

A NOTE ON 2-LOCAL REPRESENTATIONS OF C^* -ALGEBRAS

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Abstract. We survey the results on linear local and 2-local homomorphisms and zero products preserving operators between C^* -algebras, and we incorporate some new precise observations and results to prove that every bounded linear 2-local homomorphism between C^* -algebras is a homomorphism. Consequently, every linear 2-local $*$ -homomorphism between C^* -algebras is a $*$ -homomorphism.

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REFERENCES

- [1] J. ALAMINOS, M. BRESAR, J. EXTREMERA, A. VILLENA, *Characterizing homomorphisms and derivations on C^* -algebras*, Proc. Roy. Soc. Edinb. A **137**, 1–7 (2007).
- [2] C. BADEA, *The Gleason-Kahane-Żelazko theorem and Gel'fand theory without multiplication*, Université de Paris-sud, Département de mathématiques, Orsay, France, 1993.
- [3] C. BATTY, L. MOLNAR, *On topological reflexivity of the groups of $*$ -automorphisms and surjective isometries of $B(H)$* , Arch. Math. **67** (1996), 415–421.
- [4] M. BRESAR, *Characterization of derivations on some normed algebras with involution*, J. Algebra **152** (1992), 454–462.
- [5] M. BREŠAR, P. ŠSEMRL, *On local automorphisms and mappings that preserve idempotents*, Studia Math. **113**, 2 (1995), 101–108.
- [6] M. BURGOS, F. J. FERNÁNDEZ-POLO, J. J. GARCÉS, J. MARTÍNEZ MORENO, A. M. PERALTA, *Orthogonality preservers in C^* -algebras, JB*-algebras and JB*-triples*, J. Math. Anal. Appl. **348** (2008), 220–233.
- [7] M. BURGOS, F. J. FERNÁNDEZ-POLO, J. J. GARCÉS, A. M. PERALTA, *Orthogonality preservers Revisited*, Asian-European Journal of Mathematics **2**, 3 (2009), 387–405.
- [8] M. BURGOS, F. J. FERNÁNDEZ-POLO, J. J. GARCÉS, A. M. PERALTA, *Local triple derivations on C^* -algebras*, Communications in Algebra **42** (2014), 1276–1286.
- [9] M. BURGOS, F. J. FERNÁNDEZ-POLO, A. M. PERALTA, *Local triple derivations on C^* -algebras and JB*-triples*, Bull. London Math. Soc. **46** (2014) 709–724. doi:10.1112/blms/bdu024
- [10] E. CARTAN, *Sur les domaines bornés homogènes de l'espace de n variables complexes*, Abh. Math. Sem. Univ. Hamburg **11** (1935), 116–162.
- [11] CH.-H. CHU, *Jordan Structures in Geometry and Analysis*, Cambridge Tracts in Math. 190, Cambridge. Univ. Press, Cambridge, 2012.
- [12] R. CRIST, *Local automorphisms*, Proc. Amer. Math. Soc. **128** (1999), 1409–1414.
- [13] H. G. DALES, *Banach algebras and automatic continuity*, London Mathematical Society Monographs (New Series), Volume 24, Oxford Science Publications. The Clarendon Press, Oxford University Press, New York, 2000.
- [14] F. J. FERNÁNDEZ-POLO, A. MOLINO SALAS, A. M. PERALTA, *Local triple derivations on real C^* -algebras and JB*-triples*, to appear in Bull. Malaysian Math. Sci. Soc.
- [15] A. FOŠNER, *2-local Jordan automorphisms on operator algebras*, Studia Math. **209**, 3 (2012), 235–246.
- [16] J. J. GARCÉS, A. M. PERALTA, *Orthogonal forms and orthogonality preservers on real function algebras*, Linear and Multilinear Algebra, **62**, 3 (2014), 275–296. DOI:10.1080/03081087.2013.772998.

