

References

Books

- D.M. Arnold — [A] *Finite Rank Torsion-free Abelian Groups and Rings*. Lecture Notes in Mathematics, vol. 931 (Springer, New York, 1982)
- D.M. Arnold — [A1] *Abelian Groups and Representations of Finite Partially Ordered Sets* (Springer, New York, 2000)
- H. Cartan, S. Eilenberg — [CE] *Homological Algebra* (Princeton University Press, Princeton, 1956)
- P.C. Eklof, A.H. Mekler — [EM] *Almost Free Modules. Set-theoretic Methods*, revised edition (Elsevier, Amsterdam, 2002)
- T. Faticoni — [Fa] *Direct Sum Decompositions of Torsion-Free Finite Rank Groups*. Pure Applied Mathematics, vol. 285 (Chapman & Hall, Boca Raton, 2007)
- T. Faticoni — [Fat] *Modules over Endomorphism Rings*. Encyclopedia of Mathematics and Its Applications, vol. 130 (Cambridge University Press, Cambridge, 2010)
- S. Feigelstock — [Fe] *Additive Groups of Rings, vol. I and II*. Research Notes in Mathematics, vols. 83 and 169 (Pitman Advanced Publishing Program, Boston, 1983, 1988)
- L. Fuchs — [AG] *Abelian Groups*. (Akadémiai Kiadó, Budapest, 1958, Pergamon Press, London, 1960, 1967)
- L. Fuchs — [IAG] *Infinite Abelian Groups*, vols. I and II. Pure Applied Mathematics, vol. 36 (Academic, New York, London, 1970, 1973)
- R. Göbel, J. Trlifaj — [GT] *Approximations and Endomorphism Algebras and Modules*. Expositions in Mathematics, vol. 41 (W. de Gruyter, Berlin, New York, 2006)
- P. Griffith — [G] *Infinite Abelian Groups*. Chicago Lectures in Mathematics (University of Chicago Press, Chicago, 1970)
- T. Jech — [J] *Set Theory*. Pure and Applied Mathematics, vol. 79 (Academic, New York, London, 1978)
- C.U. Jensen — [Je] *Les Fonctions Dérivées de \varprojlim et leur Applications en Théorie des Modules*. Lecture Notes in Mathematics, vol. 254 (Springer, New York, 1972)
- I. Kaplansky — [K] *Infinite Abelian Groups* (University of Michigan Press, Ann Arbor, 1954, 1969)
- P.A. Krylov, A.V. Mikhalev, A.A. Tuganbaev — [KMT] *Endomorphism Rings of Abelian Groups* (Kluwer Academic, Dordrecht, Boston, London, 2010)
- S. Mac Lane — [M] *Homology* (Springer, New York, 1963)

- A. Mader — [Ma] *Almost Completely Decomposable Groups*. Algebra, Logic and Applications, vol. 13 (Gordon and Breach, Amsterdam, 2000)
- L. Salce — [S] *Struttura dei p -Gruppi Abelian* (Pitagora, Bologna, 1980)

Papers

- U. Albrecht — [1] Chain conditions in endomorphism rings. *Rocky Mt. J. Math.* **15**, 91–106 (1985). — [2] Abelian groups with self-injective endomorphism rings. *Commun. Algebra* **15**, 2451–2471 (1987). — [3] Endomorphism rings and a generalization of torsion-freeness and purity. *Commun. Algebra* **17**, 1101–1135 (1989). — [4] A -reflexive abelian groups. *Houst. J. Math.* **15**, 459–480 (1989). — [5] Endomorphism rings, tensor products and Fuchs' problem, vol. 47, in *Contemporary Mathematics*, vol. 130 (American Mathematical Society, Providence, RI, 1992), pp. 17–31. — [6] A -projective resolutions and an Azumaya theorem for a class of mixed abelian groups. *Czechoslov. Math. J.* **51**, 73–93 (2001). — [7] Fuchs' problem 34 for mixed abelian groups. *Proc. Am. Math. Soc.* **131**, 1021–1029 (2003)
- U. Albrecht, S. Breaz, C. Vinsonhaler, W. Wickless — [1] Cancellation properties for quotient divisible groups. *J. Algebra* **317**, 424–434 (2007)
- U. Albrecht, S. Breaz, W. Wickless — [1] Self-small abelian groups. *Bull. Aust. Math. Soc.* **80**, 205–216 (2009)
- U. Albrecht, T. Faticoni — [1] Abelian groups flat as modules over their endomorphism ring. *Commun. Algebra* **21**, 3403–3423 (1993)
- U. Albrecht, H.P. Goeters, W. Wickless — [1] The flat dimension of mixed abelian groups as E -modules. *Rocky Mt. J. Math.* **25**, 569–590 (1995)
- U. Albrecht, J. Hausen — [1] Mixed modules with the summand intersection property, in *Abelian Groups and Modules*. Lecture Notes in Pure and Applied Mathematics, vol. 182 (Marcel Dekker, New York, 1996), pp. 123–132
- U. Albrecht, P. Hill — [1] Butler groups of infinite rank and Axiom 3. *Czechoslov. Math. J.* **37**, 293–309 (1987). — [2] Separable vector groups, in *Abelian Group Theory, Contemporary Mathematics*, vol. 87 (American Mathematical Society, Providence, RI, 1989), pp. 155–160
- H.W.K. Angad-Gaur — [1] The homological dimension of a torsion-free abelian group of finite rank as a module over its ring of endomorphisms. *Rend. Sem. Mat. Univ. Padova* **57**, 299–309 (1977)
- J.W. Armstrong — [1] On the indecomposability of torsion-free abelian groups. *Proc. Am. Math. Soc.* **16**, 323–325 (1965)
- D.M. Arnold — [1] A duality for quotient divisible abelian groups of finite rank. *Pac. J. Math.* **42**, 11–15 (1972). — [2] Strongly homogeneous torsion-free abelian groups of finite rank. *Proc. Am. Math. Soc.* **56**, 67–72 (1976). — [3] Genera and direct sum decompositions of torsion-free modules, in *Abelian Group Theory*. Lecture Notes in Mathematics, vol. 616 (Springer, Berlin, 1977), pp. 197–218. — [4] Pure subgroups of finite rank completely decomposable groups, in *Abelian Group Theory*. Lecture Notes in Mathematics, vol. 874 (Springer, Berlin, 1981), pp. 1–31. — [5] Endomorphism rings and subgroups of finite rank torsion-free abelian groups. *Rocky Mt. J. Math.* **12**, 241–256 (1982). — [6] Direct sums of local torsion-free abelian groups. *Proc. Am. Math. Soc.* **130**, 1611–1617 (2002)
- D.M. Arnold, M. Dugas — [1] Butler groups with finite typesets and free groups with distinguished subgroups. *Commun. Algebra* **21**, 1947–1982 (1993). — [2] Locally free finite rank Butler groups and near isomorphism, in *Abelian Groups and Modules* (Kluwer Academic, Dordrecht, 1995), pp. 41–48. — [3] A survey of Butler groups and the role of representations, in *Abelian Groups and Modules*. Lecture Notes in Pure and Applied Mathematics, vol. 182 (Marcel Dekker, New York, 1996), pp. 1–13
- D.M. Arnold, J. Hausen — [1] A characterization of modules with the summand intersection property. *Commun. Algebra* **18**, 519–528 (1990)

- D.M. Arnold, R. Hunter, F. Richman — [1] Global Azumaya theorems in additive categories. *J. Pure Appl. Algebra* **16**, 223–242 (1980)
- D.M. Arnold, E.L. Lady — [1] Endomorphism rings and direct sums of torsion-free abelian groups. *Trans. Am. Math. Soc.* **211**, 225–237 (1975)
- D.M. Arnold, C.E. Murley — [1] Abelian groups A such that $\text{Hom}(A, -)$ preserves direct sums of copies of A . *Pac. J. Math.* **56**, 7–20 (1975)
- D.M. Arnold, R. Pierce, J. Reid, C. Vinsonhaler, W. Wickless — [1] Torsion-free abelian groups of finite rank projective as modules over their endomorphism rings. *J. Algebra* **71**, 1–10 (1981)
- D.M. Arnold, K.M. Rangaswamy — [1] A note on countable Butler groups. *Boll. Unione Mat. Ital. Sez. B Artic. Ric. Mat.* **10**(8), 605–611 (2007)
- D.M. Arnold, C. Vinsonhaler — [1] Pure subgroups of finite rank completely decomposable groups. II. *Lecture Notes in Mathematics*, vol. 1006 (Springer, Berlin, 1983), pp. 97–143. — [2] Representing graphs for a class of torsion-free abelian groups, in *Abelian Group Theory* (Gordon and Breach, London, 1987), pp. 309–332. — [3] Endomorphism rings of Butler groups. *J. Aust. Math. Soc.* **42**, 322–329 (1987). — [4] Duality and invariants for Butler groups. *Pac. J. Math.* **148**, 1–10 (1991). — [5] Isomorphism invariants for abelian groups. *Trans. Am. Math. Soc.* **330**, 711–724 (1992). — [6] Finite rank Butler groups: a survey of recent results, in *Abelian Groups*. *Lecture Notes in Pure and Applied Mathematics*, vol. 146 (Marcel Dekker, London, 1993), pp. 17–41
- R. Baer — [1] The decomposition of enumerable, primary, abelian groups into direct summands. *Q. J. Math. Oxford* **6**, 217–221 (1935). — [2] The decomposition of abelian groups into direct summands. *Q. J. Math. Oxford* **6**, 222–232 (1935). — [3] Types of elements and characteristic subgroups of abelian groups. *Proc. Lond. Math. Soc.* **39**, 481–514 (1935). — [4] The subgroup of elements of finite order of an abelian group. *Ann. Math.* **37**, 766–781 (1936). — [5] Primary abelian groups and their automorphisms. *Am. J. Math.* **59**, 99–117 (1937). — [6] Abelian groups without elements of finite order. *Duke Math. J.* **3**, 68–122 (1937). — [7] Dualism in abelian groups. *Bull. Am. Math. Soc.* **43**, 121–124 (1937). — [8] Abelian groups that are direct summands of every containing abelian group. *Bull. Am. Math. Soc.* **46**, 800–806 (1940). — [9] Automorphism rings of primary abelian operator groups. *Ann. Math.* **44**, 192–227 (1943). — [10] Die Torsionsuntergruppe einer abelschen Gruppe. *Math. Ann.* **135**, 219–234 (1958)
- S. Balcerzyk — [1] On algebraically compact groups of I. Kaplansky. *Fund. Math.* **44**, 91–93 (1957). — [2] On factor groups of some subgroups of a complete direct sum of infinite cyclic groups. *Bull. Acad. Polon. Sci. Cl. III* **7**, 141–142 (1959). — [3] On classes of abelian groups. *Bull. Acad. Polon. Sci. Cl. III* **9**, 327–329 (1961); *Fund. Math.* **51**, 149–178 (1962); *Fund. Math.* **56**, 199–202 (1964)
- S. Balcerzyk, A. Bialynicki-Birula, J. Łoś — [1] On direct decompositions of complete direct sums of rank 1. *Bull. Acad. Polon. Sci. Cl. III* **9**, 451–454 (1961)
- J. Barwise, P. Eklof — [1] Infinitary properties of abelian torsion groups. *Ann. Math. Logic* **2**, 25–68 (1970/71)
- S. Bazzoni, C. Metelli — [1] On abelian torsion-free separable groups and their endomorphism rings. *Symposia Math.* **23**, 259–285 (1979)
- R.A. Beaumont — [1] Rings with additive group which is the direct sum of cyclic groups. *Duke Math. J.* **15**, 367–369 (1948)
- R.A. Beaumont, D.A. Lawver — [1] Strongly semisimple abelian groups. *Pac. J. Math.* **53**, 327–336 (1974)
- R.A. Beaumont, R.S. Pierce — [1] Torsion-free rings. III. *J. Math.* **5**, 61–98 (1961). — [2] Torsion free groups of rank two. *Mem. Am. Math. Soc.* **38** (1961)
- R.A. Beaumont, H.S. Zuckerman — [1] A characterization of the subgroups of the additive rationals. *Pac. J. Math.* **1**, 169–177 (1951)
- I.Kh. Bekker, V.N. Nedov — [1] On groups with isomorphic holomorphs [Russian]. *Mat. Zametki* **62**, 343–350 (1997)
- K. Benabdallah, A. Birtz — [1] Sur une famille de groupes abéliens super-décomposables. *Can. Math. Bull.* **24**, 213–218 (1981)

