
Kui Ren; Fall 2005 - Summer 2007 (Professor Columbia University, NY).
Alexandre Jollivet; Fall 2007 - Fall 2009 (Chargé de Recherche CNRS, Lille, France).
Matias Courdurier; Fall 2007 - Fall 2009 (Associate Professor , U. Católica de Chile).
Ian Langmore; Fall 2008 - Fall 2011 (Google, CA).
Cédric Bellis; Spring 2011 - Fall 2012 (Chargé de Recherche CNRS, France).
Sébastien Imperiale; Spring 2012 - Fall 2013 (Chargé de Recherche INRIA, France).
Amir Moradifam; Fall 2012 - Winter 2013 (Associate Professor UC Riverside, CA).
Fatma Terzioglu; Fall 2018 - Fall 2021 (Assistant Professor NCSU, USA).
Benjamin Palacios; April 2018 - July 2021 (Assistant Professor, U.Católica, Chile).
Daniel Massatt; 2018 - July 2022 (Assistant Professor, Louisiana State University).
Zhongjian Wang; 2020- 2023 (Assistant Professor, NTU, Singapore).
Thuyen Dang; 2022- .
Anjali Nair; 2023- .

Undergraduate students:

Philippe Moireau, Ecole Polytechnique (Summer 2003).
Oleg Polyakov, Columbia University (Summer 2005).
Rosalia Wong, Columbia University (Summer-Fall 2006).
François Monard, SUPAERO, France (Spring 2007).
Stan Snelson, Columbia University (Fall 2007- Spring 2009).

Clément Ray, Ecole Centrale Paris (Spring 2009).
Thomas Boulier, Ecole Polytechnique (Summer 2009).
Xavier Arhan, ENS Cachan (Spring 2011).
Tristan Agaësse, Ecole Centrale and EADS (Spring 2012).
Charles Bertucci, Ecole Polytechnique (Spring 2015).
Enzo Miller, Ecole Polytechnique (Spring 2017).
Alain Blaustein, ENS Rennes (Spring 2018).
Raphael Terrine, ENSTA (Summer 2022).

List of Publications

- [0] G. Bal. *Couplage d'équations et homogénéisation en transport neutronique. Thèse de Doctorat* de l'Université Paris 6 (in French), 1997.
- [1] G. Allaire and G. Bal. Homogénéisation d'une équation spectrale de transport neutronique (homogenization of a spectral equation in neutron transport). *C. R. Acad. Sci. Paris, t.325, Série I*, pp. 1043–1048, 1997.
- [2] G. Bal and X. Warin. Discrete Ordinates Methods in xy -Geometry with spatially varying angular discretization. *Nuclear Science and Engineering*, **127**(2), pp. 169–181, 1997.
- [3] G. Bal, A. Fannjiang, G. Papanicolaou, and L. Ryzhik. Radiative transport in a periodic structure. *J. Statist. Phys.*, **95**, pp. 479–494, 1999.
- [4] G. Bal, J.B. Keller, G. Papanicolaou, and L. Ryzhik. Transport theory for waves with reflection and transmission at interfaces. *Wave Motion*, **30**, pp. 303–327, 1999.
- [5] G. Bal. First-order Corrector for the Homogenization of the Criticality Eigenvalue Problem in the Even Parity Formulation of the Neutron Transport. *SIAM J. Math. Anal.*, **30**, pp. 1208–1240, 1999.
- [6] G. Bal, G. Papanicolaou, and L. Ryzhik. Diffusive scattering from weakly random surfaces. *J. Math. Phys.*, **40**, pp. 4813–4827, 1999.
- [7] G. Allaire and G. Bal. Homogenization of the criticality spectral equation in neutron transport. *M2AN Math. Model. Numer. Anal.*, **33**(4), pp.721–746, 1999.
- [8] G. Bal. Boundary Layer Analysis in the Homogenization of Neutron Transport Equations in a Cubic Domain. *Asymptot. Anal.*, **20**(3-4), pp.213–239, 1999.
- [9] G. Bal, G. Papanicolaou, and L. Ryzhik. Probabilistic Theory of Transport Processes with Polarization. *SIAM J. App. Math.*, **60**(5), pp. 1639–1666, 2000.
- [10] G. Bal and L. Ryzhik. Diffusion approximation of radiative transfer problems with interfaces. *SIAM J. App. Math.*, **60**(6), pp. 1887–1912, 2000.
- [11] G. Bal and M. Moscoso. Polarization Effects of Seismic Waves on the Basis of Radiative Transport Theory. *Geophys. J. Int.*, **142**, pp. 571–585, 2000.
- [12] G. Bal, V. Freilikher, G. Papanicolaou, and L. Ryzhik. Wave transport along surfaces with random impedance. *Phys. Rev. B*, **62**(10), pp. 6228–6240, 2000.
- [13] G. Bal. Inverse problems for homogeneous transport equations. Part I: One dimensional case. *Inverse Problems*, **16**, pp. 997–1011, 2000.
- [14] G. Bal. Inverse problems for homogeneous transport equations. Part II: Multidimensional case. *Inverse Problems*, **16**, pp. 1013–1028, 2000.
- [15] G. Bal. Spatially Varying Discrete Ordinates Methods in XY -Geometry. *Math. Models Meth. Appl. Sci.*, **10**(9), pp. 1277–1303, 2000.
- [16] G. Bal and M. Moscoso. Radiative Transfer for Wave Propagation in Random Media. Monte Carlo Simulations of Seismic Waves. *Mathematical and numerical aspects of wave propagation (Santiago de Compostela, 2000)*, 559–563, SIAM, Philadelphia, PA, 2000.
- [17] G. Bal and M. Moscoso. Theoretical and Numerical Analysis of Polarization for Time Dependent Radiative Transfer Equations. *J. Quant. Spectroscopy Radiative Transfer*,

