PUBLICATIONS

Books

[1] Co-editor with D. A. Martin, Y. N. Moschovakis, and J. R. Steel, of the series: *Cabal-Seminar* 76–77, 77–79, 79–81, 81–85, Proc. Caltech-UCLA Logic Seminar, Lecture Note Series in Math., vols. **689, 839, 1019, 1333**, Springer-Verlag, 1978, 1981, 1983, 1988.

[2] (With A. Louveau) *Descriptive Set Theory and the Structure of Sets of Uniqueness,* London Math. Society Lecture Note Series, **128**, Cambridge University Press, 1987 (reprinted in 1989).

[3] *Classical Descriptive Set Theory,* Graduate Texts in Mathematics, **156**, Springer-Verlag, 1995.

[4] (With H. Becker) *The Descriptive Set Theory of Polish Group Actions,* London Math. Society Lecture Note Series, **232**, Cambridge Universiity Press, 1996.

[5] Co-editor with M. Foreman, A. Louveau and B. Weiss of the book: *Descriptive Set Theory and Dynamical Systems*, London Math. Society Lecture Note Series, **277**, Cambridge University Press, 2000.

[6] (With W. Henson, J. Iovino, and E. Odell) *Analysis and Logic,* London Math. Society Lecture Note Series, **262**, Cambridge University Press, 2002.

[7] (With B.D. Miller) *Topics in Orbit Equivalence,* Lecture Notes in Mathematics, **1852,** Springer, 2004.

[8] Co-editor with B. Löwe, J.R. Steel, *Games, Scales and Suslin Cardinals: The Cabal Seminar, Volume I,* Lecture Notes in Logic, **31**, Cambridge University Press, 2008.

[9] *Global aspects of ergodic group actions,* Math. Surveys and Monographs, **160**, Amer. Math. Soc., 2010.

[10] Co-editor with B. Löwe, J.R. Steel, *Wadge Degrees and Projective Ordinals: The Cabal Seminar, Volume II,* Lecture Notes in Logic, **37**, Cambridge University Press, 2012.

[11] Co-editor with B. Löwe, J.R. Steel, *Ordinal Definability and Recursion Theory: The Cabal Seminar, Volume III,* Lecture Notes in Logic, **43**, Cambridge University Press, 2016.

[12] Co-editor with B. Löwe, J.R. Steel, *Large cardinals, determinacy and other topics: The Cabal Seminar, Volume IV,* Lecture Notes in Logic, **49**, Cambridge University Press, 2021.

[13] Co-editor with N. Makarov, D. Ramakrishnan and X. Zhu, *Nine Mathematical Challenges, An Elucidation,* Proceedings of Symposia in Pure Mathematics, **104**, Amer. Math. Soc., 2021.

[14] *The theory of countable Borel equivalence relations,* Cambridge Tracts in Mathematics, **234**, Cambridge University Press, 2025.
Pre-publication version available in:
https://pma.caltech.edu/people/alexander-kechris

Articles

[1] (With Y. N. Moschovakis) Notes on the theory of scales, *Cabal Seminar* 76–77, Proc. of Caltech-UCLA Logic Seminar 1976–77, eds. A. S. Kechris and Y. N. Moschovakis, Lecture Notes in Mathematics, **689**, Springer-Verlag (1978), 1–54.

[2] (With Y. N. Moschovakis) Two theorems about projective sets, *Israel J. Math.*, **12** (1972), 391–399.

[3] On projective ordinals, *J. Symb. Logic*, **39** (1974), 269–282.

[4] Measure and category in effective descriptive set theory, *Ann. Math. Logic*, **5** (1973), 337–384.

[5] The theory of countable analytical sets, *Trans. Amer. Math. Soc.*, **202** (1975), 259–297.

[6] (With L. A. Harrington) On characterizing Spector classes, *J. Symb. Logic*, **40** (1975), 19–24.

[7] (With L. A. Harrington) A basis result for Σ^0_3 set of reals with an application to minimal covers, *Proc. Amer. Math. Soc.*, **53** (1975), 445–448.

[8] (With L. A. Harrington) Π^1_2 singletons and $0^{\#}$, *Fund. Math.*, **95** (1977), 167–171.

[9] Countable ordinals and the analytical hierarchy I, *Pacific J. Math.*, **60** (1975), 223–227.

