

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, New York, 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 Univ. Press, Cambridge, 1987 (reprinted in 1989).
- [3] *Classical Descriptive Set Theory*, Graduate Texts in Mathematics, **156**, Springer-Verlag, New York, 1995.
- [4] (With H. Becker) *The Descriptive Set Theory of Polish Group Actions*, London Math. Society Lecture Note Series, **232**, Cambridge University Press, Cambridge, 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, Cambridge, 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*, to appear in Cambridge Tracts in Mathematics, Cambridge University Press, 2024.
Pre-publication version available in:
<https://pma.caltech.edu/people/alexander-kechris>

Papers

- [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_3^0 set of reals with an application to minimal covers, *Proc. Amer. Math. Soc.*, **53** (1975), 445–448.
- [8] (With L. A. Harrington) Π_2^1 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_{2n}^1 -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 Σ_2^1 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_3^1 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 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 Π_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. Latała 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_3^1 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*, 105 pp, 2023.
- [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>

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