- 70**(1), pp. 75–90, 2001.
- [18] G. Bal. Fourier analysis of the diamond discretization in particle transport. *Calcolo*, **38**(3), pp. 141–172, 2001.
- [19] G. Bal. Diffusion Approximation of Radiative Transfer Equations in a Channel. *Transport Theory Statist. Phys.*, **30**(2-3), pp. 269–293, 2001.
- [20] G. Bal. Homogenization of a Spectral Equation with Drift in Linear Transport. *ESAIM Contr. Op. Ca. Va.*, **6**(26), pp. 613–627, 2001.
- [21] G. Bal and L. Ryzhik. Time Reversal for Classical Waves in Random Media. *C. R. Acad. Sci. Paris, Série I*, **333**, pp. 1041–1046, 2001.
- [22] G. Bal and T. Chou. Capillary-gravity wave transport over spatially random drift. *Wave Motion*, **35**, pp. 107–124, 2002.
- [23] G. Bal and L. Ryzhik. Wave transport for a scalar model of the Love waves. *Wave Motion*, **36**, pp. 49–66, 2002.
- [24] G. Bal and Y. Maday. Coupling of transport and diffusion models in linear transport theory. *M2AN Math. Model. Numer. Anal.*, **36**(1), pp. 69–86, 2002.
- [25] G. Bal. Transport through diffusive and non-diffusive regions, embedded objects, and clear layers. *SIAM J. Appl. Math.*, **62**(5), pp. 1677–1697, 2002.
- [26] G. Bal and Y. Maday. A “parareal” time discretization for non-linear PDE’s with application to the pricing of an American put, in Recent developments in domain decomposition methods (Zürich, 2001), L.F. Pavarino and A. Toselli, eds., Vol. 23 of Lecture Notes in Computational Science and Engineering, Springer Verlag, Berlin, pp. 189-202, 2002.
- [27] G. Bal, G. Papanicolaou and L. Ryzhik. Radiative transport limit for the random Schrödinger equation. *Nonlinearity*, **15**, pp. 513-529, 2002.
- [28] G. Bal. Particle transport through scattering regions with clear layers and inclusions. *J. Comp. Phys.*, **180**(2), pp. 659-685, 2002.
- [29] G. Allaire, G. Bal and V. Siess. Homogenization and localization in locally periodic transport. *ESAIM Contr. Op. Ca. Va.*, **8**, pp. 1-20, 2002.
- [30] G. Bal, G. Papanicolaou and L. Ryzhik. Self-averaging in time reversal for the parabolic wave equation. *Stoch. Dyn.*, **2**(4), pp. 507–532, 2002.
- [31] G. Bal. Optical tomography of small volume absorbing inclusions. *Inverse Problems*, **19**(2), pp. 371-386, 2003.
- [32] G. Bal and L. Ryzhik. Time Reversal and Refocusing in Random Media. *SIAM J. Appl. Math.*, **63**(5), pp. 1475-1498, 2003.
- [33] G. Bal, T. Komorowski and L. Ryzhik. Self-averaging of Wigner transforms in random media. *Comm. Math. Phys.*, **242**(1-2), pp. 81-135, 2003.
- [34] G. Bal and K. Ren. Generalized diffusion model in optical tomography with clear layers. *J. Opt. Soc. Amer. A*, **20**(12), pp. 2355-2364, 2003.
- [35] G. Bal. On the attenuated Radon transform with full and partial measurements. *Inverse Problems*, **20**(2), pp. 399-419, 2004.
- [36] K. Ren, G. S. Abdoulaev, G. Bal and A.H. Hielscher. Algorithm for solving the equation of radiative transfer in the frequency domain. *Optics Letter*, **29**(6), pp. 578-580, 2004.