[10] (With D. A. Martin) A note on universal sets for classes of countable G_δ's, *Mathematika*, **22** (1975), 43–45.

[11] Countable ordinals and the analytical hierarchy II, *Ann. Math. Logic*, **15** (1978), 193–223.

[12] (With L. A. Harrington) On monotone vs. nonmonotone induction, *Bull. Amer. Math. Soc.*, **82** (1976), 888–890.

[13] (With Y. N. Moschovakis) Recursion in higher types, *Handbook of Mathematical Logic*, ed. J. Barwise, North Holland (1977), 681– 737.

[14] On a notion of smallness for subsets of the Baire space, *Trans. Amer. Math. Soc.* **229** (1977), 191–207.

[15] The perfect set theorem and definable wellorderings of the continuum, *J. Symb. Logic.* **43** (1978), 630–634.

[16] Minimal upper bounds for sequences of Δ^1_{2n}-degrees, *J. Symb. Logic*, **43** (1978), 502–507.

[17] Forcing in analysis, *Higher Set Theory*, Proceedings, Oberwolfach, Germany 1977, eds. G. H. Müller and D. S. Scott, Lecture Notes in Mathematics, **669**, Springer-Verlag (1978), 277–302.

[18] On Spector classes, *Cabal Seminar*, 76–77, ibid, 245–278.

[19] Classifying projective-like hierarchies, *Bull. Greek Math. Soc.*, **18** (1977), 254–275.

[20] On transfinite sequences of projective sets with an application to $\mathbf{\Sigma}^1_2$ equivalence relations, *Logic Colloquium 77*, eds. A. Macintyre, L. Pacholski, J. Paris, North-Holland, Amsterdam (1978), 155–160.

[21] (With D. A. Martin) On the theory of Π^1_3 sets of reals, *Bull. Amer. Math. Soc.*, **84** (1978), 149–151.

[22] AD and projective ordinals, *Cabal Seminar* 76–77, ibid 91– 132.

[23] Spector second order classes and reflection, *Generalized Theory II*, eds. J. E. Fenstad, R. O. Gandy and G. E. Sacks, North-Holland, Amsterdam (1978), 147–183.

[24] (With D. A. Martin) Infinite games and effective descriptive set theory, *Analytic Sets*, C. A. Rogers et al., Academic Press (1981), 404– 470.

[25] Recent advances in the theory of higher level projective sets, *The Kleene Symposium*, eds J. Barwise, H. J. Keisler and K. Kunen, North- Holland (1980), 149–166.

[26] The renaissance of descriptive set theory (in Greek), *Review Greek Math. Soc.*, **11** (1978), 1–20.

[27] (With L. A. Harrington) Ordinal games and their applications, Logic, Meth. and Phil. of Sc. VI, *Proc. of 6th Intern. Congr. of Logic, Math. and Phil. of Sc.*, Hannover (1979), 273–277.

[28] Homogeneous trees and projective scales, *Cabal Seminar* 77– 79, Proc. Caltech-UCLA Logic Seminar 1977–79, eds. A. S. Kechris, D. A. Martin and Y. N. Moschovakis, Lecture Notes in Mathematics, **839**, Springer-Verlag (1981), 33–73.

[29] A note on Wadge degrees, *Cabal Seminar* 77–79, ibid, 165– 169.

[30] Forcing with Δ perfect trees and minimal Δ-degrees, *J. Symb. Logic*, **46** (1981), 803–816.

[31] (With L. A. Harrington) On the determinacy of games on ordinals, *Ann. Math. Logic*, **20** (1981), 109–154.

[32] An overview of descriptive set theory, *Seminaire d'Initiation a l'Analyse*, G. Choquet, M. Rogalski and J. Saint Raymond (eds), 18e Année, (1978/1979) **4**, 1–35.

[33] (With E. M. Kleinberg, Y. N. Moschovakis and W.H. Woodin) The Axiom of Determinacy, strong partition relations and nonsingular measures, *Cabal Seminar* 77–79, ibid, 75–100.

[34] Souslin cardinals, κ-Souslin sets and the scale property in the hyperprojective hierarchy, *Cabal Seminar*, 77–79, ibid, 127–146.

[35] (With R. M. Solovay and J. R. Steel) The axiom of determinacy and the prewellordering property, *Cabal Seminar*, 77–79, ibid, 101–126.