- K. Benabdallah, J.M. Irwin, M. Rafiq — [1] A core class of abelian p -groups. *Symposia Math.* **13**, 195–206 (1974)
- K. Benabdallah, T. Okuyama — [1] On purifiable subgroups of primary abelian groups. *Commun. Algebra* **19**, 85–96 (1991)
- G.M. Bergman — [1] Boolean rings of projective maps. *J. Lond. Math. Soc.* **4**, 593–598 (1972)
- L. Bican — [1] Completely decomposable abelian groups any pure subgroup of which is completely decomposable. *Czechoslov. Math. J.* **24**, 176–191 (1974). — [2] Splitting in abelian groups. *Czechoslov. Math. J.* **28**, 356–364 (1978). — [3] Purely finitely generated abelian groups. *Comment. Math. Univ. Carol.* **21**, 209–218 (1980)
- L. Bican, L. Fuchs — [1] On abelian groups by which balanced extensions of a rational group split. *J. Pure Appl. Algebra* **78**, 221–138 (1992); II: *Czechoslov. J. Math.* **44**, 649–660 (1994). — [2] Subgroups of Butler groups. *Commun. Algebra* **22**, 1037–1047 (1994)
- L. Bican, K.M. Rangaswamy — [1] Smooth unions of Butler groups. *Forum Math.* **10**, 233–247 (1998)
- L. Bican, K.M. Rangaswamy, C. Vinsonhaler — [1] Butler groups as smooth ascending unions. *Commun. Algebra* **28**, 5039–5045 (2000)
- L. Bican, L. Salce — [1] Butler groups of infinite rank. *Abelian Group Theory, Lecture Notes in Mathematics*, vol. 1006 (Springer, Berlin, 1983), pp. 171–189
- E.A. Blagoveshchenskaya — [1] Definability of torsion-free abelian groups of countable rank of a certain class by their endomorphism rings [Russian]. *Fundam. Prikl. Mat.* **13**, 31–43 (2007); *J. Math. Sci.* **152**, 469–478 (2008)
- E. Blagoveshchenskaya, R. Göbel, L. Strümgmann — [1] Classification of some Butler groups of infinite rank. *J. Algebra* **380**, 1–17 (2013)
- E.A. Blagoveshchenskaya, A.V. Yakovlev — [1] Direct decompositions of torsion-free abelian groups of finite rank [Russian]. *Algebra i Analiz* **1**, 111–127 (1989); *Leningr. Math. J.* **1**, 117–136 (1990)
- A. Blass — [1] On the divisible parts of quotient groups, in *Abelian Group Theory and Related Topics, Contemporary Mathematics*, vol. 171 (American Mathematical Society, Providence, RI, 1994), pp. 37–50
- A. Blass, J. Irwin — [1] Is there a core class for almost free groups of size \aleph_1 ? *Commun. Algebra* **32**, 1189–1200 (2004). — [2] Special families of sets and Baer-Specker groups. *Commun. Algebra* **33**, 1733–1744 (2005)
- A.V. Blazhenov — [1] Genera and cancellation of torsion-free modules of finite rank [Russian]. *Algebra i Analiz* **7**(6), 33–78 (1995); *St. Petersburg Math. J.* **7**(6), 891–924 (1996)
- I.V. Bobylev — [1] Projective dimension of an abelian group over its endomorphism ring [Russian]. *Usp. Mat. Nauk* **28**, 229–230 (1973)
- M. Bognár — [1] Ein einfaches Beispiel direkt unzerlegbarer abelscher Gruppen. *Publ. Math. Debrecen* **4**, 509–511 (1956)
- W. Borho — [1] Über die abelschen Gruppen auf denen sich nur endlich viele wesentlich verschiedene Ringe definieren lassen. *Abh. Math. Sem. Univ. Hamburg* **37**, 98–107 (1972)
- H. Bowman, K.M. Rangaswamy — [1] Torsion-free separable abelian groups quasi projective over their endomorphism rings. *Houst. J. Math.* **11**, 447–453 (1985)
- R.A. Bowshell, P. Schultz — [1] Unital rings whose additive endomorphisms commute. *Math. Ann.* **228**, 197–214 (1977)
- D.L. Boyer — [1] Enumeration theorems in infinite abelian groups. *Proc. Am. Math. Soc.* **7**, 565–570 (1956)
- D. Boyer, A. Mader — [1] Functorial topologies on abelian groups. *Rocky Mt. J. Math.* **10**, 695–708 (1980)
- R. Brandl — [1] Abelian torsion groups with soluble automorphism groups. *Rend. Circ. Mat. Palermo Suppl.* **23**, 43–44 (1990)
- E.I. Bunina, A.V. Mikhalëv — [1] Elementary equivalence of endomorphism rings of abelian p -groups [Russian]. *Fundam. Prikl. Mat.* **10**, 135–224 (2004); *J. Math. Sci.* **137**, 5275–5335 (2006)
- E.I. Bunina, M.A. Rožner — [1] Elementary equivalence of automorphism groups of abelian p -groups. *Fundam. Prikl. Mat.* **15**, 81–112 (2009); *J. Math. Science* **169**, 614–635 (2010)

- R. Burkhardt — [1] On a special class of almost completely decomposable torsion-free abelian groups, in *Abelian Groups and Modules*. CISM Courses Lectures, vol. 287 (Springer, Berlin, 1984), pp. 141–150
- M.C.R. Butler — [1] A class of torsion-free abelian groups of finite rank. *Proc. Lond. Math. Soc.* **15**, 680–698 (1965)
- G.G. Călugăreanu — [1] Abelian groups with semi-local endomorphism ring. *Commun. Algebra* **30**, 4105–4111 (2002)
- M.O’N. Campbell — [1] Countable torsion-free abelian groups. *Proc. Lond. Math. Soc.* **10**, 11–23 (1960)
- F. Castagna — [1] Sums of automorphisms of a primary abelian group. *Pac. J. Math.* **27**, 463–473 (1968)
- W. Chachólski, E.D. Farjoun, R. Göbel, Y. Segev — [1] Cellular covers of divisible abelian groups, in *Alpine perspectives on algebraic topology, Contemporary Mathematics*, vol. 504 (American Mathematical Society, Providence, RI, 2009), pp. 77–97
- B. Charles — [1] Le centre de l’anneau des endomorphismes d’un groupe abélien primaire. *C. R. Acad. Sci. Paris* **236**, 1122–1123 (1953). — [2] Étude des groupes abéliens primaires de type $\leq \omega$. *Ann. Univ. Saraviensis* **4**, 184–199 (1955). — [3] Méthodes topologiques en théorie des groupes abéliens, in *Proceedings of the Colloquium on Abelian Groups* (Akadémiai Kiadó, Budapest, 1964), pp. 29–42. — [4] Sous-groupes fonctoriels et topologies, in *Studies on Abelian Groups* (Dunod, Paris, 1968), pp.75–92
- S.U. Chase — [1] Direct product of modules. *Trans. Am. Math. Soc.* **97**, 457–473 (1960)
- A.R. Chekhlov — [1] Intersection of direct summands of abelian p -groups [Russian], in *Abelian Groups and Modules* (Tomsk. Gos. Univ., Tomsk, 1981), pp. 240–244. — [2] Quasipure injective torsion-free abelian groups [Russian]. *Mat. Zametki* **46**, 93–99 (1989). — [3] Abelian groups with normal endomorphism rings [Russian]. *Algebra Logika* **48**, 520–539 (2009); *Algebra Logic* **48**, 298–308 (2009)
- A.R. Chekhlov, P.A. Krylov — [1] On L. Fuchs’ problems 17 and 43. *J. Math. Sci.* **143**, 3517–3602 (2007)
- J. Cohen, H. Gluck — [1] Stacked bases for modules over principal ideal domains. *J. Algebra* **14**, 493–505 (1970)
- P.M. Cohn — [1] The complement of a finitely generated direct summand of an abelian group. *Proc. Am. Math. Soc.* **7**, 520–521 (1956). — [2] Eine Bemerkung über die multiplikative Gruppe eines Körpers. *Arch. Math.* **13**, 344–348 (1962)
- E.F. Cornelius Jr. — [1] A sufficient condition for separability. *J. Algebra* **67**, 476–478 (1980)
- A.L.S. Corner — [1] A note on rank and direct decompositions of torsion-free abelian groups. *Proc. Cambridge Philos. Soc.* **57**, 230–233 (1961); *Proc. Cambridge Philos. Soc.* **66**, 239–240 (1969). — [2] Every countable reduced torsion-free ring is an endomorphism ring. *Proc. Lond. Math. Soc.* **13**, 687–710 (1963). — [3] On a conjecture of Pierce concerning direct decompositions of abelian groups. *Proceedings of the Colloquium on Abelian Groups* (Akadémiai Kiadó, Budapest, 1964), pp. 43–48. — [4] Endomorphism rings of torsion-free abelian groups, in *Proceedings of the International Conference on the Theory of Groups* (Gordon and Breach, New York, 1967), pp. 59–69. — [5] On endomorphism rings of primary abelian groups. *Q. J. Math. Oxford* **20**, 277–296 (1969). — [6] Endomorphism algebras of large modules with distinguished submodules. *J. Algebra* **11**, 155–185 (1969). — [7] The independence of Kaplansky’s notions of transitivity and full transitivity. *Q. J. Math. Oxford* **27**, 15–20 (1976). — [8] On the existence of very decomposable abelian groups, in *Abelian Group Theory*. *Lecture Notes in Mathematics*, vol. 1006 (Springer, Berlin, 1983), pp. 354–357. — [9] Fully rigid systems of modules. *Rend. Sem. Mat. Univ. Padova* **82**, 55–66 (1989). — [10] Groups of units of order in \mathbb{Q} -algebras, in *Models, Modules and Abelian Groups* (W. de Gruyter, Berlin, 2008), pp. 9–61
- A.L.S. Corner, R. Göbel — [1] Prescribing endomorphism algebras, a unified treatment. *Proc. Lond. Math. Soc.* **50**, 447–479 (1985)