- [37] G. Bal. On the self-averaging of wave energy in random media. *Multiscale Model. Simul.*, **2**(3), pp. 398-420, 2004.
- [38] G. Bal and T. Chou. On the reconstruction of diffusions using a single first-exit time distribution. *Inverse Problems*, **20**(4), pp. 1053-1066, 2004.
- [39] G. Bal and P. Moireau. Fast numerical inversion of the attenuated Radon transform with full and partial measurements. *Inverse Problems*, **20**(4), pp. 1137-1164, 2004.
- [40] G. Bal and R. Verástegui. Time Reversal in Changing Environment. *Multiscale Model. Simul.*, **2**(4), pp. 639-661, 2004.
- [41] G. Bal and L. Ryzhik. Time splitting for the Liouville equation in a random medium. *Comm. Math. Sci.*, **2**(3), pp. 515-534, 2004.
- [42] G. Bal. On the Convergence and the Stability of the Parareal Algorithm to solve Partial Differential Equations, in Domain Decomposition Methods in Science and Engineering, R. Kornhuber, R. Hoppe, J. Périaux, O. Pironneau, O. Widlund, J. Xu, eds., Vol. 40 of Lecture Notes in Computational Science and Engineering, Springer Verlag, Berlin, pp. 425-432, 2004.
- [43] G. Bal and L. Ryzhik. Time splitting for wave equations in random media. *M2AN Math. Model. Numer. Anal.*, **38**(6), pp. 961-988, 2004.
- [44] G. Bal. Reconstructions in impedance and optical tomography with singular interfaces. *Inverse Problems*, **21**(1), pp. 113-132, 2005.
- [45] G. Bal and K. Ren. Atmospheric concentration profile reconstructions from Radiation measurements. *Inverse Problems*, **21**(1), pp. 153-168, 2005.
- [46] G. Bal and L. Ryzhik. Stability of time reversed waves in changing media. *Disc. Cont. Dyn. Syst. A*, **12**(5), pp. 793-815, 2005.
- [47] G. Bal. Ray transforms in hyperbolic geometry. *J. Math. Pures Appl.*, **84**(10), pp. 1362-1392, 2005.
- [48] G. Bal and O. Pinaud. Time Reversal Based Detection in Random Media. *Inverse Problems*, **21**(5), pp. 1593-1620, 2005.
- [49] G. Bal. Kinetics of scalar wave fields in random media. *Wave Motion*, **43**, pp. 132-157, 2005.
- [50] G. Bal. Transport approximations in partially diffusive media. *Lecture Notes in Computational Science and Engineering; Ed. F. Graziani, Proceedings of the Computational Methods in Transport Workshop, Lake Tahoe, September 2004*, **48**, pp. 373-400, 2006.
- [51] G. Bal and K. Ren. Reconstruction of singular surfaces by shape sensitivity analysis and level set method. *Math. Models Meth. Appl. Sci.*, **16**(8), pp. 1347-1373, 2006.
- [52] G. Bal. Radiative transfer equations with varying refractive index: a mathematical perspective. *J. Opt. Soc. Am. A*, **23**(7), pp. 1639-1644, 2006.
- [53] G. Bal and L. Ryzhik. Wave field correlations in weakly mismatched random media. *Stochastics & Dynamics*, **6**(3), pp. 301-328, 2006.
- [54] G. Bal and O. Pinaud. Accuracy of transport models for waves in random media. *Wave Motion*, **43**(7), pp. 561-578, 2006.
- [55] K. Ren, G. Bal and A. H. Hielscher. Frequency Domain Optical Tomography Based on the Equation of Radiative Transfer. *SIAM J. Sci. Comput.*, **28**(4), pp. 1463-1489, 2006.

