

List of publications

Joonas Ilmavirta

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The publications listed here can be found on my webpage in PDF format:
<http://users.jyu.fi/~jojapeil>

Preprints

1. Joonas Ilmavirta, Antti Kykkänen, Teemu Saksala. **The elastic ray transform**, 2025.
2. Maarten V. de Hoop, Joonas Ilmavirta, Vitaly Katsnelson. **Principal spectral rigidity implies subprincipal spectral rigidity**, 2025.
3. Maarten V. de Hoop, Joonas Ilmavirta, Antti Kykkänen, Rafe Mazzeo. **Geometric inverse problems on gas giants**, 2024.
4. Joonas Ilmavirta, Antti Kykkänen, Matti Lassas, Teemu Saksala, Andrew Shedlock. **Lipschitz Stability of Travel Time Data**, 2024.
5. Joonas Ilmavirta, Antti Kykkänen, Kelvin Lam. **Microlocal analysis of the X-ray transform in non-smooth geometry**, 2023.
6. Maarten V. de Hoop, Joonas Ilmavirta, Matti Lassas, Anthony Várilly-Alvarado. **Reconstruction of generic anisotropic stiffness tensors from partial data around one polarization**. 2023.
7. J. Ilmavirta, G. Uhlmann. **Breaking the conformal freedom of spacetime with supernova neutrino imaging**. 2021.
8. J. Ilmavirta. **On Radon transforms on finite groups**. 2014.

Peer reviewed scientific articles (A1)

9. J. Ilmavirta, H. Schlüter. **Gauge freedoms in the anisotropic elastic Dirichlet-to-Neumann map**, *Inverse Problems and Imaging*, 19(4):816–828, 2025.
10. J. Ilmavirta, M. Lassas, J. Lu, L. Oksanen, L. Ylinen. **Quantum computing algorithms for inverse problems on graphs and an NP-complete inverse problem**. *Inverse Problems and Imaging*, 19(4):660–692, 2025.

11. M. V. de Hoop, J. Ilmavirta, M. Lassas. **Reconstruction along a geodesic from sphere data in Finsler geometry and anisotropic elasticity.** *Journal de Mathématiques Pures et Appliquées*, 196:103688, 2025.
12. J. Ilmavirta, P. Kow, S. K. Sahoo. **Unique continuation for the momentum ray transform.** *Journal of Fourier Analysis and Applications*, 31:17, 2025.
13. J. Ilmavirta, A. Kykkänen. **Tensor tomography on negatively curved manifolds of low regularity.** *Journal of Geometric Analysis*, 34:146–187, 2024.
14. M. V. de Hoop, J. Ilmavirta, V. Katsnelson. **Spherically symmetric terrestrial planets with discontinuities are spectrally rigid.** *Communications in Mathematical Physics*, 405, 2024.
15. M. V. de Hoop, J. Ilmavirta, M. Lassas, T. Saksala. **Determination of a compact Finsler manifold from its boundary distance map and an inverse problem in elasticity.** *Communications in Analysis and Geometry*, 31:1693–1747, 2023.
16. J. Ilmavirta, B. Liu, T. Saksala. **Three travel time inverse problems on simple Riemannian manifolds.** *Proceedings of the American Mathematical Society*, 151:4513–4525, 2023.
17. J. Ilmavirta, A. Kykkänen. **Pestov identities and X-ray tomography on manifolds of low regularity.** *Inverse Problems and Imaging*, 17:1301–1328, 2023.
18. M. V. de Hoop, J. Ilmavirta, M. Lassas, T. Saksala. **Stable reconstruction of simple Riemannian manifolds from unknown interior sources.** *Inverse Problems*, 39(9):095002, 2023.
19. J. Ilmavirta, K. Mönkkönen. **The geodesic ray transform on spherically symmetric reversible Finsler manifolds.** *The Journal of Geometric Analysis*, 33, 2023.
20. J. Ilmavirta, K. Mönkkönen, J. Railo. **On mixed and transverse ray transforms on orientable surfaces.** *Journal of Inverse and Ill-Posed Problems*, 31(1):43–63, 2023.
21. M. V. de Hoop, J. Ilmavirta, V. Katsnelson. **Spectral rigidity for spherically symmetric manifolds with boundary.** *Journal de mathématiques pures et appliquées*, 160:54–98, 2022.
22. J. Ilmavirta, G. Paternain. **Broken ray tensor tomography with one reflecting obstacle.** *Communications in Analysis and Geometry*, 30:1269–1300, 2022.
23. J. Ilmavirta, K. Mönkkönen. **Partial data problems in scalar and vector field tomography.** *Journal of Fourier Analysis and Applications*, 28(34), 2022.
24. M. V. de Hoop, J. Ilmavirta, M. Lassas, T. Saksala. **A foliated and reversible Finsler manifold is determined by its broken scattering relation.** *Pure and Applied Analysis*, 4(4):789–811, 2021.