- A.L.S. Corner, B. Goldsmith — [1] Isomorphic automorphism groups of torsion-free p -adic modules, in *Abelian Groups, Module Theory, and Topology*. Lecture Notes in Pure and Applied Mathematics, vol. 201 (Dekker, New York, 1998), pp. 125–130
- P. Crawley — [1] Solution of Kaplansky's Test Problems for primary abelian groups. *J. Algebra* **2**, 413–431 (1965). — [2] The cancellation of torsion abelian groups in direct sums. *J. Algebra* **2**, 432–442 (1965). — [3] Abelian p -groups determined by their Ulm sequences. *Pac. J. Math.* **22**, 235–239 (1967). — [4] On the structure of a class of abelian p -groups. *Symposia Math.* **23**, 33–45 (1979)
- P. Crawley, A.W. Hales — [1] The structure of torsion abelian groups given by presentations. *Bull. Am. Math. Soc.* **74**, 954–956 (1968). — [2] The structure of abelian p -groups given by certain presentations. *J. Algebra* **12**, 10–23 (1969); **18**, 264–268 (1971)
- P. Crawley, B. Jónsson — [1] Refinements for infinite direct decompositions of algebraic systems. *Pac. J. Math.* **14**, 797–855 (1964)
- P. Crawley, C. Megibben — [1] A simple construction of bizarre abelian groups, unpublished
- D.O. Cutler — [1] Abelian p -groups A and B such that $\text{Tor}(A, G) = \text{Tor}(B, G)$, G reduced. *Proc. Am. Math. Soc.* **91**, 12–14 (1984). — [2] Abelian groups determined by their p -socle, in *Abelian Groups and Modules* (Gordon and Breach, New York, 1987), pp. 111–116. — [3] The existence of certain pure dense subgroups of abelian p -groups is not decidable in ZFC. *J. Algebra* **127**, 269–278 (1989)
- D. Cutler, J. Irwin — [1] Essentially fully indecomposable abelian p -groups. *Quaest. Math.* **9**, 135–148 (1986)
- D. Cutler, J. Irwin, J. Pfaendtner, T. Snabb — [1] Direct sums of cyclic summands. *Comment. Math. Univ. St. Pauli* **32**, 171–176 (1983)
- D. Cutler, J. Irwin, T. Snabb — [1] Abelian p -groups containing proper $p^{\omega+n}$ -projective subgroups. *Comment. Math. Univ. St. Pauli* **33**, 95–97 (1984)
- D. Cutler, C. Missel — [1] The structure of C -indecomposable $p^{\omega+n}$ -projective abelian p -groups. *Commun. Algebra* **12**, 301–319 (1984)
- D.O. Cutler, R.W. Stringall — [1] A topology for primary abelian groups, in *Studies on Abelian Groups* (Dunod, Paris, 1968), pp. 93–100
- P.V. Danchev — [1] A note on the countable extensions of separable $p^{\omega+n}$ -projective abelian p -groups. *Archiv Math. (Brno)* **42**, 251–254 (2006). — [2] On some fully invariant subgroups of summable groups. *Ann. Math. Blaise Pascal* **15**, 147–152 (2008)
- G. De Marco, A. Orsatti — [1] Complete linear topologies on abelian groups. *Symposia Math.* **13**, 153–161 (1974)
- D. Derry — [1] Über eine Klasse von abelschen Gruppen. *Proc. Lond. Math. Soc.* **43**, 490–506 (1937)
- G. D'Este — [1] Abelian groups with anti-isomorphic endomorphism rings. *Rend. Sem. Mat. Univ. Padova* **60**, 55–75 (1978)
- C. De Vivo, C. Metelli — [1] Admissible matrices as base changes of $B^{(1)}$ -groups: a realizing algorithm, in *Abelian Groups and Modules*. Trends in Mathematics (Birkhäuser, Basel, 1999), pp. 135–147. — [2] Finite partition lattices and Butler groups. *Commun. Algebra* **27**, 1571–1590 (1999)
- J. Dieudonné — [1] Sur les p -groupes abéliens infinis. *Portugaliae Math.* **11**, 1–5 (1952)
- D. Dikranjan, B. Goldsmith, L. Salce, P. Zanardo — [1] Algebraic entropy for abelian groups. *Trans. Am. Math. Soc.* **361**, 3401–3434 (2009)
- S.Z. Ditor — [1] On the group of units of a ring. *Am. Math. Monthly* **78**, 522–523 (1971)
- A.J. Douglas, H.K. Farahat — [1] The homological dimension of an abelian group as a module over its ring of endomorphisms. *Monatshefte Math.* **69**, 294–305 (1965); II: *Monatshefte Math.* **76**, 109–111 (1972); III: *Monatshefte Math.* **80**, 37–44 (1975)
- P.F. Dubois — [1] Generally p^α -torsion-complete abelian groups. *Trans. Am. Math. Soc.* **159**, 245–255 (1971)

- M. Dugas — [1] Fast freie abelsche Gruppen mit Endomorphismenring *Z*. *J. Algebra* **71**, 314–321 (1981). — [2] On the Jacobson radical of some endomorphism rings. *Proc. Am. Math. Soc.* **102**, 823–826 (1988). — [3] Localizations of torsion-free abelian groups. *J. Algebra* **278**, 411–429 (2004); **284**, 811–823 (2005). — [4] Co-local subgroups of abelian groups. II. *J. Pure Appl. Algebra* **208**, 117–126 (2007)
- M. Dugas, S. Feigelstock — [1] *A*-rings. *Colloq. Math.* **96**, 277–292 (2003)
- M. Dugas, R. Göbel — [1] Algebraisch kompakte Faktorgruppen. *J. Reine Angew. Math.* **307/8**, 341–352 (1979). — [2] Every cotorsion-free ring is an endomorphism ring. *Proc. Lond. Math. Soc.* **45**, 319–336 (1982). — [3] On endomorphism rings of primary abelian groups. *Math. Ann.* **261**, 359–385 (1982). — [4] Every cotorsion-free algebra is an endomorphism algebra. *Math. Z.* **181**, 451–470 (1982). — [5] Torsion-free abelian groups with prescribed finitely topologized endomorphism ring. *Proc. Am. Math. Soc.* **90**, 519–527 (1984). — [6] An extension of Zassenhaus' theorem on endomorphism rings. *Fund. Math.* **194**, 239–251 (2007)
- M. Dugas, J. Hausen — [1] Torsion-free *E*-uniserial groups of infinite rank, in *Abelian Group Theory, Contemporary Mathematics*, vol. 87 (American Mathematical Society, Providence, RI, 1989), pp. 181–189
- M. Dugas, G. Herden — [1] Arbitrary torsion classes of abelian groups. *Commun. Algebra* **11**, 1455–74 (1983)
- M. Dugas, P. Hill, K.M. Rangaswamy — [1] Butler groups of infinite rank. II. *Trans. Am. Math. Soc.* **320**, 643–664 (1990)
- M. Dugas, J. Irwin — [1] On pure subgroups of cartesian products of integers. *Results Math.* **15**, 35–52 (1989). — [2] On basic subgroups of $\prod \mathbb{Z}$. *Commun. Algebra* **19**, 2907–2921 (1991)
- M. Dugas, J. Irwin, S. Khabbaz — [1] Countable rings as endomorphism rings. *Q. J. Math. Oxford* **39**, 201–211 (1988)
- M. Dugas, A. Mader, C. Vinsonhaler — [1] Large *E*-rings exist. *J. Algebra* **108**, 88–101 (1987)
- M. Dugas, K.M. Rangaswamy — [1] Infinite rank Butler groups. *Trans. Am. Math. Soc.* **305**, 129–142 (1988)
- M. Dugas, B. Thomé — [1] The functor *Bext* under the negation of CH. *Forum Math.* **3**, 23–33 (1991). — [2] Countable Butler groups and vector spaces with four distinguished subspaces. *J. Algebra* **138**, 249–272 (1991)
- M. Dugas, R. Vergohsen — [1] On socles of abelian *p*-groups in *L*. *Rocky Mt. J. Math.* **18**, 733–752 (1988)
- M. Dugas, B. Zimmermann-Huisgen — [1] Iterated direct sums and products of modules, in *Abelian Group Theory*. *Lecture Notes in Mathematics*, vol. 874 (Springer, Berlin, 1982), pp. 179–193
- K. Eda — [1] A Boolean power and a direct product of abelian groups. *Tsukuba J. Math.* **6**, 187–193 (1982). — [2] On a Boolean power of a torsion-free abelian group. *J. Algebra* **82**, 84–93 (1983). — [3] On \mathbb{Z} -kernel groups. *Arch. Math.* **41**, 289–293 (1983). — [4] A characterization of \aleph_1 -free abelian groups and its application to the Chase radical. *Isr. J. Math.* **60**, 22–30 (1987). — [5] Slender modules, endo-slender abelian groups and large cardinals. *Fund. Math.* **135**, 5–24 (1990)
- K. Eda, H. Ohta — [1] On abelian groups of integer-valued continuous functions, their \mathbb{Z} -duals and \mathbb{Z} -reflexivity, in *Abelian Group Theory* (Gordon and Breach, New York, 1987), pp. 241–257
- A. Ehrenfeucht — [1] On a problem of J.H.C. Whitehead concerning abelian groups. *Bull. Acad. Polon. Sci. Cl. III* **3**, 127–128 (1955)
- A. Ehrenfeucht, J. Łoś — [1] Sur les produits cartésiens des groupes cycliques infinis. *Bull. Acad. Polon. Sci. Cl. III* **2**, 261–263 (1954)
- S. Eilenberg, S. MacLane — [1] On the homology theory of abelian groups. *Can. J. Math.* **7**, 43–53 (1955)
- P.C. Eklof — [1] The structure of ultraproducts of abelian groups. *Pac. J. Math.* **47**, 67–79 (1973). — [2] On the existence of κ -free abelian groups. *Proc. Am. Math. Soc.* **47**, 65–72 (1975). — [3] Whitehead's problem is undecidable. *Am. Math. Monthly* **83**, 775–788 (1976). — [4] Applications of logic to the problem of splitting abelian groups, in *Logic Colloquium*,

- vol. 76 (North Holland, Amsterdam, 1977), pp. 287–299. — [5] *Set-theoretical Methods in Homological Algebra and Abelian Groups* (Les Presses University, Montreal, 1980). — [6] On singular compactness. *Algebra Univ.* **14**, 310–316 (1982)
- P.C. Eklof, M. Huber — [1] On the rank of Ext. *Math. Z.* **174**, 159–185 (1980)
- P. Eklof, M. Huber, A. Mekler — [1] Totally Crawley groups. *J. Algebra* **112**, 370–384 (1988)
- P.C. Eklof, A.H. Mekler, S. Shelah — [1] Almost disjoint abelian groups. *Isr. J. Math.* **49**, 34–54 (1984)
- P. Eklof, H.C. Mez — [1] Additive groups of essentially closed rings, in *Abelian Groups and Modules*. CISM Courses Lectures, vol. 287 (Springer, Berlin, 1984), pp. 243–252
- P.C. Eklof, S. Shelah — [1] On groups A such that $A \oplus \mathbb{Z}^n = A$, in *Abelian Group Theory* (Gordon and Breach, New York, 1987), pp. 149–163
- E. Enochs — [1] Isomorphic refinements of decompositions of a primary group into closed groups. *Bull. Sci. Math. France* **91**, 63–75 (1963). — [2] Torsion free covering modules. *Proc. Am. Math. Soc.* **14**, 884–889 (1963). — [3] Extending isomorphisms between basic subgroups. *Arch. Math.* **15**, 175–178 (1964)
- M. Erdélyi — [1] Direct summands of abelian torsion groups [Hungarian]. *Acta Univ. Debrecen* **2**, 145–149 (1955)
- J. Erdős — [1] Torsion-free factor groups of free abelian groups and a classification of torsion free abelian groups. *Publ. Math. Debrecen* **5**, 172–184 (1957)
- M.V. Eremina, P.A. Krylov — [1] The tensor product of abelian groups as a noetherian module over an endomorphism ring [Russian]. *Izv. Vyssh. Uchebn. Zaved. Mat.* **45**(4), 16–23 (2001); *Russian Math.* **45**(4), 14–21 (2001)
- K. Faltings — [1] Automorphismgruppen endlicher abelscher p -Gruppen, in *Studies on Abelian Groups* (Dunod, Paris, 1968), pp. 101–119
- T.G. Faticoni — [1] Each countable reduced torsion-free commutative ring is a pure subring of an E -ring. *Commun. Algebra* **15**, 2545–2564 (1987). — [2] On the lattice of right ideals of the endomorphism ring of an abelian group. *Bull. Aust. Math. Soc.* **38**, 273–291 (1988). — [3] Torsion-free abelian groups torsion over their endomorphism rings. *Bull. Aust. Math. Soc.* **50**, 177–195 (1994)
- T.G. Faticoni, P. Goeters — [1] Examples of torsion-free groups flat as modules over their endomorphism rings. *Commun. Algebra* **19**, 1–27 (1991)
- T. Faticoni, H.P. Goeters, C. Vinsonhaler, W.J. Wickless — [1] Torsion-free duality is Warfield. *Proc. Am. Math. Soc.* **125**, 961–969 (1997)
- T.H. Fay, G.L. Walls — [1] Maximal functorial topologies on abelian groups. *Arch. Math.* **38**, 167–174 (1992)
- S. Feigelstock — [1] The type set of groups and nilpotence. *Comment. Math. Univ. St. Pauli* **25**, 159–165 (1977). — [2] Additive groups of self-injective rings. *Soochow J. Math.* **33**, 641–645 (2007)
- S. Feigelstock, J. Hausen, R. Raphael — [1] Abelian groups mapping onto their endomorphism rings, in *Abelian Groups and Modules*. Trends in Mathematics (Birkhäuser, Basel, 1999), pp. 231–239
- S.T. Files — [1] Endomorphisms of local Warfield groups, in *Abelian Group Theory and Related Topics*. Contemporary Mathematics, vol. 171 (American Mathematical Society, Providence, RI, 1994), pp. 99–107. — [2] On transitive mixed abelian groups, in *Abelian Groups and Modules*. Lecture Notes in Pure and Applied Mathematics, vol. 182 (Marcel Dekker, New York, 1996), pp. 243–251
- S. Files, B. Goldsmith — [1] Transitive and fully transitive groups. *Proc. Am. Math. Soc.* **126**, 1605–1610 (1998)
- S. Files, W. Wickless — [1] The Baer-Kaplansky theorem for a class of global mixed groups. *Rocky Mt. J. Math.* **26**, 593–613 (1996)
- T. Fink — [1] A note on direct decompositions of large powers of the group of integers. *Commun. Algebra* **26**, 3553–3562 (1998)
- M.A. Flagg — [1] Jacobson radical isomorphism theorem for torsion-free modules, in *Models, Modules and Abelian groups* (W. de Gruyter, Berlin, 2008), pp. 309–314