- [56] D. Liu, S. Vasudevan, J. Krolik, G. Bal and L. Carin. Electromagnetic Time-Reversal Imaging in Changing Media: Experiment and Analysis. *IEEE Transactions on Antennas and Propagation*, **55**(2), pp. 344-354, 2007.
- [57] G. Bal and A. Tamasan. Inverse source problems in transport equations. *SIAM J. Math. Anal.*, **39**(1), pp. 57-76, 2007.
- [58] G. Bal. Homogenization in random media and effective medium theory for high frequency waves. *Disc. Cont. Dyn. Syst. B*, **8**(2), pp. 473-492, 2007.
- [59] G. Bal and O. Pinaud. Kinetic models for imaging in random media. *Multiscale Model. Simul.*, **6**(3), pp. 792-819, 2007.
- [60] K. Ren, G. Bal and A. H. Hielscher. Transport- and diffusion-based optical tomography in small domains: A comparative study. *Applied Optics*, **46**(27), pp. 6669-6679, 2007.
- [61] G. Bal, L. Carin, D. Liu, and K. Ren. Experimental validation of a transport-based imaging method in highly scattering environments. *Inverse Problems*, **23**(6), pp. 2527-2539, 2007.
- [62] G. Bal and O. Pinaud. Self-averaging of kinetic models for waves in random media. *Kinetic Related Models*, **1**(1), pp. 85-100, 2008.
- [63] G. Bal and Q. Wu. Symplectic parareal. *Domain decomposition methods in science and engineering XVII*, Lect. Notes Comput. Sci. Eng., **60**, pp. 401-408, 2008.
- [64] G. Bal, I. Langmore and F. Monard. Inverse transport with isotropic sources and angularly averaged measurements. *Inverse Probl. Imaging*, **2**(1), pp. 23-42, 2008.
- [65] G. Bal. Parallelization in time of (stochastic) ordinary differential equations. www.columbia.edu/~gb2030/PAPERS/parallelttime.pdf.
- [66] G. Bal and K. Ren. Transport-based imaging in random media. *SIAM J. Appl. Math.*, **68**(6), pp. 1738-1762, 2008.
- [67] G. Bal, J. Garnier, S. Motsch, and V. Perrier. Random integrals and correctors in homogenization. *Asymptot. Anal.*, **59**(1-2), pp. 1-26, 2008.
- [68] G. Bal. Central limits and homogenization in random media. *Multiscale Model. Simul.*, **7**(2), pp. 677-702, 2008.
- [69] G. Bal. Inverse transport from angularly averaged measurements and time harmonic isotropic sources. *Mathematical Methods in Biomedical Imaging and Intensity-Modulated Radiation Therapy*, Eds. Y. Censor, M. Jiang, A.K. Louis, CRM Series, Scuola Normale Superiore Pisa, Italy, pp. 19-35, 2008.
- [70] G. Bal. Inverse Problems in random media: a kinetic approach. *J. Phys. Conf. Series*, **124**, 012001, 2008.
- [71] G. Bal and A. Jollivet. Stability estimates in stationary inverse transport. *Inverse Probl. Imaging*, **2**(4), pp. 427-454, 2008.
- [72] G. Bal and K. Ren. Physics-based models for measurement correlations. Application to an inverse Sturm-Liouville problem. *Inverse Problems*, **25**, 055006, 2009.
- [73] G. Bal. Inverse transport theory and applications. *Inverse Problems*, **25**, 053001, 2009.
- [74] G. Bal and A. Jollivet. Approximate stability in inverse transport. *in Biomedical Mathematics*, Ed. Y. Censor, M. Jiang, G. Wang, Medical Physics Publishing, Wisconsin,