[36] (With R. M. Solovay) On the relative consistency strength of determinacy hypotheses, *Trans. Amer. Math. Soc.*, **290** (1985), 179–211.

[37] (With D. A. Martin and R. M. Solovay) Introduction to Q-theory, *Cabal Seminar* 79–81, Proc. Caltech-UCLA Logic Seminar 1979–81, eds. A. S. Kechris, D. A. Martin, and Y. N. Moschovakis, Lecture Notes in Math., **1019**, Springer-Verlag (1983), 207–289.

[38] Effective Ramsey theorems in the projective hierarchy, *Proc. Herbrand Symposium/Logic Colloquium* 1981, ed. J. Stern, North-Holland (1982), 179–187.

[39] (With W.H. Woodin) Equivalence of partition properties and determinacy, *Proc. Nat. Acad. Sci.* USA, **80** (1983), 1783–86.

[40] The axiom of determinacy implies independent choices in $L(\mathbb{R})$, *J. Symb. Logic*, **49** (1984), 255–267.

[41] Determinacy and the structure of $L(\mathbb{R})$, *Proc. Symp. in Pure Math.*, Amer. Math. Soc., **42** (1985), 271–283.

[42] (With H. Becker) Sets of ordinals constructible from trees and the Third Victoria Delfino Problem, Axiomatic Set Theory, J. E. Baumgartner, D. A. Martin and S. Shelah, eds., *Contemporary Mathematics*, **31** (1984), 13–29.

[43] Determinacy with complicated strategies, *Proc. Amer. Math. Soc.*, **94** (1985), 333–336.

[44] Boundedness theorems for dilators and ptykes, *Ann. Pure Appl. Logic*, **52** (1991), 79–92.

[45] (With W.H. Woodin) A strong boundedness theorem for dilators, *Ann. Pure Appl. Logic*, **52** (1991), 93–97.

[46] (With W.H. Woodin) Ranks of differentiable functions, *Mathematika*, **33** (1986), 252–278.

[47] Sets of everywhere singular functions, *Recursion Theory Week, Proc. Oberwolfach*, 1984 Ed. by H.-D. Ebbinghaus, G. H. Müller and G. E. Sacks, Lecture Notes in Math., Springer-Verlag, **1141** (1985), 233–244.

[48] (With M. Ajtai) The set of functions with everywhere convergent Fourier series, *Trans. Amer. Math. Soc.*, **302** (1) (1987), 207–221.

[49] (With A. Louveau and W.H. Woodin) The structure of σ-ideals of compact sets, *Trans. Amer. Math. Soc.*, **301** (1) (1987), 263–288.

[50] A coding theorem for measures, *Cabal Seminar* 81-85, Proc. Caltech-UCLA Logic Seminar 1981-85, eds. A. S. Kechris, D. A. Martin and J. R. Steel, Lecture Notes in Math., **1333**, Springer-Verlag (1988), 103–109.

[51] "AD + Uniformization" is equivalent to "Half $\mathrm{AD}_{\mathbb{R}}$", *Cabal Seminar* 81-85, ibid, 98–102.

[52] Subsets of $\aleph_1$ constructible from a real, *Cabal Seminar* 81-85, ibid, 110–116.

[53] The complexity of antidifferentiation, Denjoy totalization and hyperarithmetic reals, *Proc. Intern. Congr. Math.*, Berkeley, CA 1986, 307–313.

[54] (With A. Louveau) Covering theorems for uniqueness and extended uniqueness sets, *Colloq. Math.*, LIX, **1** (1990), 63–79.

[55] (With R. Dougherty) The complexity of antidifferentiation, *Adv. in Math.*, **88** (2) (1991), 145–169.

[56] (With A. Louveau) A classification of Baire class 1 functions, *Trans. Amer. Math. Soc.*, **318** (1) (1990), 209–236.

[57] (With D. Marker and R. Sami) Π^1_1-Borel sets, *J. Symb. Logic*, **54** (1989), 915–920.

[58] (With R. Lyons) Ordinal rankings on measures annihilating thin sets, *Trans. Amer. Math. Soc.*, **310** (2) (1988), 747–758.

[59] (With A. Louveau and V. Tardivel) The class of synthesizable pseudomeasures, *Ill. J. Math.*, **35** (1) (1991), 107–146.

