

## References

- [1] C. A. Akemann, G. K. Pedersen, and J. Tomiyama, [Multipliers of  \$C^\*\$ -algebras](#). *J. Functional Analysis* **13** (1973), 277–301
- [2] M. Amini, K. Li, D. Sawicki, and A. Shakibazadeh, [Dynamic asymptotic dimension for actions of virtually cyclic groups](#). *Proc. Edinb. Math. Soc. (2)* **64** (2021), no. 2, 364–372
- [3] W. Arveson, [Notes on extensions of  \$C^\*\$ -algebras](#). *Duke Math. J.* **44** (1977), no. 2, 329–355
- [4] S. Barlak and X. Li, [Cartan subalgebras and the UCT problem](#). *Adv. Math.* **316** (2017), 748–769
- [5] S. Barlak and X. Li, [Cartan subalgebras and the UCT problem, II](#). *Math. Ann.* **378** (2020), no. 1-2, 255–287
- [6] S. Barlak and G. Szabó, [Rokhlin actions of finite groups on UHF-absorbing  \$C^\*\$ -algebras](#). *Trans. Amer. Math. Soc.* **369** (2017), no. 2, 833–859
- [7] B. Blackadar,  [\$K\$ -theory for operator algebras](#). 2nd edn., Math. Sci. Res. Inst. Publ. 5, Cambridge University Press, Cambridge, 1998
- [8] B. Blackadar, [Operator algebras](#). Encyclopedia Math. Sci. 122, Springer, Berlin, 2006
- [9] J. Bosa, N. P. Brown, Y. Sato, A. Tikuisis, S. White, and W. Winter, [Covering dimension of  \$C^\*\$ -algebras and 2-coloured classification](#). *Mem. Amer. Math. Soc.* **257** (2019), no. 1233, vii+97
- [10] N. P. Brown and N. Ozawa,  [\$C^\*\$ -algebras and finite-dimensional approximations](#). Grad. Stud. Math. 88, American Mathematical Society, Providence, RI, 2008
- [11] J. Carrión, J. Gabe, C. Schafhauser, A. Tikuisis, and S. White, [Classifying  \$\*\$ -homomorphisms I: Unital simple nuclear  \$C^\*\$ -algebras](#). 2023, arXiv:2307.06480
- [12] J. Castillejos and S. Evington, [Nuclear dimension of simple stably projectionless  \$C^\*\$ -algebras](#). *Anal. PDE* **13** (2020), no. 7, 2205–2240
- [13] J. Castillejos, S. Evington, A. Tikuisis, S. White, and W. Winter, [Nuclear dimension of simple  \$C^\*\$ -algebras](#). *Invent. Math.* **224** (2021), no. 1, 245–290
- [14] J. Chabert, S. Echterhoff, and H. Oyono-Oyono, [Going-down functors, the Künneth formula, and the Baum–Connes conjecture](#). *Geom. Funct. Anal.* **14** (2004), no. 3, 491–528
- [15] X. Chen and J. Zhang, [Large scale properties for bounded automata groups](#). *J. Funct. Anal.* **269** (2015), no. 2, 438–458
- [16] M. D. Choi and E. G. Effros, [Nuclear  \$C^\*\$ -algebras and injectivity: The general case](#). *Indiana Univ. Math. J.* **26** (1977), no. 3, 443–446
- [17] E. Christensen, A. M. Sinclair, R. R. Smith, S. A. White, and W. Winter, [Perturbations of nuclear  \$C^\*\$ -algebras](#). *Acta Math.* **208** (2012), no. 1, 93–150
- [18] C. T. Conley, S. C. Jackson, A. S. Marks, B. M. Seward, and R. D. Tucker-Drob, [Borel asymptotic dimension and hyperfiniteness equivalence relations](#). *Duke Math. J.* **172** (2023), no. 16, 3175–3226