2010.

[75] G. Bal. Convergence to SPDEs in Stratonovich form. *Comm. Math. Phys.*, **212**(2), pp. 457-477, 2009.

[76] G. Bal and A. Jollivet. Time-dependent angularly averaged inverse transport. *Inverse Problems*, **25**, 075010, 2009.

[77] G. Bal, I. Langmore, and O. Pinaud. Single scattering estimates for the scintillation function of waves in random media. *J. Math. Phys.*, **51**, 022903, 2009.

[78] G. Bal and A. Jollivet. Stability for time dependent inverse transport. *SIAM J. Math. Anal.*, **42**(2), pp. 679-700, 2010.

[79] G. Bal and F. Monard. An accurate solver for forward and inverse transport. *J. Comp. Phys.*, **229**, pp. 4952-4979, 2010.

[80] G. Bal, A. Jollivet and V. Jugnon. Inverse transport theory of Photoacoustics. *Inverse Problems*, **26**, 025011, 2010.

[81] G. Bal, J.C. Schotland. Inverse Scattering with Interior Control and Acousto-Optic Imaging. *Phys. Rev. Letters*, **104**, 043902, 2010.

[82] G. Bal and O. Pinaud. Dynamics of wave scintillation in random media. *Comm. Partial Differential Equations*, **35**, pp. 1176-1235, 2010.

[83] G. Bal. Homogenization with large spatial random potential. *Multiscale Model. Simul.*, **8**, pp. 1484-1510, 2010.

[84] G. Bal and O. Pinaud. Small volume expansions for elliptic equations. *Asymptotic Analysis*, **70**(1-2), pp. 13-50, 2010.

[85] G. Bal, G. Uhlmann. Inverse Diffusion Theory of Photoacoustics. *Inverse Problems*, **26**(8), 085010, 2010.

[86] G. Bal, W. Jing. Homogenization and Corrector Theory for Linear Transport in Random Media. *Disc. Cont. Dyn. Syst. A*, **28**(4), 1311 - 1343, 2010.

[87] G. Bal, T. Komorowski and L. Ryzhik. Kinetic limits for waves in a random medium. *Kinetic Related Models*, **3**(4), pp. 529 - 644, 2010.

[88] G. Bal, and O. Pinaud. Imaging using transport models for wave-wave correlations. *Math. Models Methods Appl. Sci.*, **21**(3), pp. 1071-1093, 2011.

[89] G. Bal, W. Jing. Fluctuation theory for Radiative transfer in random media. *J. Quant. Spectroscopy Radiative Transfer*, **112**(4), pp. 660-670, 2011.

[90] G. Bal, T. Komorowski, and L. Ryzhik. Asymptotics of the phase of the solutions of the random Schrödinger equation. *Archives for Rational Mechanics and Analysis*, **200**(2), pp. 613-664, 2011.

[91] G. Bal, W. Jing. Corrector theory for elliptic equations in random media with singular Green's function. Application to random boundaries. *Comm. Math. Sci.*, **9**(2), pp. 383-411, 2011.

[92] G. Bal and K. Ren. Multi-source quantitative PAT in diffusive regime. *Inverse Problems*, **27**(7), 075003, 2011.

[93] G. Bal. Convergence to Homogenized or Stochastic Partial Differential Equations. *Appl Math Res Express*, **2011**(2), pp. 215-241, 2011.