[60] (With R. Dougherty) Hausdorff measures and sets of uniqueness for trigonometric series, *Proc. Amer. Math. Soc.*, **105** (4) (1989), 894–897.

[61] The descriptive set theory of σ-ideals of compact sets, *Logic Colloquium '88*, Ferro et al. (eds), North Holland (1989), 117– 138.

[62] Amenable equivalence relations and Turing degrees, *J. Symb. Logic*, **56** (1991), 182–194.

[63] Hereditary properties of the class of closed uniqueness sets, *Israel J. Math.*, **73** (2) (1991), 189–198.

[64] (With L.A. Harrington and A. Louveau) A Glimm-Effros dichotomy for Borel equivalence relations, *J. Amer. Math. Soc.*, **3** (4) (1990), 903–928.

[65] The structure of Borel equivalence relations in Polish spaces, *Set Theory of the Continuum*, H. Judah, W. Just and W. H. Woodin (eds.), MSRI Publications, **26**, Springer-Verlag (1992), 89–102.

[66] Countable sections for locally compact group actions, *Erg. Th. and Dyn. Syst.*, **12** (1992), 283–295.

[67] (With A. Louveau) Descriptive set theory and harmonic analysis, *J. Symb. Logic*, **57** (2) (1992), 413–441.

[68] (With R. Dougherty and S. Jackson) The structure of hyperfinite Borel equivalence relations, *Trans. Amer. Math. Soc.*, **341** (1) (1994), 193–225.

[69] Amenable vs. hyperfinite Borel equivalence relations, *J. Symb. Logic*, **58** (3) (1993), 894–907.

[70] Countable sections for locally compact group actions, II, *Proc. Amer. Math. Soc.*, **120** (1) (1994), 241–247.

[71] (With H. Becker) Borel actions of Polish groups, *Bull. Amer. Math. Soc.*, **28** (2) (1993), 334–341.

[72] Topology and descriptive set theory, *Topology and its Appl.*, **58** (1994), 1–28.

[73] (With S. Solecki) Approximation of analytic by Borel sets and countable chain conditions, *Israel J. Math.*, **89** (1995), 343–356.

[74] (With A. Louveau) The classification of hypersmooth Borel equivalence relations, *J. Amer. Math. Soc*, **10** (1997), 215–242.

[75] (With G. Hjorth) Analytic equivalence relations and Ulm-type classifications, *J. Symb. Logic*, **60** (1995), 1273–1300.

[76] (With S. Solecki and S. Todorcevic) Borel chromatic numbers, *Adv. Math.*, **141** (1999), 1–44.

[77] (With G. Hjorth) Borel equivalence relations and classifications of countable models, *Ann. Pure and Applied Logic*, **82** (1996), 221–272.

[78] On the concept of $\mathbf{\Pi}^1_1$-completeness, *Proc. Amer. Math. Soc*, **125** (1997), 1811–1814.

[79] (With G. Hjorth and A. Louveau) Borel equivalence relations induced by actions of the symmetric group, *Ann. Pure and Applied Logic*, **92** (1998), 63–112.

[80] Rigidity properties of Borel ideals on the integers, *Topology and its Appl.*, **85** (1998), 195–205.

[81] The descriptive classification of some classes of C^*-algebras, *Proc. 6th Asian Logic Conference*, Eds. C.T. Chong et al., World Scientific, Singapore (1998), 121–149.

[82] (With G. Hjorth) New dichotomies for Borel equivalence relations, *Bull. Symb. Logic* **3(3)** (1997), 329–346.

[83] Descriptive dynamics, *Descriptive Set Theory and Dynamical Systems*, Ed. by M. Foreman et al., London Math. Society Lecture Note Series, **277**, Cambridge University Press, 2000.

[84] (With G. Hjorth) The complexity of the classification of Riemann surfaces and complex manifolds, *Illinois J. Math.*, **44(1)** (2000), 104–137.

[85] (With A. Gordon) Measurable enumeration of eigenelements, *Applicable Analysis*, **71** (1999), 41–62.

[86] (With R. Camerlo) Countable structures with a fixed group of automorphisms, *Israel J. Math.*, **117** (2000), 105–124.