- A.A. Fomin — [1] Tensor product of torsion-free abelian groups. *Sibirsk. Mat. Ž.* **16**, 1071–1080 (1975). — [2] Duality in certain classes of torsion-free abelian groups of finite rank [Russian]. *Sibirsk. Mat. Ž.* **27**(4), 117–127 (1986). — [3] Quotient divisible mixed groups, in *Abelian Groups, Rings and Modules. Contemporary Mathematics*, vol. 273 (American Mathematical Society, Providence, RI, 2001), pp. 117–128
- A.A. Fomin, W.J. Wickless — [1] Quotient divisible abelian groups. *Proc. Am. Math. Soc.* **126**, 45–52 (1998)
- S.V. Fomin — [1] Über periodische Untergruppen der unendlichen abelschen Gruppen. *Mat. Sbornik* **2**, 1007–1009 (1937)
- B. Franzen — [1] Algebraic compactness and filtered quotients, in *Abelian Group Theory. Lecture Notes in Mathematics*, vol. 874 (Springer, Berlin, 1981), pp. 228–241
- B. Franzen, B. Goldsmith — [1] On endomorphism algebras of mixed modules. *J. Lond. Math. Soc.* **31**, 468–472 (1985)
- H. Freedman — [1] The automorphisms of countable primary reduced abelian groups. *Proc. Lond. Math. Soc.* **12**, 77–99 (1962). — [2] On the additive group of a torsion-free ring of rank two. *Publ. Math. Debrecen* **20**, 85–87 (1973)
- E. Fried — [1] On the subgroups of an abelian group that are ideals in every ring, in *Proceedings of the Colloquium on Abelian Groups* (Akadémiai Kiadó, Budapest, 1964), pp. 51–54
- G. Frobenius, L. Stickelberger — [1] Über Gruppen von vertauschbaren Elementen. *J. Reine Angew. Math.* **86**, 217–262 (1878)
- L. Fuchs — [1] The direct sum of cyclic groups. *Acta Math. Acad. Sci. Hungar.* **3**, 177–195 (1952). — [2] On the structure of abelian p -groups. *Acta Math. Acad. Sci. Hungar.* **4**, 267–288 (1953). — [3] On a property of basic subgroups. *Acta Math. Acad. Sci. Hungar.* **5**, 143–144 (1954). — [4] On abelian torsion groups which can not be represented as the direct sum of a given cardinal number of components. *Acta Math. Acad. Sci. Hungar.* **7**, 115–124 (1956). — [5] Ringe und ihre additive Gruppe. *Publ. Math. Debrecen* **4**, 488–508 (1956). — [6] Über das Tensorprodukt von Torsionsgruppen. *Acta Sci. Math. Szeged* **18**, 29–32 (1957). — [7] On quasi nil groups. *Acta Sci. Math. Szeged* **18**, 33–43 (1957). — [8] Wann folgt die Maximalbedingung aus der Minimalbedingung? *Arch. Math.* **8**, 317–319 (1957). — [9] On a directly indecomposable abelian group of power greater than continuum. *Acta Math. Acad. Sci. Hungar.* **8**, 453–454 (1957). — [10] On character groups of discrete abelian groups. *Acta Math. Acad. Sci. Hungar.* **10**, 133–140 (1959). — [11] Notes on abelian groups. I. *Annales Univ. Sci. Budapest* **2**, 5–23 (1959). — [12] The existence of indecomposable abelian groups of arbitrary power. *Acta Math. Acad. Sci. Hungar.* **10**, 453–457 (1959). — [13] Note on factor groups in complete direct sums. *Bull. Acad. Pol. Sci. Cl. III* **11**, 39–40 (1963). — [14] Recent results and problems on abelian groups, in *Topics in Abelian Groups* (Chicago, 1963), Scott, Foresman & Co. pp. 9–40. — [15] Note on linearly compact abelian groups. *J. Aust. Math. Soc.* **9**, 433–440 (1969). — [16] Summands of separable abelian groups. *Bull. London Math. Soc.* **2**, 205–208 (1970). — [17] Note on decompositions of torsion-free abelian groups. *Comment. Math. Helvetici* **46**, 409–413 (1971). — [18] Indecomposable abelian groups of measurable cardinalities. *Symposia Math.* **13**, 233–244 (1974). — [19] On torsion abelian groups quasi-projective over their endomorphism rings. *Proc. Am. Math. Soc.* **42**, 13–15 (1974). — [20] On $p^{\omega+n}$ -projective p -groups. *Publ. Math. Debrecen* **23**, 309–313 (1976). — [21] Butler groups of infinite rank. *J. Pure Appl. Algebra* **98**, 25–44 (1995). — [22] Large indecomposable modules with many automorphisms. *Houst. J. Math.* **23**, 959–966 (2007)
- L. Fuchs, R. Göbel — [1] Union of slender groups. *Arch. Math.* **87**, 6–14 (2006). — [2] Cellular covers of abelian groups. *Results Math.* **53**, 59–76 (2009)
- L. Fuchs, P. Gräbe — [1] Numbers of indecomposable summands in direct decompositions of torsion-free abelian groups. *Rend. Sem. Mat. Univ. Padova* **53**, 135–148 (1975)
- L. Fuchs, I. Halperin — [1] On the imbedding of a regular ring in a regular ring with identity. *Fund. Math.* **54**, 285–290 (1964)
- L. Fuchs, P. Hill — [1] The balanced-projective dimension of abelian p -groups. *Trans. Am. Math. Soc.* **293**, 99–112 (1986)

- L. Fuchs, K.H. Hofmann — [1] Extensions of compact abelian groups by discrete ones and their duality theory. *I. J. Algebra* **196**, 578–594 (1997)
- L. Fuchs, J.M. Irwin — [1] On $p^{\omega+1}$ -projective p -groups. *Proc. Lond. Math. Soc.* **30**, 459–470 (1975)
- L. Fuchs, F. Loonstra — [1] On direct decompositions of torsion-free abelian groups of finite rank. *Rend. Sem. Mat. Univ. Padova* **44**, 175–183 (1970)
- L. Fuchs, M. Magidor — [1] Butler groups of arbitrary cardinality. *Isr. J. Math.* **84**, 239–263 (1993)
- L. Fuchs, C. Metelli — [1] On a class of Butler groups. *Manuscripta Math.* **71**, 1–28 (1991). — [2] Indecomposable Butler groups of large cardinalities. *Arch. Math.* **57**, 339–344 (1991). — [3] Countable Butler groups, in *Contemporary Mathematics*, vol. 130 (American Mathematical Society, Providence, RI, 1992), pp. 133–143
- L. Fuchs, C. Metelli, K.M. Rangaswamy — [1] Corank one subgroups of completely decomposable abelian groups. *Commun. Algebra* **22**, 1031–1037 (1994)
- L. Fuchs, K.M. Rangaswamy — [1] On generalized regular rings. *Math. Z.* **107**, 71–81 (1968). — [2] Quasi-projective abelian groups. *Bull. Soc. Math. France* **98**, 5–8 (1970). — [3] Unions of chains of Butler groups, in *Abelian Group Theory and Related Topics, Contemporary Mathematics*, vol. 171 (American Mathematical Society, Providence, RI, 1994), pp. 141–146. — [4] Chains of projective modules. *J. Algebra Appl.* **10**, 167–180 (2011)
- L. Fuchs, L. Salce — [1] Almost totally injective p -groups. *Quaest. Math.* **1**, 225–234 (1976). — [2] Abelian p -groups of not limit length. *Comment. Math. Univ. St. Pauli* **26**, 25–33 (1977)
- L. Fuchs, L. Salce, P. Zanardo — [1] Note on the transitivity of pure-essential extensions. *Colloq. Math.* **78**, 283–291 (1998)
- L. Fuchs, G. Viljoen — [1] Note on extensions of Butler groups. *Bull. Aust. Math. Soc.* **41**, 117–122 (1990). — [2] Completely decomposable pure subgroups of completely decomposable abelian groups. *Rend. Sem. Mat. Univ. Padova* **92**, 63–69 (1994)
- S. Gacsályi — [1] On algebraically closed abelian groups. *Publ. Math. Debrecen* **2**, 292–296 (1952)
- B.J. Gardner — [1] Rings on completely decomposable torsion-free abelian groups. *Comment. Math. Univ. Carolin.* **15**, 381–392 (1974)
- O. Gerstner — [1] Algebraische Kompaktheit bei Faktorgruppen von Gruppen ganzzahliger Abbildungen. *Manuscr. Math.* **11**, 103–109 (1974)
- R.W. Gilmer — [1] Finite rings having a cyclic multiplicative group of units. *Am. J. Math.* **85**, 447–452 (1963)
- A.J. Giovannitti — [1] Extensions of Butler groups, in *Abelian Group Theory*. *Lecture Notes in Mathematics*, vol. 1006 (Springer, Berlin, 1983), pp. 164–170. — [2] A note on proper classes of exact sequences, in *Methods in Module Theory*. *Lecture Notes in Pure and Applied Mathematics*, vol. 140 (Marcel Dekker, New York, 1992), pp. 107–116
- S. Glaz, C. Vinsonhaler, W. Wickless — [1] Splitting rings for p -local torsion-free groups, in *Zero-dimensional commutative rings*. *Lecture Notes in Pure and Applied Mathematics*, vol. 171 (Dekker, New York, 1995), pp. 223–239
- S. Glaz, W. Wickless — [1] Regular and principal projective endomorphism rings of mixed abelian groups. *Commun. Algebra* **22**, 1161–1176 (1994)
- R. Göbel — [1] Darstellung von Ringen als Endomorphismenringe. *Arch. Math.* **35**, 338–350 (1980)
- R. Göbel, D. Herden, S. Shelah — [1] Absolute E -rings. *Adv. Math.* **226**, 235–253 (2011)
- R. Göbel, W. May — [1] Cancellation of direct sums of countable abelian p -groups. *Proc. Am. Math. Soc.* **131**, 2705–2710 (2003)
- R. Göbel, S. Pokutta — [1] Construction of dual groups using Martin’s axiom. *J. Algebra* **320**, 2388–2404 (2008)
- R. Göbel, R. Prella — [1] Solution of two problems on cotorsion abelian groups. *Arch. Math.* **31**, 423–431 (1978)
- R. Göbel, S.V. Rychkov, B. Wald — [1] A general theory of slender groups and Fuchs-44-groups, in *Abelian Group Theory*. *Lecture Notes in Mathematics*, vol. 874 (Springer, Berlin, 1981), pp. 194–201