- [17] S. R. GARCIA, J. TENER, *Unitary equivalence of a matrix to its transpose*, J. Operator Theory **68**, 1 (2012), 179–203.
- [18] J. J. GARCÉS, A. M. PERALTA, D. PUGLISI, M. I. RAMÍREZ, *Orthogonally additive, orthogonality preserving, holomorphic mappings between C^* -algebras*, Abstr. Appl. Anal. 2013, Art. ID 415354, 9 pp.
- [19] A. M. GLEASON, *A characterization of maximal ideals*, J. Analyse Math. **19** (1967), 171–172.
- [20] U. HAAGERUP, *The Grothendieck inequality for bilinear forms on C^* -algebras*, Adv. Math. **56** (1985), 93–116.
- [21] D. HADWIN, J. LI, *Local derivations and local automorphisms*, J. Math. Anal. Appl. **290**, 2 (2004), 702–714.
- [22] P. R. HALMOS, *A Linear Algebra Problem Book*, Dolciani Math. Exp., vol. 16, Math. Assoc. America, Washington, DC 1995.
- [23] B. E. JOHNSON, *Local derivations on C^* -algebras are derivations*, Trans. Amer. Math. Soc. **353** (2001), 313–325.
- [24] R. V. KADISON, *Local derivations*, J. Algebra **130** (1990), 494–509.
- [25] J. P. KAHANE, W. ŹELAZKO, *A characterization of maximal ideals in commutative Banach algebras*, Studia Math. **29** (1968), 339–343.
- [26] W. KAUP, *A Riemann mapping theorem for bounded symmetric domains in complex Banach spaces*, Math. Z. **183** (1983), 503–529.
- [27] S. O. KIM, J. S. KIM, *Local automorphisms and derivations on M_n* , Proc. Amer. Math. Soc. **132**, 5 (2004), 1389–1392.
- [28] S. O. KIM, J. S. KIM, *Local automorphisms and derivations on certain C^* -algebras*, Proc. Amer. Math. Soc. **133**, 11 (2005), 3303–3307.
- [29] S. KOWALSKI, Z. SŁODKOWSKI, *A characterization of multiplicative linear functionals in Banach algebras*, Studia Math. **67** (1980), 215–223.
- [30] D. R. LARSON AND A. R. SOUOUR, *Local derivations and local automorphisms of $B(X)$* , Proc. Sympos. Pure Math. **51**, Part 2, Providence, Rhode Island 1990, pp. 187–194.
- [31] J. LI, Z. PAN, *Annihilator-preserving maps, multipliers, and derivations*, Linear Algebra Appl. **423** (2010), 5–13.
- [32] J.-H. LIU, N.-C. WONG, *2-Local automorphisms of operator algebras*, J. Math. Anal. Appl. **321** (2006), 741–750.
- [33] M. MACKEY, *Local derivations on Jordan triples*, Bull. London Math. Soc. **45**, 4 (2013), 811–824. doi: 10.1112/blms/bdt007
- [34] L. MOLNAR, *2-local isometries of some operator algebras*, Proc. Edinburgh Math. Soc. **45** (2002), 349–352.
- [35] L. MOLNAR, *Local automorphisms of operator algebras on Banach spaces*, Proc. Amer. Math. Soc. **131** (2003), 1867–1874.
- [36] L. MOLNAR, *Selected preserver problems on algebraic structures of linear operators and on function spaces*, Lecture Notes in Mathematics, 1895. Springer-Verlag, Berlin, 2007.
- [37] L. MOLNAR AND P. ŠEMRL, *Local automorphisms of the unitary group and the general linear group on a Hilbert space*, Expo. Math. **18** (2000), 231–238.
- [38] F. D. MURNAGHAN, *On the unitary invariants of a square matrix*, An. Acad. Brasil. Cienc. **26** (1954), 1–7.
- [39] C. PEARCY, *A complete set of unitary invariants for 3×3 complex matrices*, Trans. Amer. Math. Soc. **104** (1962), 425–429.
- [40] G. K. PEDERSEN, *C^* -algebras and their automorphism groups*, Academic Press, London 1979.
- [41] F. POP, *On local representation of von Neumann algebras*, Proc. Amer. Math. Soc. **132**, 12 (2004), 3569–3576.
- [42] S. SAKAI, *C^* -algebras and W^* -algebras*, Springer-Verlag, Berlin 1971.
- [43] P. ŠEMRL, *Local automorphisms and derivations on $B(H)$* , Proc. Amer. Math. Soc. **125** (1997), 2677–2680.
- [44] V. SHUL’MAN, *Operators preserving ideals in C^* -algebras*, Studia Math. **109** (1994), 67–72.
- [45] W. SPECHT, *Zur Theorie der Matrizen. II.*, Jber. Deutsch. Math. Verein. **50** (1940), 19–23.
- [46] H. UPMEIER, *Symmetric Banach Manifolds and Jordan C^* -algebras*, North Holland, Amsterdam, 1985.

- [47] A. R. VILLENA, *Automatic continuity in associative and nonassociative context*, Irish Math. Soc. Bull. **46** (2001), 43–76.
- [48] NG.-CH. WONG, *Zero product preservers of C^* -algebras*, Contemp. Math. **435** (2007), 377–380.
- [49] W. ŻELAZKO, *A characterization of multiplicative linear functionals in complex Banach algebras*, Studia Math. **30** (1968), 83–85.
- [50] J. ZHANG, F. PAN, A. YANG, *Local derivations on certain CSL algebras*, Linear Algebra Appl. **413** (2006), 93–99.