[87] (With S. Adams) Linear algebraic groups and countable Borel equivalence relations, *J. Amer. Math. Soc.*, **13(4)** (2000), 909–943.

[88] On the classification problem for rank 2 torsion-free abelian groups, *J. London Math. Soc.*, **62(2)** (2000), 437–450.

[89] New directions in descriptive set theory, *Bulletin of Symbolic Logic*, **5(2)** (1999), 161–174.

[90] (With R. Dougherty) How many Turing degrees are there?, *Computability Theory and Its Applications*, Ed. by P.A. Cholak et al., Contemp. Mathematics, **257**, Amer. Math. Soc., (2000), 83–95.

[91] (With G. Hjorth) Recent developments in the theory of Borel reducibility, *Fund. Math.*, **170(1-2)** (2001), 21-52.

[92] (With N. Sofronidis) A strong generic ergodicity property of unitary and self-adjoint operators, *Erg. Theory and Dyn. Systems*, **21** (2001), 1459-1479.

[93] (With S. Gao) On the classification of Polish metric spaces up to isometry, *Memoirs of the Amer. Math. Soc.*, Vol. **161**, No. **766**, 2003.

[94] (With S. Jackson and A. Louveau) Countable Borel equivalence relations, *J. Math. Logic*, **2(1)**, (2002), 1-80.

[95] (With J. Clemens and S. Gao) Polish metric spaces: Their classification and isometry groups, *Bull. of Symbolic Logic*, **7(3)** (2001), 361-375.

[96] (With S. Buss, A. Pillay, and R. Shore) The prospects for mathematical logic in the 21st century, *Bull. of Symbolic Logic*, **7 (2)** (2001), 169–196.

[97] (With G. Hjorth) Rigidity theorems for actions of product groups and countable Borel equivalence relations, *Memoirs of the Amer. Math. Soc.,* **177 (833)**, 2005.

[98] Unitary representations and modular actions, *Journal of Math. Sciences,* **140(3)** (2007), 398-425.

[99] (With V. Pestov and S. Todorcevic) Fraïssé limits, Ramsey theory and topological dynamics of automorphism groups, *Geometric and Functional Analysis,* **15 (1)** (2005), 106–189.

[100] (With C. Rosendal) Turbulence, amalgamation and generic automorphisms of homogeneous structures, *Proceedings of the London Math. Society,* **94 (3)** (2007), 302–350.

[101] (With B.D. Miller) Means on equivalence relations, *Israel J. Math.*, **163** (2008), 241–262.

[102] (With T. Tsankov) Amenable actions and almost invariant sets, *Proc. Amer. Math. Soc.,* **136(2)** (2008), 687–697.

[103] (With W. H. Woodin) Generic codes for uncountable ordinals, partition properties and elementary embeddings, *Games, Scales and Suslin Cardinals: The Cabal Seminar, Volume I,* Lecture Notes in Logic, 31, ASL, Cambridge University Press, 2008, 379–397.

[104] (With W. H. Woodin) The equivalence of partition properties and determinacy, *Games, Scales and Suslin Cardinals: The Cabal Seminar, Volume I,* Lecture Notes in Logic, 31, ASL, Cambridge University Press, 2008, 355–378.

[105] (with A. Ioana and T. Tsankov) Subequivalence relations and positive-definite functions, *Groups, Geometry and Dynamics*, **3** (2009), 579–625.

[106] Set theory and dynamical systems, *Proceedings of the 13th International Congress of Logic, Methodology and Philosophy of Science*, C. Glymour, W. Wei, D.Westerstahl, Eds., College Publications, 2009, 97–107.

[107] Weak containment in the space of actions of a free group, *Israel J. Math.*, **189** (2012), 461–507.

[108] (With C. Conley) Measurable chromatic and independence numbers for ergodic graphs and group actions, *Groups, Geometry and Dynamics*, **7** (2013), 127–180.

[109] (With C. Conley and R. Tucker-Drob) Ultraproducts of measure preserving actions and graph combinatorics, *Erg. Theory and Dyn. Systems*, **33** (2013), 334–374.

[110] (With R. Tucker-Drob) The complexity of classification problems in ergodic theory, *Appalachian Set Theory*, Ed. by J. Cummings and E. Schimmerling, London Math. Society Lecture Note Series, **406**, 265-299, Cambridge University Press, 2013.