- R. Göbel, S. Shelah — [1] Semirigid classes of cotorsion-free abelian groups. *J. Algebra* **93**, 136–150 (1985). — [2] On the existence of rigid \aleph_1 -free abelian groups of cardinality \aleph_1 , in *Abelian Groups and Modules* (Kluwer Academic Publishers, Dordrecht, 1995), pp. 227–237. — [3] Cotorsion theories and splitters. *Trans. Am. Math. Soc.* **352**, 5357–5379 (2000). — [4] Reflexive subgroups of the Baer-Specker group and Martin's axiom, in *Abelian Groups, Rings and Modules. Contemporary Mathematics*, vol. 273 (American Mathematical Society, Providence, RI, 2001), pp. 145–158. — [5] Absolutely indecomposable modules. *Proc. Am. Math. Soc.* **135**, 1641–1649 (2007)
- R. Göbel, S. Shelah, L. Strüngmann — [1] Almost-free E -rings of cardinality \aleph_1 . *Can. J. Math.* **55**, 750–765 (2003)
- R. Göbel, S. Shelah, S. Wallutis — [1] On the lattice of cotorsion theories. *J. Algebra* **238**, 292–313 (2001)
- R. Göbel, B. Wald — [1] Wachstumstypen und schlanke Gruppen. *Symposia Math.* **23**, 201–239 (1979)
- R. Göbel, S. Wallutis — [1] An algebraic version of the strong black box. *Algebra Discrete Math.* **1**, 7–45 (2003)
- R. Göbel, M. Ziegler — [1] Very decomposable abelian groups. *Math. Z.* **200**, 485–496 (1989)
- H.P. Goeters — [1] Torsion-free abelian groups with finite rank endomorphism rings. *Quaest. Math.* **14**, 111–115 (1991). — [2] Cobalanced torsion-free abelian groups. *Commun. Algebra* **21**, 2715–2726 (1993). — [3] An extension of Warfield duality for abelian groups. *J. Algebra* **180**, 848–861 (1996)
- H.P. Goeters, J.D. Reid — [1] On the p -rank of $\text{Hom}(A, B)$, in *Abelian Group Theory. Contemporary Mathematics*, vol. 87 (American Mathematical Society, Providence, RI, 1989), pp. 171–179
- H.P. Goeters, W. Ullery, C. Vinsonhaler — [1] Numerical invariants for a class of Butler groups, in *Abelian Group Theory and Related Topics, Contemporary Mathematics*, vol. 171 (American Mathematical Society, Providence, RI, 1994), pp. 159–172
- B. Goldsmith — [1] Essentially indecomposable modules over a complete discrete valuation ring. *Rend. Semin. Mat. Univ. Padova* **70**, 21–29 (1983). — [2] On endomorphism rings of nonseparable abelian p -groups. *J. Algebra* **127**, 73–79 (1989)
- B. Goldsmith, C. Meehan, S.L. Wallutis — [1] On unit sum numbers of rational groups. *Rocky Mt. J. Math.* **32**, 1431–1450 (2002)
- B. Goldsmith, P. Vámos — [1] A note on clean abelian groups. *Rend. Semin. Mat. Univ. Padova* **117**, 181–191 (2007)
- J. Gregory — [1] Abelian groups infinitarily equivalent to free ones. *Notices Am. Math. Soc.* **20**, A-500 (1973)
- P. Griffith — [1] Purely indecomposable torsion-free groups. *Proc. Am. Math. Soc.* **18**, 738–742 (1967). — [2] Decompositions of pure subgroups of torsion free groups. *Ill. J. Math.* **12**, 433–438 (1968). — [3] Separability of torsion free groups and a problem of J.C. Whitehead. *Ill. J. Math.* **12**, 654–659 (1968). — [4] A solution to the splitting mixed problem of Baer. *Trans. Am. Math. Soc.* **139**, 261–269 (1969). — [5] Extensions of free groups by torsion groups. *Proc. Am. Math. Soc.* **24**, 677–679 (1970). — [6] On a subfunctor of Ext . *Arch. Math.* **21**, 17–22 (1970). — [7] \aleph_n -free abelian groups. *Q. J. Math. Oxford* **23**, 417–425 (1972)
- S.Ya. Grinshpon, P.A. Krylov — [1] Fully invariant subgroups, full transitivity, and homomorphism groups of abelian groups. *J. Math. Sci.* **128**, 2894–2897 (2005)
- S.Ya. Grinshpon, V.M. Misyakov — [1] Complete transitivity of direct products of abelian groups [Russian], in *Abelian Groups and Modules*, vol. 10 (Tomsk. Gos. Univ., Tomsk, 1991), pp. 23–30
- J. de Groot — [1] Indecomposable abelian groups. *Proc. Ned. Akad. Wetensch.* **60**, 137–145 (1957)
- F. Haimo — [1] Preservation of divisibility in quotient groups. *Duke Math. J.* **15**, 347–356 (1948). — [2] Radical and antiradical groups. *Rocky Mt. J. Math.* **3**, 91–106 (1973)
- G. Hajós — [1] Über einfache und mehrfache Bedeckung des n -dimensionalen Raumes mit einem Würfelgitter. *Math. Z.* **47**, 427–467 (1942)

- J.T. Hallett, K.A. Hirsch — [1] Torsion-free groups having finite automorphism groups. *J. Algebra* **2**, 287–298 (1965)
- D.K. Harrison — [1] Infinite abelian groups and homological methods. *Ann. Math.* **69**, 366–391 (1959). — [2] Two of the problems of L. Fuchs. *Publ. Math. Debrecen* **7**, 316–319 (1960). — [3] On the structure of Ext, in *Topics in Abelian Groups* (Chicago, 1963), Scott, Foresman & Co. pp. 195–209
- J. Hausen — [1] The hypo residuum of the automorphism group of an abelian p -group. *Pac. J. Math.* **35**, 127–139 (1970). — [2] Automorphisms of abelian torsion groups of finite p -ranks. *Arch. Math.* **22**, 128–135 (1971). — [3] On the normal structure of automorphism groups of abelian p -groups. *J. Lond. Math. Soc.* **5**, 409–413 (1972). — [4] The normal structure of the automorphism groups of an abelian p -group. *Symposia Math.* **13**, 21–24 (1974). — [5] The Jacobson radical of endomorphism rings of totally projective groups of finite type. *J. Reine Angew. Math.* **292**, 19–24 (1977). — [6] A cardinal-determined projectivity condition for abelian groups and modules, in *Abelian Group Theory*. Lecture Notes in Mathematics, vol. 874 (Springer, Berlin, 1981), pp. 109–113. — [7] Abelian groups which are uniserial as modules over their endomorphism rings, in *Abelian Group Theory*. Lecture Notes in Mathematics, vol. 1006 (Springer, Berlin, 1983), pp. 204–208. — [8] E -uniserial torsion-free abelian groups of finite rank, in *Abelian Groups and Modules*. CISM Courses Lectures, vol. 287 (Springer, Berlin, 1984), pp. 181–187. — [9] Modules with the summand intersection property. *Commun. Algebra* **17**, 135–148 (1989)
- J. Hausen, J.A. Johnson — [1] Abelian groups with many automorphisms. *Rend. Sem. Mat. Univ. Padova* **55**, 1–5 (1976). — [2] A note on constructing E -rings. *Publ. Math. Debrecen* **38**, 33–38 (1991)
- J. Hausen, C.E. Praeger, P. Schultz — [1] Most abelian p -groups are determined by the Jacobson radical of their endomorphism rings. *Math. Z.* **216**, 431–436 (1994)
- T.J. Head — [1] Dense submodules. *Proc. Am. Math. Soc.* **13**, 197–199 (1962)
- G. Heinlein — [1] *Vollreflexive Ringe und schlanke Moduln*, Dissertation, Erlangen, 1971
- D. Herden, S. Shelah — [1] An upper cardinal bound on absolute E -rings. *Proc. Am. Math. Soc.* **137**, 2843–2847 (2009)
- P. Hill — [1] Certain pure subgroups of primary groups, in *Topics in Abelian Groups* (Chicago, 1963), pp. 311–314. — [2] Pure subgroups having prescribed socles. *Bull. Am. Math. Soc.* **71**, 608–609 (1965). — [3] A classification of direct sums of closed groups. *Acta Math. Acad. Sci. Hungar.* **17**, 263–266 (1966). — [4] The isomorphic refinement theorem for direct sums of closed groups. *Proc. Am. Math. Soc.* **18**, 913–919 (1967). — [5] Isotype subgroups of direct sums of countable groups. *Ill. J. Math.* **13**, 281–290 (1969). — [6] Endomorphism rings generated by units. *Trans. Am. Math. Soc.* **141**, 99–105 (1969); *Trans. Am. Math. Soc.* **157**, 511 (1971). — [7] A countability condition for primary groups presented by relations of length two. *Bull. Am. Math. Soc.* **75**, 780–782 (1969). — [8] On the decomposition of groups. *Can. J. Math.* **21**, 762–768 (1969). — [9] On the freeness of abelian groups: a generalization of Pontryagin's theorem. *Bull. Am. Math. Soc.* **76**, 1118–1120 (1970). — [10] The automorphisms of primary abelian groups. *Proc. Lond. Math. Soc.* **22**, 24–38 (1971). — [11] On the classification of abelian groups. *Period. Math. Hungar.* **69**, 41–52 (2014). — [12] Two problems of Fuchs concerning Tor and Hom. *J. Algebra* **19**, 379–383 (1971). — [13] Primary groups whose subgroups of smaller cardinality are direct sums of cyclic groups. *Pac. J. Math.* **42**, 63–67 (1972). — [14] The additive group of commutative rings generated by idempotents. *Proc. Am. Math. Soc.* **38**, 499–502 (1973). — [15] Countable unions of totally projective groups. *Trans. Am. Math. Soc.* **190**, 385–392 (1974). — [16] The third axiom of countability for abelian groups. *Proc. Am. Math. Soc.* **82**, 347–350 (1981). — [17] Isotype subgroups of totally projective groups, in *Abelian Group Theory*, Lecture Notes in Mathematics, vol. 874 (Springer, Berlin, 1981), pp. 305–321. — [18] The recovery of some abelian groups from their socles. *Proc. Am. Math. Soc.* **86**, 553–560 (1982). — [19] Balanced subgroups of totally projective groups. *J. Algebra* **88**, 346–349 (1984). — [20] On the structure of abelian p -groups. *Trans. Am. Math. Soc.* **288**, 505–525 (1985)