- [19] A. Connes, [Classification of injective factors. Cases  \$II\_1\$ ,  \$II\_\infty\$ ,  \$III\_\lambda\$ ,  \$\lambda \neq 1\$](#) . *Ann. of Math.* (2) **104** (1976), no. 1, 73–115
- [20] A. Connes, [On the cohomology of operator algebras](#). *J. Functional Analysis* **28** (1978), no. 2, 248–253
- [21] M. Dadarlat, Some remarks on the universal coefficient theorem in  $KK$ -theory. In *Operator algebras and mathematical physics (Constanța, 2001)*, pp. 65–74, Theta, Bucharest, 2003
- [22] G. A. Elliott, [The classification problem for amenable  \$C^\*\$ -algebras](#). In *Proceedings of the International Congress of Mathematicians, Vol. 1, 2 (Zürich, 1994)*, pp. 922–932, Birkhäuser, Basel, 1995
- [23] G. A. Elliott, G. Gong, H. Lin, and Z. Niu, [On the classification of simple amenable  \$C^\*\$ -algebras with finite decomposition rank, II](#). 2015, arXiv:1507.03437
- [24] G. A. Elliott, G. Gong, H. Lin, and Z. Niu, [The classification of simple separable unital  \$\mathbb{Z}\$ -stable locally ASH algebras](#). *J. Funct. Anal.* **272** (2017), no. 12, 5307–5359
- [25] T. Giordano, I. Putnam, and C. Skau, [Affable equivalence relations and orbit structure of Cantor dynamical systems](#). *Ergodic Theory Dynam. Systems* **24** (2004), no. 2, 441–475
- [26] G. Gong, H. Lin, and Z. Niu, [A classification of finite simple amenable  \$\mathbb{Z}\$ -stable  \$C^\*\$ -algebras, I:  \$C^\*\$ -algebras with generalized tracial rank one](#). *C. R. Math. Acad. Sci. Soc. R. Can.* **42** (2020), no. 3, 63–450
- [27] G. Gong, H. Lin, and Z. Niu, [A classification of finite simple amenable  \$\mathbb{Z}\$ -stable  \$C^\*\$ -algebras, II:  \$C^\*\$ -algebras with rational generalized tracial rank one](#). *C. R. Math. Acad. Sci. Soc. R. Can.* **42** (2020), no. 4, 451–539
- [28] B. I. Gray, [Spaces of the same  \$n\$ -type, for all  \$n\$](#) . *Topology* **5** (1966), 241–243
- [29] E. Guentner, R. Tessera, and G. Yu, [A notion of geometric complexity and its application to topological rigidity](#). *Invent. Math.* **189** (2012), no. 2, 315–357
- [30] E. Guentner, R. Tessera, and G. Yu, [Discrete groups with finite decomposition complexity](#). *Groups Geom. Dyn.* **7** (2013), no. 2, 377–402
- [31] E. Guentner, R. Willett, and G. Yu, [Dynamical complexity and controlled operator  \$K\$ -theory](#). 2016, arXiv:1609.02093, to appear in *Astérisque*
- [32] E. Guentner, R. Willett, and G. Yu, [Dynamic asymptotic dimension: relation to dynamics, topology, coarse geometry, and  \$C^\*\$ -algebras](#). *Math. Ann.* **367** (2017), no. 1-2, 785–829
- [33] U. Haagerup, [All nuclear  \$C^\*\$ -algebras are amenable](#). *Invent. Math.* **74** (1983), no. 2, 305–319
- [34] N. Higson and E. Guentner, [Group  \$C^\*\$ -algebras and  \$K\$ -theory](#). In *Noncommutative geometry*, pp. 137–251, Lecture Notes in Math. 1831, Springer, Berlin, 2004
- [35] N. Higson and G. Kasparov,  [\$E\$ -theory and  \$KK\$ -theory for groups which act properly and isometrically on Hilbert space](#). *Invent. Math.* **144** (2001), no. 1, 23–74
- [36] N. Higson and J. Roe, *Analytic  $K$ -homology*. Oxford Math. Monogr., Oxford University Press, Oxford, 2000
- [37] A. Jaime and R. Willett, [Complexity rank for  \$C^\*\$ -algebras](#). *Münster J. Math.* **16** (2023), no. 1, 51–94