25. E. Iversen, B. Ursin, T. Saksala, J. Ilmavirta, and M. V. de Hoop. **Higher-order Hamilton-Jacobi perturbation theory for anisotropic heterogeneous media: dynamic ray tracing in ray-centred coordinates.** *Geophysical Journal International*, 226(2): 1262–1307, 2021.
26. E. Iversen, B. Ursin, T. Saksala, J. Ilmavirta, and M. V. de Hoop. **Higher-order Hamilton-Jacobi perturbation theory for anisotropic heterogeneous media: transformation between Cartesian and ray-centred coordinates.** *Geophysical Journal International*, 226(2): 893–927, 2021.
27. A. Feizmohammadi, J. Ilmavirta, Y. Kian, L. Oksanen. **Recovery of time dependent coefficients from boundary data for hyperbolic equations.** *Journal of Spectral Theory*, 11(3):1107–1143, 2021.
28. J. Ilmavirta, K. Mönkkönen. **X-ray tomography of one-forms with partial data.** *SIAM Journal on Mathematical Analysis*, 53: 3002–3015, 2021.
29. A. Feizmohammadi, J. Ilmavirta, L. Oksanen. **The Light Ray transform in Stationary and Static Lorentzian geometries.** *Journal of Geometric Analysis*, 31: 3656–3682, 2021.
30. T. Brander, J. Ilmavirta, P. Piiroinen, T. Tyni. **Optimal recovery of a radiating source with multiple frequencies along one line.** *Inverse Problems and Imaging*, 14: 967–983, 2020.
31. J. Ilmavirta, O. Koskela, J. Railo. **Torus computed tomography.** *SIAM Journal on Applied Mathematics*, 80(4), 2020.
32. J. Ilmavirta, J. Railo. **Geodesic ray transform with matrix weights for piecewise constant functions.** *Annales Academiæ Scientiarum Fennicæ Mathematica*, 45: 1095–1102, 2020.
33. J. Ilmavirta, K. Mönkkönen. **Unique continuation of the normal operator of the X-ray transform and applications in geophysics.** *Inverse Problems*, 26(4): 045014, 2020.
34. J. Ilmavirta, J. Lehtonen, M. Salo. **Geodesic X-ray tomography for piecewise constant functions on nontrapping manifolds.** *Mathematical Proceedings of the Cambridge Philosophical Society*, 168(1):29–41, 2020.
35. J. Ilmavirta, G. Paternain. **Functions of constant geodesic X-ray transform.** *Inverse Problems*, 35(6):065002, 2019.
36. E. Iversen, B. Ursin, T. Saksala, J. Ilmavirta, and M. V. de Hoop. **Higher-order Hamilton-Jacobi perturbation theory for anisotropic heterogeneous media: Dynamic ray tracing in Cartesian coordinates.** *Geophysical Journal International*, 216(3): 2044–2070, 2019.
37. J. Ilmavirta, G. Uhlmann. **Tensor tomography in periodic slabs.** *Journal of Functional Analysis*, 275(2): 288–299, 2018.

38. J. Ilmavirta, A. Waters. **Recovery of the sound speed for the Acoustic wave equation from phaseless measurements.** *Communications in Mathematical Sciences*, 16(4): 1017–1041, 2018.
39. J. Ilmavirta. **X-ray transforms in pseudo-Riemannian geometry.** *Journal of Geometric Analysis*, 28(1): 606–626, 2018.
40. T. Brander, J. Ilmavirta, M. Kar. **Superconductive and insulating inclusions for linear and non-linear conductivity equations.** *Inverse Problems and Imaging*, 12(1): 91–123, 2018.
41. M. V. de Hoop, J. Ilmavirta. **Abel transforms with low regularity with applications to X-ray tomography on spherically symmetric manifolds.** *Inverse Problems*, 33(12): 124003, 2017. Special issue “100 Years of the Radon Transform”.
42. J. Ilmavirta. **Coherent quantum tomography.** *SIAM Journal on Mathematical Analysis*, 48(5): 3039–3064, 2016.
43. J. Ilmavirta. **On Radon transforms on compact Lie groups.** *Proceedings of the American Mathematical Society*, 144(2): 681–691, 2016.
44. J. Ilmavirta, M. Salo. **Broken ray transform on Riemann surface with a convex obstacle.** *Communications in Analysis and Geometry*, 24(2): 379–408, 2016.
45. J. Ilmavirta. **A reflection approach to the broken ray transform.** *Mathematica Scandinavica*, 117(29): 231–257, 2015.
46. J. Ilmavirta. **On Radon transforms on tori.** *Journal of Fourier Analysis and Applications*, 21(2): 370–382, 2015.
47. J. Ilmavirta. **Boundary reconstruction for the broken ray transform.** *Annales Academiæ Scientiarum Fennicæ Mathematica*, 39(2): 485–502, 2014.
48. J. Ilmavirta. **Broken ray tomography in the disc.** *Inverse Problems*, 29(3): 035008, 2013.

Review articles (A2)

49. J. Ilmavirta, F. Monard. **Integral geometry on manifolds with boundary and applications.** 73 pp. Printed as a chapter of the book “The Radon Transform: The First 100 Years and Beyond” (Ronny Ramlau, Otmar Scherzer, eds.), de Gruyter, 2019.

Conference publications (A5)

50. J. Ilmavirta, J. C.-E. Stén. **A Eulogy in Honour of Anders Johan Lexell, an 18th Century Finnish Mathematician.** *Proceedings of Bridges 2016: Mathematics, Music, Art, Architecture, Education, Culture*, pp. 545–548, 2016.

Teaching material

51. J. Ilmavirta. **Geometry of geodesics.** Lecture notes for a course by the same name, 82 pp., 2020. (arXiv:2008.00073)
52. J. Ilmavirta. **Analysis and X-ray tomography.** Lecture notes for a course by the same name, 84 pp., 2017. (arXiv:1711.06557)

Articles in professional magazines (D1)

Several articles about results in the International Physics Olympiad and the training process of Finnish and Estonian teams for the competition. One article for the general public about inverse problems in Latin. More information on my webpage.

Dissertation (G5)

53. Dissertation in mathematics, University of Jyväskylä (2014):
On the broken ray transform
Supervisor: prof. M. Salo.

Other theses are listed in the CV. All theses have been accepted with the highest possible grade.