[111] In memoriam: Gregory Hjorth 1963–2011, *Bull. Symb. Logic*, **17(3)** (2011), 471–477.

[112] (With M. Sokić) Dynamical properties of the automorphism groups of the random poset and random distributive lattice, *Fund. Math.*, **218** (2012), 69–94

[113] Trigonometric series and set theory, *Wiadomości Matematyczne*, **48(2)** (2012), 109–118.

[114] (with C. Conley and B. Miller) Stationary probability measures and topological realizations, *Israel J. Math.*, **198(1)** (2013), 333–345.

[115] Dynamics of non-archimedean Polish groups, *European Congress of Mathematics, Krakow, 2-7 July, 2012*, R. Latala et al., Eds., 375-397, European Math. Society, 2014.

[116] (with O. Angel and R. Lyons) Random orderings and unique ergodicity of automorphism groups, *J. European Math. Society*, **16** (2014), 2059-2095.

[117] Commentary on Problem 50 (of Banach) in the Scottish Book, in: *The Scottish Book, Second Edition*, R.D. Mauldin, Birkhäuser, 2015, 127-129.

[118] (with D.A. Martin) On the theory of Π^1_3 sets of reals, II, in: *Ordinal Definability and Recursion Theory: The Cabal Seminar, Volume III*, Lecture Notes in Logic **43**, Cambridge University Press, 2016, 200-219.

[119] (with H. L. Macdonald), Borel equivalence relations and cardinal algebras, *Fund. Math.*, **235** (2016), 183–198.

[120] (with M. Sokić and S. Todorcevic) Ramsey properties of finite measure algebras and topological dynamics of the group of measure preserving automorphisms: some results and an open problem, *Contemporary Mathematics*, **690** (2017), 69–85.

[121] (with P.J. Burton) Invariant random subgroups and action versus representation maximality, *Proc. Amer. Math. Soc.*, **145(9)** (2017), 3961–3971.

[122] (with R. Chen) Structurable equivalence relations, *Fund. Math.*, **242** (2018), 109–185.

[123] (with A. Nies and K. Tent) The complexity of topological group isomorphism, *J. Symb. Logic*, **83(3)** (2018), 1190–1203.

[124] (with V. Quorning) Co-induction and invariant random subgroups, *Groups, Geometry, and Dynamics*, **13(4)** (2019), 1151–1193.

[125] (with A. S. Marks) Descriptive graph combinatorics, *preprint*, 139 pp, 2020.
https://pma.caltech.edu/people/alexander-kechris

[126] (with P.J. Burton) Weak containment of measure preserving group actions, *Erg. Theory and Dynam. Systems*, **40** (2020), 2681–2733.

[127] Quasi-invariant measures for continuous group actions, *Contemporary Mathematics*, **752** (2020), 113–120.

[128] Global aspects of measure preserving equivalence relations and graphs, *New Zealand Journal of Math., Vaughan Jones Memorial Issue*, **52** (2021), 691–726.

[129] (with J. Frisch and F. Shinko) Lifts of Borel actions on quotient spaces, *Israel J. Math., special volume for Benjamin Weiss*, **251** (2022), 379-421.

[130] (with M. Malicki, A. Panagiotopoulos and J. Zielinski) On Polish groups admitting non-essentially countable actions, *Erg. Theory and Dynam. Systems*, **42** (2022), 180–194.

[131] (with J. Frisch, F. Shinko and Z. Vidnyánszky) Realizations of countable Borel equivalence relations, *arXiv:2109.1246*, 108 pp, 2023. To appear in Memoirs Amer. Math. Soc.

[132] The spaces of measure preserving equivalence relations and graphs, *preprint*, 152 pp, 2024.
https://pma.caltech.edu/people/alexander-kechris

[133] (with M. Wolman) Ditzen's effective version of Nadkarni's Theorem, *preprint*, 22pp, 2024.
https://pma.caltech.edu/people/alexander-kechris

[134] (with M. Wolman) Invariant uniformization and reducibility, *preprint*, 32pp, 2024.
https://pma.caltech.edu/people/alexander-kechris

[135] (with T. Arant and P. Lutz) Borel graphable equivalence relations, *arXiv: 2409.08624*

[136] Definable cardinality, *preprint*, 7pp, 2025.
https://pma.caltech.edu/people/alexander-kechris

6/21/2025