- P. Hill, M. Lane, C. Megibben — [1] On the structure of p -local abelian groups. *J. Algebra* **143**, 29–45 (1991)
- P. Hill, C. Megibben — [1] Minimal pure subgroups in abelian groups. *Bull. Soc. Math. France* **92**, 251–257 (1964). — [2] Quasi-closed primary groups. *Acta Math. Acad. Sci. Hungar.* **16**, 271–274 (1965). — [3] On primary groups with countable basic subgroups. *Trans. Am. Math. Soc.* **124**, 49–59 (1966). — [4] Extending automorphisms and lifting decompositions in abelian groups. *Math. Ann.* **175**, 159–168 (1968). — [5] On direct sums of countable groups and generalizations, in *Studies in Abelian Groups* (Dunod, Paris, 1968), pp. 183–206. — [6] On the theory and classification of abelian p -groups. *Math. Z.* **190**, 17–38 (1985). — [7] Torsion-free groups. *Trans. Am. Math. Soc.* **295**, 735–751 (1986). — [8] The local equivalence theorem, in *Abelian Group Theory, Contemporary Mathematics*, vol. 87 (American Mathematical Society, Providence, RI, 1989), pp. 201–219. — [9] Mixed groups. *Trans. Am. Math. Soc.* **334**, 121–142 (1992). — [10] The classification of certain Butler groups. *J. Algebra* **160**, 524–551 (1993).
- P. Hill, C. Megibben, W. Ullery — [1] Every endomorphism of a local Warfield module is the sum of two automorphisms, in *Abelian Groups, Rings, Modules and Homological Algebra. Lecture Notes in Pure and Applied Mathematics*, vol. 249 (Chapman & Hall, London, 2006), pp. 175–181
- P. Hill, W. Ullery — [1] Isotype subgroups of local Warfield groups. *Commun. Algebra* **29**, 1899–1907 (2001)
- H.L. Hiller, M. Huber, S. Shelah — [1] The structure of $\text{Ext}(A, \mathbb{Z})$ and $V = L$. *Math. Z.* **162**, 39–50 (1978)
- K.Y. Honda — [1] On primary groups. *Comment. Math. Univ. St. Pauli* **2**, 71–83 (1954). — [2] On a decomposition theorem of primary groups. *Comment. Math. Univ. St. Pauli* **4**, 53–66 (1955). — [3] Realism in the theory of abelian groups. *Comment. Math. Univ. St. Pauli* **5**, 37–75 (1956); *Math. Univ. St. Pauli* **9**, 11–28 (1961); *Math. Univ. St. Pauli* **12**, 75–111 (1964)
- M. Huber — [1] On cartesian powers of a rational group. *Math. Z.* **169**, 253–259 (1979). — [2] On reflexive modules and abelian groups. *J. Algebra* **82**, 469–487 (1983)
- M. Huber, R.B. Warfield Jr. — [1] On the values of the functor \varprojlim^1 . *Arch. Math.* **33**, 430–436 (1979/80)
- A. Hulanicki — [1] Algebraic structure of compact abelian groups. *Bull. Acad. Polon. Sci. Cl. III* **6**, 71–73 (1958). — [2] Note on a paper of de Groot. *Proc. Ned. Akad. Wetensch.* **61**, 114 (1958). — [3] The structure of the factor group of an unrestricted sum by the restricted sum of abelian groups. *Bull. Acad. Polon. Sci. Cl. III* **10**, 77–80 (1962)
- R.H. Hunter — [1] Balanced subgroups of abelian groups. *Trans. Am. Math. Soc.* **215**, 81–89 (1976)
- R.H. Hunter, F. Richman — [1] Global Warfield groups. *Trans. Am. Math. Soc.* **266**, 555–572 (1981)
- R.H. Hunter, F. Richman, E. Walker — [1] Simply presented valued abelian p -groups. *J. Algebra* **49**, 125–133 (1977). — [2] Existence theorems for Warfield groups. *Trans. Am. Math. Soc.* **235**, 345–362 (1978). — [3] Ulm’s theorem for simply presented valued p -groups, in *Abelian Group Theory* (Gordon and Breach, New York, 1987), pp. 33–64
- D. van Huynh — [1] Die Spaltbarkeit von MHP-Ringen. *Bull. Acad. Polon. Sci. Cl. III*, **25**, 939–941 (1977)
- J. Irwin, J. O’Neill — [1] On direct products of abelian groups. *Can. J. Math.* **22**, 525–544 (1970)
- J.M. Irwin, F. Richman, E.A. Walker — [1] Countable direct sums of torsion complete groups. *Proc. Am. Math. Soc.* **17**, 763–766 (1966)
- J. Irwin, T. Snabb — [1] A new class of subgroups of $\prod_{\aleph_0} \mathbb{Z}$, in *Abelian Group Theory. Lecture Notes in Mathematics*, vol. 874 (Springer, Berlin, 1981), pp. 154–160
- J.M. Irwin, C. Walker, E.A. Walker — [1] On p^α -pure sequences of abelian groups, in *Topics in Abelian Groups* (Chicago, 1963), Scott, Foresman & Co. pp. 69–119
- J.M. Irwin, E.A. Walker — [1] On N -high subgroups of abelian groups. *Pac. J. Math.* **11**, 1363–1374 (1961). — [2] On isotype subgroups of abelian groups. *Bull. Soc. Math. France* **89**, 451–460 (1961)

- A.V. Ivanov — [1] A problem on abelian groups [Russian]. *Mat. Sbornik* **105**(4), 525–542 (1978); *Mat. USSR Sbornik* **34**, 461–474 (1978). — [2] Countable direct sums of complete and torsion-complete groups [Russian]. *Trudy Moskov. Mat. Obshch.* **40**, 121–170 (1979). — [3] Direct sums and complete direct sums of abelian groups [Russian], in *Abelian Groups and Modules* (Tomsk. Gos. Univ., Tomsk, 1980), pp. 70–90. — [4] Countable direct sums of certain groups [Russian]. *Trudy Moskov. Mat. Obshch.* **41**, 217–240 (1980). — [5] A class of abelian groups [Russian]. *Mat. Zametki* **29**, 351–358 (1981); *Math. Notes* **29**, 182–185 (1981). — [6] Abelian groups with self-injective rings of endomorphisms and with rings of endomorphisms with the annihilator condition [Russian], in *Abelian Groups and Modules* (Tomsk. Gos. Univ., Tomsk, 1981), pp. 93–109. — [7] On a test problem of Kaplansky [Russian]. *Trudy Moskov. Mat. Obshch.* **42**, 200–220 (1981); *Trans. Moscow Math. Soc.* 199–218 (1982)
- D.R. Jackett — [1] Some topics in the theory of ring structures on abelian groups. *Bull. Aust. Math. Soc.* **18**, 155–156 (1978). — [2] Rings on certain mixed abelian groups. *Pac. J. Math.* **98**, 365–373 (1982)
- C. Jacoby, K. Leistner, P. Loth, L. Strümgmann — [1] Abelian groups with partial decomposition bases in $L_{\infty\omega}^{\delta}$, Part I, in *Groups and Model Theory, Contemporary Mathematics*, vol. 576 (American Mathematical Society, Providence, RI, 2012), pp. 163–175
- S. Janakiraman, K.M. Rangaswamy — [1] Strongly pure subgroups of abelian groups, in *Group Theory. Lecture Notes in Mathematics*, vol. 573 (Springer, Berlin, 1976), pp. 57–65
- C.U. Jensen — [1] On $\text{Ext}(A, R)$ for torsion-free A . *Bull. Am. Math. Soc.* **78**, 831–834 (1972)
- L. Jeśmanowicz — [1] On direct decompositions of torsion-free abelian groups. *Bull. Acad. Polon. Sci. Cl. III* **8**, 505–510 (1960)
- B. Jónsson — [1] Unique factorization problem for torsionfree abelian groups. *Bull. Am. Math. Soc.* **51**, 364 (1945). — [2] On direct decomposition of torsion free abelian groups. *Math. Scand.* **5**, 230–235 (1957); and **7**, 361–371 (1959)
- F.F. Kamalov — [1] Intersection of direct summands of torsion-free abelian groups. *Izv. Vyssh. Uchebn. Zaved. Mat.* **5**, 45–56 (1977).
- I. Kaplansky — [1] Some results on abelian groups. *Proc. Nat. Acad. Sci. USA* **38**, 538–540 (1952). — [2] Projective modules. *Ann. Math.* **68**, 372–377 (1958)
- I. Kaplansky, G.W. Mackey — [1] A generalization of Ulm’s theorem. *Summa Brasil. Math.* **2**, 195–202 (1951)
- A.V. Karpenko, V.M. Misyakov — [1] On the regularity of the center of the endomorphism ring of an abelian group [Russian]. *Fundam. Prikl. Mat.* **13**(3), 39–44 (2007); *J. Math. Sci.* **154**, 304–307 (2008)
- L. Kaup, M.S. Kleane — [1] Induktive Limiten endlich erzeugter freier Moduln. *Manuscripta Math.* **1**, 9–21 (1969)
- P.F. Keef — [1] On set theory and the balanced-projective dimension of C_{Ω} -groups, in *Abelian Group Theory, Contemporary Mathematics*, vol. 87 (American Mathematical Society, Providence, RI, 1989), pp. 31–42. — [2] On iterated torsion products of abelian p -groups. *Rocky Mt. J. Math.* **21**, 1035–55 (1991). — [3] On products of primary abelian groups. *J. Algebra* **152**, 116–134 (1992). — [4] A class of primary abelian groups characterized by its socles. *Proc. Am. Math. Soc.* 115 (1992), no. 3, 647–653. — [5] Extending homomorphisms on the socles of primary abelian groups. *Commun. Algebra* **21**, 3439–53 (1993). — [6] Primary abelian groups admitting only small homomorphisms. *Commun. Algebra* **23**, 3615–26 (1995). — [7] Representable preradicals with enough projectives, in *Abelian Groups and Modules* (Kluwer Academic Publishers, Dordrecht, 1995), pp. 301–311. — [8] Abelian groups and the torsion product, in *Abelian Groups and Modules. Lecture Notes Pure Applied Mathematics*, vol. 182 (Marcel Dekker, New York, 1996), pp. 45–66. — [9] Mahlo cardinals and the torsion product of primary abelian groups. *Pac. J. Math.* **259**, 117–139 (2012)
- P.F. Keef, P.V. Danchev — [1] On n -simply presented primary abelian groups. *Houst. J. Math.* **38**, 1027–1050 (2012)
- T. Kemoklidze — [1] On the full transitivity and fully invariant subgroups of cotorsion hulls of separable p -groups. *J. Math. Sci.* **153**(4), 506–517 (2008); *J. Math. Sci.* **155**(5), 748–786 (2008)