- [94] G. Bal, A. Jollivet, I. Langmore, and F. Monard. Angular average of time-harmonic transport solutions. *Comm. Partial Differential Equations*, **36**(6), pp. 1044-1070, 2011.
- [95] G. Bal, K. Ren, G. Uhlmann, and T. Zhou. Quantitative Thermo-acoustics and related problems. *Inverse Problems*, **27**(5), 055007, 2011.
- [96] G. Bal, R. Ghanem, and I. Langmore. Large Deviation Theory for a Homogenized and "Corrected" Elliptic ODE. *J. Differential Equations*, **251**(7), pp. 1864-1902, 2011.
- [97] G. Bal, D. Finch, P. Kuchment, P. Stefanov, G. Uhlmann (Editors). Tomography and Inverse Transport Theory. *Contemporary Mathematics*, **559**, 2011
- [98] G. Bal and K. Ren. Non-uniqueness results for a hybrid inverse problem. *In Tomography and Inverse Transport Theory, (G. Bal, D. Finch, P. Kuchment, P. Stefanov, G. Uhlmann (Editors)), Contemporary Mathematics*, **559**, pp. 29-38, 2011.
- [99] G. Bal and A. Jollivet. Combined source and attenuation reconstructions in SPECT. *In Tomography and Inverse Transport Theory, (G. Bal, D. Finch, P. Kuchment, P. Stefanov, G. Uhlmann (Editors)), Contemporary Mathematics*, **559**, pp. 13-28, 2011.
- [100] G. Bal and W. Jing. Corrector theory for MsFEM and HMM in random media. *Multiscale Model. Simul.*, **9**, pp. 1549-1587, 2011.
- [101] G. Bal, A.B. Davis, and I. Langmore. A hybrid (Monte Carlo/deterministic) approach for multi-dimensional radiation transport. *J. Computational Physics*, **230**(20), pp. 7723-7735, 2011.
- [102] G. Bal and F. Monard. Inverse transport with isotropic time-harmonic sources. *SIAM J. Math. Anal.*, **44**, pp. 134-161, 2012.
- [103] G. Bal and K. Ren. On multi-spectral quantitative photoacoustic tomography in diffusive regime. *Inverse Problems*, **28**, 025010, 2012.
- [104] N. Hoell and G. Bal. Ray Transforms on a Conformal Class of Curves. *Inverse Problems and Imaging*, **8**(1), pp. 103-125, 2014.
- [105] G. Bal, and O. Pinaud. Analysis of the double scattering scintillation of waves in random media. *Comm. Partial Differential Equations*, **38**(6), pp. 945-984, 2013.
- [106] G. Bal, J. Garnier, W. Jing, Y. Gu. Corrector Theory for Elliptic Equations with Long-range Correlated Random Potential. *Asymptotic Analysis*, **77**(3-4), pp. 123-145, 2012.
- [107] G. Bal, E. Bonnetier, F. Monard, and F. Triki. Inverse diffusion from knowledge of power densities. *Inverse Problems and Imaging*, **7**(2), pp. 353-375, 2013.
- [108] G. Bal. Cauchy problem and Ultrasound Modulated EIT. *Analysis & PDE*, **6**(4), pp. 751-775, 2013.
- [109] G. Bal. Hybrid inverse problems and internal measurements (review paper). *Inside Out II, MSRI Publications, G. Uhlmann Editor, Cambridge University Press, 2012.*
- [110] F. Monard and G. Bal. Inverse diffusion problem with redundant internal information. *Inverse Problems Imaging*, **6**(2), pp. 289-313, 2012.
- [111] Y. Gu and G. Bal. Random homogenization and convergence to integrals with respect to the Rosenblatt process. *J. Diff. Equ.* **253**(4), pp. 1069-1087, 2012.
- [112] G. Bal, I. Langmore, and A. Davis. Multi-Pixel Retrieval of Structural and Optical Parameters in a 2D Scene with a Path-Recycling Monte Carlo Forward Model and a New

- Bayesian Inference Engine. *IEEE Trans. Geosci. Remote Sensing*, **51**(5), pp.9203-2919, 2013.
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