- [38] C. U. Jensen, *Les foncteurs dérivés de  $\varprojlim$  et leurs applications en théorie des modules*. Lecture Notes in Math. 254, Springer, Berlin, 1972
- [39] B. E. Johnson, *Approximate diagonals and cohomology of certain annihilator Banach algebras*. *Amer. J. Math.* **94** (1972), 685–698
- [40] G. G. Kasparov, *Hilbert  $C^*$ -modules: theorems of Stinespring and Voiculescu*. *J. Operator Theory* **4** (1980), no. 1, 133–150
- [41] T. Kato, *Perturbation theory for linear operators*. Classics Math., Springer, Berlin, 1995
- [42] E. Kirchberg, *Exact  $C^*$ -algebras, tensor products, and the classification of purely infinite algebras*. In *Proceedings of the International Congress of Mathematicians, Vol. 1, 2 (Zürich, 1994)*, pp. 943–954, Birkhäuser, Basel, 1995
- [43] E. Kirchberg, *Central sequences in  $C^*$ -algebras and strongly purely infinite algebras*. In *Operator Algebras: The Abel Symposium 2004*, pp. 175–231, Abel Symp. 1, Springer, Berlin, 2006
- [44] E. Kirchberg and S. Wassermann, *Permanence properties of  $C^*$ -exact groups*. *Doc. Math.* **4** (1999), 513–558
- [45] E. C. Lance, *Hilbert  $C^*$ -modules. A toolkit for operator algebraists*. London Math. Soc. Lecture Note Ser. 210, Cambridge University Press, Cambridge, 1995
- [46] J. Milnor, *Introduction to algebraic  $K$ -theory*. Ann. of Math. Stud. 72, Princeton University Press, Princeton, NJ; University of Tokyo Press, Tokyo, 1971
- [47] H. Oyono-Oyono and G. Yu, *On quantitative operator  $K$ -theory*. *Ann. Inst. Fourier (Grenoble)* **65** (2015), no. 2, 605–674
- [48] H. Oyono-Oyono and G. Yu, *Quantitative  $K$ -theory and the Künneth formula for operator algebras*. *J. Funct. Anal.* **277** (2019), no. 7, 2003–2091
- [49] G. K. Pedersen, *A commutator inequality*. In *Operator algebras, mathematical physics, and low-dimensional topology (Istanbul, 1991)*, pp. 233–235, Res. Notes Math. 5, A K Peters, Wellesley, MA, 1993
- [50] N. C. Phillips, *A classification theorem for nuclear purely infinite simple  $C^*$ -algebras*. *Doc. Math.* **5** (2000), 49–114
- [51] J. Renault,  *$C^*$ -algebras and dynamical systems*. Publ. Mat. IMPA, 27<sup>o</sup> Colóq. Bras. Mat., Instituto Nacional de Matemática Pura e Aplicada (IMPA), Rio de Janeiro, 2009
- [52] J. Roe, *Lectures on coarse geometry*. Univ. Lecture Ser. 31, American Mathematical Society, Providence, RI, 2003
- [53] M. Rørdam, *Classification of nuclear, simple  $C^*$ -algebras*. In *Classification of nuclear  $C^*$ -algebras. Entropy in operator algebras*, pp. 1–145, Encyclopaedia Math. Sci. 126, Springer, Berlin, 2002
- [54] M. Rørdam, F. Larsen, and N. Laustsen, *An introduction to  $K$ -theory for  $C^*$ -algebras*. London Math. Soc. Stud. Texts 49, Cambridge University Press, Cambridge, 2000
- [55] J. Rosenberg and C. Schochet, *The Künneth theorem and the universal coefficient theorem for Kasparov’s generalized  $K$ -functor*. *Duke Math. J.* **55** (1987), no. 2, 431–474
- [56] C. L. Schochet, *The UCT, the Milnor sequence, and a canonical decomposition of the Kasparov groups*.  *$K$ -Theory* **10** (1996), no. 1, 49–72

- [57] C. L. Schochet, [The fine structure of the Kasparov groups. II. Topologizing the UCT.](#) *J. Funct. Anal.* **194** (2002), no. 2, 263–287
- [58] C. L. Schochet, [A Pext primer: Pure extensions and  \$\lim^1\$  for infinite abelian groups.](#) NYJM Monogr. 1, State University of New York, University at Albany, Albany, NY, 2003
- [59] A. Sims, Hausdorff étale groupoids and their  $C^*$ -algebras. In *Operator algebras and dynamics: Groupoids, crossed products, and Rokhlin dimension*, edited by F. Perera, pp. 59–120, Adv. Courses Math. CRM Barcelona, Birkhäuser/Springer, Cham, 2020
- [60] G. Skandalis, [Une notion de nucléarité en  \$K\$ -théorie \(d’après J. Cuntz\).](#) *K-Theory* **1** (1988), no. 6, 549–573
- [61] G. Skandalis, J. L. Tu, and G. Yu, [The coarse Baum–Connes conjecture and groupoids.](#) *Topology* **41** (2002), no. 4, 807–834
- [62] K. Thomsen, [On absorbing extensions.](#) *Proc. Amer. Math. Soc.* **129** (2001), no. 5, 1409–1417
- [63] A. Tikuisis, S. White, and W. Winter, [Quasidiagonality of nuclear  \$C^\*\$ -algebras.](#) *Ann. of Math. (2)* **185** (2017), no. 1, 229–284
- [64] J.-L. Tu, [La conjecture de Baum–Connes pour les feuilletages moyennables.](#) *K-Theory* **17** (1999), no. 3, 215–264
- [65] S. Wassermann, [Injective  \$W^\*\$ -algebras.](#) *Math. Proc. Cambridge Philos. Soc.* **82** (1977), no. 1, 39–47
- [66] C. A. Weibel, [An introduction to homological algebra.](#) Cambridge Stud. Adv. Math. 38, Cambridge University Press, Cambridge, 1994
- [67] R. Willett, [Approximate ideal structures and  \$K\$ -theory.](#) *New York J. Math.* **27** (2021), 1–52
- [68] R. Willett and G. Yu, [Controlled  \$KK\$ -theory I: A Milnor exact sequence.](#) 2020, arXiv:2011.10906
- [69] R. Willett and G. Yu, [Higher index theory.](#) Cambridge Stud. Adv. Math. 189, Cambridge University Press, Cambridge, 2020
- [70] W. Winter and J. Zacharias, [The nuclear dimension of  \$C^\*\$ -algebras.](#) *Adv. Math.* **224** (2010), no. 2, 461–498
- [71] G. Yu, [The Novikov conjecture for groups with finite asymptotic dimension.](#) *Ann. of Math. (2)* **147** (1998), no. 2, 325–355
- [72] S. Zhang, [A property of purely infinite simple  \$C^\*\$ -algebras.](#) *Proc. Amer. Math. Soc.* **109** (1990), no. 3, 717–720