- A. Kertész — [1] On the decomposability of abelian p -groups into the direct sum of cyclic groups. *Acta Math. Acad. Sci. Hungar.* **3**, 122–126 (1952)
- A. Kertész, T. Szele — [1] On the existence of non-discrete topologies in infinite abelian groups. *Publ. Math. Debrecen* **3**, 187–189 (1953)
- S.A. Khabbaz — [1] Abelian torsion groups having a minimal system of generators. *Trans. Am. Math. Soc.* **98**, 527–538 (1961)
- F. Kiefer — [1] The duals of totally projective groups, in *Abelian Group Theory*. Lecture Notes in Mathematics, vol. 874 (Springer, Berlin, 1981), pp. 297–304
- M.A. Kil'p — [1] Quasi-injective abelian groups. *Vestnik Moskov. Univ. Mat. Mekh.* **3**, 3–4 (1967)
- J. Koehler — [1] Some torsion-free rank two groups. *Acta Sci. Math. Szeged* **25**, 186–190 (1964). — [2] The type set of a torsion-free group of finite rank. *Ill. J. Math.* **9**, 66–86 (1965)
- M. Kojman, S. Shelah — [1] Universal abelian groups. *Isr. J. Math.* **92**, 113–124 (1995)
- G. Kolettis, Jr. — [1] Direct sums of countable groups. *Duke Math J.* **27**, 111–125 (1960). — [2] Homogeneously decomposable modules, in *Studies on Abelian Groups* (Dunod, Paris, 1968), pp. 223–238
- E.I. Kompantseva — [1] Torsion-free rings [Russian]. *J. Math. Sci.* **171**, 213–247 (2010). — [2] Absolute nil-ideals of an abelian group. *Fundam. Prikl. Mat.* **17:8**, 63–76 (2012); *J. Math. Sci.* **197**, 625–634 (2014)
- L. Kovács — [1] On subgroups of the basic subgroup. *Publ. Math. Debrecen* **5**, 261–264 (1958)
- T. Koyama — [1] On quasi-closed groups and torsion complete groups. *Bull. Soc. Math. France* **95**, 89–94 (1967)
- S.F. Kozhukhov — [1] Torsion-free abelian groups of finite rank without nilpotent endomorphisms [Russian]. *Sibirsk. Mat. Ž.* **29**, 58–69 (1988); *Siberian Math. J.* **29**, 45–53 (1988)
- A.A. Kravchenko — [1] Completely decomposable groups [Russian]. *Mat. Zametki* **31**, 171–185 (1982); *Math. Notes* **31**, 88–95 (1982). — [2] Balanced and cobalanced Butler groups [Russian]. *Mat. Zametki* **45**, 32–37 (1989); *Math. Notes* **45**, 369–373 (1989)
- M. Król — [1] Separable groups. *I. Bull. Acad. Polon. Sci. Cl. III* **9**, 337–344 (1961). — [2] Automorphism groups and endomorphism rings of torsion-free abelian groups of rank two, *Dissertationes Mathematicae*, vol. 55, Warsaw, 1967
- M. Król, E. Sasiada — [1] The complete direct sums of torsion-free abelian groups of rank one which are separable. *Bull. Acad. Polon. Sci. Cl. III* **8**, 1–2 (1960)
- N.I. Kruchkov — [1] Some generalizations of slender abelian groups. *J. Math. Sci.* **154**, 344–349 (2008)
- P.A. Krylov — [1] Radicals of rings of endomorphisms of torsion-free abelian groups [Russian]. *Mat. Sbornik* **95**(2), 214–228 (1974); *Math. USSR Sbornik* **24**, 209–222 (1976). — [2] Torsion-free abelian groups with cyclic p -basic subgroups [Russian]. *Mat. Zametki* **20**, 805–813 (1976). — [3] The group of homomorphisms into a torsion-free group of rank 1 [Russian], in *Abelian Groups and Modules* (Tomsk. Gos. Univ., Tomsk, 1979), pp. 104–121. — [4] Two problems on the extension groups of abelian groups [Russian]. *Mat. Sbornik* **185**, 73–94 (1994). — [5] Jacobson radical of the endomorphism ring of a torsion-free abelian group, in *Abelian Groups and Modules*, vol. 11–12 (Tomsk. Gos. Univ., Tomsk, 1994), pp. 77–104. — [6] The Jacobson radical of an endomorphism ring of an abelian group [Russian]. *Algebra Logika* **43**, 60–76 (2004); *Algebra Logic* **43**, 34–43 (2004)
- P.A. Krylov, A.A. Tuganbaev — [1] Modules over discrete valuation domains. *J. Math. Sci.* **145**, 4997–5117 (2007); II: **151**, 3255–3371 (2008)
- L.Ya. Kulikov — [1] Zur Theorie der abelschen Gruppen von beliebiger Mächtigkeit [Russian]. *Mat. Sbornik* **9**, 165–182 (1941). — [2] On the theory of abelian groups of arbitrary power [Russian]. *Mat. Sbornik* **16**, 129–162 (1945). — [3] Generalized primary groups. I [Russian]. *Trudy Moskov. Mat. Obshch.* **1**, 247–326 (1952); II. *Trudy Moskov. Mat. Obshch.* **2**, 85–167 (1953). — [4] On direct decompositions of groups [Russian]. *Ukrain. Mat. Zh.* **4**, 230–275 (1952)

- A.G. Kurosh — [1] Zur Zerlegung unendlicher Gruppen. *Math. Ann.* **106**, 107–113 (1932). — [2] Primitive torsionsfreie Gruppen vom endlichen Range. *Ann. Math.* **38**, 175–203 (1937)
- E.L. Lady — [1] Countable torsion products of abelian p -groups. *Proc. Am. Math. Soc.* **37**, 10–16 (1973). — [2] Almost completely decomposable torsion-free abelian groups. *Proc. Am. Math. Soc.* **45**, 41–47 (1974). — [3] Summands of finite rank torsion-free abelian groups. *J. Algebra* **32**, 51–52 (1974). — [4] Nearly isomorphic torsion-free abelian groups. *J. Algebra* **35**, 235–238 (1975). — [5] Splitting fields for torsion-free modules over discrete valuation rings. I. *J. Algebra* **49**, 261–275 (1977). II: *J. Algebra* **66**, 281–306 (1980). III: *J. Algebra* 307–320. — [6] On classifying torsion-free modules over discrete valuation rings, in *Abelian Group Theory*. *Lecture Notes in Mathematics*, vol. 616 (Springer, Berlin, 1977), pp. 168–172
- M. Lane — [1] A new characterization of p -local balanced projective groups. *Proc. Am. Math. Soc.* **96**, 379–386 (1986). — [2] The balanced-projective dimension of p -local abelian groups. *J. Algebra* **109**, 1–13 (1987)
- M. Lane, C. Megibben — [1] Balanced projectives and axiom 3. *J. Algebra* **111**, 457–474 (1987)
- H. Lausch — [1] Eine geometrische Beschreibung des Tensorproduktes zweier torsionsfreier abelscher Gruppen endlichen Ranges. *Geom. Dedicata* **13**, 419–428 (1983)
- J. Lawrence — [1] Countable abelian groups with a discrete norm are free. *Proc. Am. Math. Soc.* **90**, 352–354 (1984)
- W.Y. Lee — [1] Co-diagonal Butler groups. *Chinese J. Math.* **17**, 259–271 (1989)
- H. Leptin — [1] Zur Theorie der überabzählbaren abelschen p -Gruppen. *Abh. Math. Sem. Univ. Hamburg* **24**, 79–90 (1960). — [2] Abelsche p -Gruppen und ihre Automorphismengruppen. *Math. Z.* **73**, 235–253 (1960). — [3] Einige Bemerkungen über die Automorphismen abelscher p -Gruppen, in *Proceedings of the Colloquium on Abelian Groups* (Akadémiai Kiadó, Budapest, 1964), pp. 99–104
- F.W. Levi — [1] *Abelsche Gruppen mit abzählbaren Elementen*, Habilitationsschrift (Leipzig, 1917)
- W. Liebert — [1] Charakterisierung der Endomorphismenringe beschränkter abelscher Gruppen. *Math. Ann.* **174**, 217–232 (1967). — [2] Die minimalen Ideale der Endomorphismenringe abelscher p -Gruppen. *Math. Z.* **97**, 85–104 (1967). — [3] Endomorphism rings of abelian p -groups, in *Studies on Abelian Groups* (Dunod, Paris, 1968), pp. 239–258. — [4] Endomorphism rings of abelian p -groups, in *Abelian Group Theory*. *Lecture Notes in Mathematics*, vol. 1006 (Springer, Berlin, 1983), pp. 384–399. — [5] Isomorphic automorphism groups of primary abelian groups. I. *Abelian Group Theory* (Gordon and Breach, New York, 1987), pp. 9–31; II: *Abelian Group Theory, Contemporary Mathematics*, vol. 87 (American Mathematical Society, Providence, RI, 1989), pp. 51–59
- R.C. Linton — [1] On fully invariant subgroups of primary abelian groups. *Mich. Math. J.* **22**, 281–284 (1975). — [2] λ -large subgroups of C_λ -groups. *Pac. J. Math.* **78**, 477–486 (1978)
- J. Łoś — [1] Abelian groups which are direct summands of every abelian group which contains them as pure subgroups. *Bull. Acad. Polon. Sci. Cl. III* **4**, 73 (1956); *Fund. Math.* **44**, 84–90 (1957). — [2] Linear equations and pure subgroups. *Bull. Acad. Polon. Sci. Cl. III* **7**, 13–18 (1959)
- P. Loth — [1] The duals of Warfield groups. *Pac. J. Math.* **181**, 333–356 (1997). — [2] Characterizations of Warfield groups. *J. Algebra* **204**, 32–41 (1998). — [3] Classifications of abelian groups and Pontryagin duality, in *Algebra, Logic and Applications*, vol. 10 (Gordon and Breach, Amsterdam, 1998)
- E.S. Lyapin — [1] On the decompositions of abelian groups into direct sums of rational groups [Russian]. *Mat. Sbornik* **8**, 205–231 (1940); *Am. Math. Soc. Transl.* **7**, 1–56 (1950)
- S. MacLane — [1] Group extensions by primary abelian groups. *Trans. Am. Math. Soc.* **95**, 1–16 (1960)

- A. Mader — [1] On the automorphism group and the endomorphism ring of abelian groups. *Ann. Univ. Sci. Budapest* **8**, 3–12 (1965). — [2] On the normal structure of the automorphism group and the ideal structure of the endomorphism ring of abelian p -groups. *Publ. Math. Debrecen* **13**, 123–137 (1966). — [3] Extensions of abelian groups, in *Studies on Abelian Groups* (Paris, 1968), pp. 259–266. — [4] Groups and modules that are slender as modules over their endomorphism rings, in *Abelian Groups and Modules*, CISM Courses Lectures, vol. 287 (Springer, Berlin, 1984), pp. 315–327. — [5] Regularity in endomorphism rings. *Commun. Algebra* **37**, 2823–2844 (2009)
- A. Mader, O. Mutzbauer, C. Vinsonhaler — [1] Local-global relations for almost completely decomposable groups. *Rocky Mt. J. Math.* **29**, 1429–1453 (1999)
- A. Mader, L. Strütingmann — [1] A class of Butler groups and their endomorphism rings. *Hokkaido Math. J.* **37**, 399–425 (2008)
- M. Magidor, S. Shelah — [1] When does almost free imply free? (For groups, transversals, etc.). *J. Am. Math. Soc.* **7**, 769–830 (1994). — [2] $\text{Bext}^2(G, T)$ can be nontrivial even assuming GCH, in *Abelian Group Theory and Related Topics, Contemporary Mathematics*, vol. 171 (American Mathematical Society, Providence, RI, 1994), pp. 287–294
- A.I. Mal'cev — [1] Torsion-free abelian groups of finite rank [Russian]. *Mat. Sbornik* **4**, 45–68 (1938)
- J.M. Maranda — [1] On pure subgroups of abelian groups. *Arch. Math.* **11**, 1–13 (1960)
- W. May — [1] Multiplicative groups of fields. *Proc. Lond. Math. Soc.* **24**, 295–306 (1972). — [2] Isomorphism of group algebras. *J. Algebra* **40**, 10–18 (1976). — [3] Multiplicative groups under field extension. *Can. J. Math.* **31**, 436–440 (1979). — [4] Endomorphism rings of mixed abelian groups, in *Abelian Group Theory, Contemporary Mathematics*, vol. 87 (American Mathematical Society, Providence, RI, 1989), pp. 61–74. — [5] Endomorphism algebras of not necessarily cotorsion-free modules. *Contemporary Math.*, vol. 130 (American Mathematical Society, Providence, RI, 1992), pp. 257–264. — [6] Abelian automorphism groups of countable rank, in *Abelian Groups and Modules*. Trends in Mathematics (Birkhäuser, Basel, 1999), pp. 23–42. — [7] The use of the finite topology on endomorphism rings. *J. Pure Appl. Algebra* **163**, 107–117 (2001)
- W. May, E. Toubassi — [1] Classifying endomorphism rings of rank one mixed groups, in *Abelian Groups and Modules*. CISM Courses and Lectures, vol. 287 (Springer, Berlin, 1984), pp. 253–263
- C.K. Megibben — [1] On subgroups of primary abelian groups. *Publ. Math. Debrecen* **12**, 293–294 (1965). — [2] Large subgroups and small homomorphisms. *Mich. Math. J.* **13**, 153–160 (1966). — [3] On mixed groups of torsion-free rank one. *Ill. J. Math.* **11**, 134–144 (1967). — [4] The generalized Kulikov criterion. *Can. J. Math.* **21**, 1192–1208 (1969). — [5] A generalization of the classical theory of primary groups. *Tōhoku Math. J.* **22**, 347–356 (1970). — [6] Generalized pure injectivity. *Symposia Math.* **13**, 257–271 (1974). — [7] Crawley's problem on the unique ω -elongation of p -groups is undecidable. *Pac. J. Math.* **107**, 205–212 (1983). — [8] ω_1 -separable p -groups, in *Abelian Group Theory* (Gordon and Breach, New York, 1987), pp. 117–136
- C.K. Megibben, W. Ullery — [1] Isotype Warfield subgroups of global Warfield groups. *Rocky Mt. J. Math.* **32**, 1523–1542 (2002). — [2] The sequentially pure projective dimension of global groups with decomposition bases. *J. Pure Appl. Algebra* **187**, 183–205 (2004)
- K. Meinel — [1] Superdecomposable modules over integral domains. *Arch. Math.* **39**, 11–18 (1982)
- A.H. Mekler — [1] Proper forcing and abelian groups, in *Abelian Group Theory*. Lecture Notes in Mathematics, vol. 1006 (Springer, Berlin, 1983), pp. 285–303. — [2] \aleph_1 -separable groups of mixed type, in *Abelian Group Theory*. Lecture Notes in Mathematics, vol. 874 (Springer, Berlin, 1981), pp. 114–126
- A. Mekler, G. Schlitt — [1] The theory of dual groups. *Fund. Math.* **144**, 129–142 (1994)

- A. Mekler, S. Shelah — [1] A solution to Crawley's problem. *Pac. J. Math.* **121**, 133–134 (1986). — [2] When κ -free implies strongly κ -free, in *Abelian Group Theory* (Gordon and Breach, New York, 1987), pp. 137–148. — [3] Every coseparable group may be free. *Isr. J. Math.* **81**, 161–178 (1993)
- C. Metelli — [1] Bihomogeneous groups, in *Abelian Group Theory, Contemporary Mathematics*, vol. 87 (American Mathematical Society, Providence, RI, 1989), pp. 161–169. — [2] On automorphisms of completely decomposable torsion-free abelian groups. *Commun. Algebra* **18**, 529–549 (1990). — [3] On direct sums of $B^{(1)}$ -groups. *Comment. Math. Univ. Carolin.* **34**, 587–591 (1993). — [4] An adjointness relation for finite partition lattices, in *Abelian Groups, Module Theory, and Topology*. Lecture Notes in Pure and Applied Mathematics, vol. 201 (Dekker, New York, 1998), pp. 301–310
- C. Metelli, L. Salce — [1] The endomorphism ring of an abelian torsion-free homogeneous separable group. *Arch. Math.* **26**, 480–485 (1975)
- R. Mines — [1] A family of functors defined on generalized abelian groups. *Pac. J. Math.* **26**, 349–360 (1968)
- R. Mines, C. Vinsonhaler — [1] Butler groups and Bext: a constructive view, in *Contemporary Mathematics*, vol. 130 (American Mathematical Society, Providence, RI, 1992), pp. 289–299
- A.P. Mishina — [1] On the direct summands of complete direct sums of torsion-free abelian groups of rank one [Russian]. *Sibirsk. Mat. Zh.* **3**, 244–249 (1962). — [2] Separability of complete direct sums of torsion-free abelian groups of rank one [Russian]. *Dokl. Akad. Nauk SSSR* **143**, 275–276 (1962); *Mat. Sbornik* **57**, 375–383 (1962). — [3] On automorphisms and endomorphisms of abelian groups [Russian]. *Vestnik Moskov. Univ.* 1962, Nr. 4, 39–43. — [4] On automorphisms and endomorphisms of abelian groups [Russian]. *Vestnik Moskov. Univ.* **27**, 62–66 (1972)
- V.M. Misyakov — [1] On complete transitivity of reduced abelian groups [Russian], in *Abelian Groups and Modules*, vol. 11–12 (Tomsk. Gos. Univ., Tomsk, 1994), pp. 134–156; *J. Math. Sci.* **154**, 350–373 (2008)
- A.V. Misyakova — [1] Abelian groups with semiprime endomorphism ring [Russian]. *Mat. Sbornik* **202**, 117–126 (2011); *Mat. Sbornik* **202**, 739–748 (2011)
- G.S. Monk — [1] One-sided ideals in the endomorphism ring of an abelian p -group. *Acta Math. Acad. Sci. Hungar.* **19**, 171–185 (1968). — [2] Essentially indecomposable abelian p -groups. *J. Lond. Math. Soc.* **3**, 341–345 (1971)
- J.H. Moore — [1] A characterization of Warfield groups. *Proc. Am. Math. Soc.* **87**, 617–620 (1983)
- A.I. Moskalenko — [1] Cotorsion hull of a separable p -group [Russian]. *Algebra Logika* **28**, 207–226 (1989); *Algebra Logic* **28**, 139–151 (1989). — [2] Definability of a countable periodic group by groups of extensions [Russian], in *Abelian Groups and Modules*, vol. 10 (Tomsk. Gos. Univ., Tomsk, 1991), pp. 86–90
- C.E. Murley — [1] The classification of certain classes of torsion-free abelian groups. *Pac. J. Math.* **40**, 647–665 (1972)
- O. Mutzbauer — [1] Klassifizierung torsionsfreier abelscher Gruppen des Ranges 2. I: *Rend. Sem. Mat. Univ. Padova* **55**, 195–208 (1976). II: *Rend. Sem. Mat. Univ. Padova* **58**, 163–174 (1977). — [2] Type invariants of torsion-free abelian groups, in *Abelian Group Theory, Contemporary Mathematics*, vol. 87 (American Mathematical Society, Providence, RI, 1989), pp. 133–154
- O. Mutzbauer, E. Toubassi — [1] Quasibases of p -groups. *Rend. Sem. Mat. Univ. Padova* **102**, 77–95 (1999)
- V.I. Myshkin — [1] Countable abelian groups of rank 1 [Russian]. *Mat. Sbornik* **76**, 435–448 (1968)
- G.P. Niedzwecki — [1] Rings on groups, Thesis, Wesleyan University, 1982
- G.P. Niedzwecki, J. Reid — [1] Abelian groups projective over their endomorphism rings. *J. Algebra* **159**, 139–149 (1993)
- G. Nöbeling — [1] Verallgemeinerung eines Satzes von Herrn E. Specker. *Invent. Math.* **6**, 41–55 (1968)

- L.G. Nongxa — [1] A note on homogeneous torsion-free abelian groups. *Q. J. Math. Oxford* **35**, 183–190 (1984). — [2] $*$ -pure subgroups of completely decomposable abelian groups. *Proc. Am. Math. Soc.* **100**, 613–618 (1987)
- L.G. Nongxa, K.M. Rangaswamy, C. Vinsonhaler — [1] Balanced subgroups of completely decomposable groups, in *Abelian Groups and Modules*. Lecture Notes in Pure and Applied Mathematics, vol. 182 (Marcel Dekker, New York, 1996), pp. 331–351
- L.G. Nongxa, C. Vinsonhaler — [1] Balanced Butler groups. *J. Algebra* **180**, 546–570 (1996)
- R.J. Nunke — [1] Modules of extensions over Dedekind rings. *Ill. J. Math.* **3**, 222–241 (1959). — [2] Slender groups. *Bull. Am. Math. Soc.* **67**, 274–275 (1961); *Acta Sci. Math. Szeged* **23**, 67–73 (1962). — [3] Purity and subfunctors of the identity, in *Topics in Abelian Groups* (Chicago, 1963), Scott, Foresman & Co. pp. 121–171. — [4] On the structure of Tor, in *Proceedings of the Colloquium on Abelian Groups* (Akadémiai Kiadó, Budapest, 1964), pp. 115–124; *Pac. J. Math.* **22**, 453–464 (1967). — [5] Homology and direct sums of countable abelian groups. *Math. Z.* **101**, 182–212 (1967). — [6] A note on endomorphism rings of abelian p -groups, in *Studies on Abelian Groups* (Dunod, Paris, 1968), pp. 305–308. — [7] Uniquely elongating modules. *Symposia Math.* **13**, 315–330 (1974)
- R.J. Nunke, J.J. Rotman — [1] Singular cohomology groups. *J. Lond. Math. Soc.* **37**, 301–306 (1962)
- T. Okuyama — [1] On purifiable subgroups in arbitrary abelian groups. *Commun. Algebra* **28**, 121–139 (2000). — [2] Purifiability in pure subgroups. *Hokkaido Math. J.* **36**, 365–381 (2007)
- K.C. O’Meara, C. Vinsonhaler — [1] Separative cancellation and multiple isomorphism in torsion-free abelian groups. *J. Algebra* **221**, 536–550 (1999)
- J.D. O’Neill — [1] Noetherian rings with free additive groups. *Proc. Am. Math. Soc.* **92**, 323–324 (1984). — [2] Direct summands of vector groups. *Acta Math. Acad. Sci. Hungar.* **55**, 207–209 (1990). — [3] Direct summands of \mathbb{Z}^κ for large κ . in *Abelian Group Theory and Related Topics, Contemporary Mathematics*, vol. 171 (American Mathematical Society, Providence, RI, 1994), pp. 313–323. — [4] A result on direct products of copies of the integers. *Commun. Algebra* **23**, 4825–4830 (1995). — [5] Summable subsets of direct products of infinite cyclic groups, in *Abelian Groups and Modules*. Lecture Notes in Pure and Applied Mathematics, vol. 182 (Marcel Dekker, New York, 1996), pp. 353–361
- A. Orsatti — [1] Alcuni gruppi abeliani il cui anello degli endomorfismi è locale. *Rend. Sem. Mat. Univ. Padova* **35**, 107–115 (1965). — [2] A class of rings which are the endomorphism rings of some torsion-free abelian groups. *Ann. Scuola Norm. Sup. Pisa* **23**, 143–153 (1969)
- B.L. Osofsky — [1] Lifting direct sum decompositions of bounded abelian p -groups, in *Abelian Groups, Rings and Modules, Contemporary Mathematics*, vol. 273 (American Mathematical Society, Providence, RI, 2001), pp. 253–260
- M.A. Ould-Beddi, L. Strüngmann — [1] Stacked bases for a pair of homogeneous completely decomposable groups with bounded quotient, in *Abelian Groups and Modules*. Trends in Mathematics (Birkhäuser, Basel, 1999), pp. 199–209
- S. Pabst — [1] On \aleph_1 -free modules with trivial dual. *Commun. Algebra* **28**, 5053–5065 (2000)
- E.A. Palyutin — [1] Indecomposable ω_1 -free abelian groups [Russian]. *Sibirsk. Mat. Zh.* **19**, 1415–1417 (1978)
- A.T. Paras — [1] Abelian groups as noetherian modules over their endomorphism rings, in *Abelian Group Theory and Related Topics, Contemporary Mathematics*, vol. 171 (American Mathematical Society, Providence, RI, 1994), pp. 325–332
- L.D. Parker, E.A. Walker — [1] An extension of the Ulm-Kolettis theorems, in *Studies on Abelian Groups* (Dunod, Paris, 1968), pp. 309–325
- K.R. Pearson, J.E. Schneider — [1] Rings with a cyclic group of units. *J. Algebra* **16**, 243–251 (1970)
- R.S. Pierce — [1] Homomorphisms of primary abelian groups, in *Topics in Abelian Groups* (Chicago, 1963), Scott, Foresman & Co. pp. 215–310. — [2] Centers of purity in abelian groups. *Pac. J. Math.* **13**, 215–219 (1963). — [3] Endomorphism rings of primary abelian

- groups, in *Proceedings of the Colloquium on Abelian Groups* (Akadémiai Kiadó, Budapest, 1964), pp. 125–137. — [4] E -modules, in *Abelian Group Theory, Contemporary Mathematics*, vol. 87 (American Mathematical Society, Providence, RI, 1989), pp. 221–240
- R.S. Pierce, C. Vinsonhaler — [1] Classifying E -rings. *Commun. Algebra* **19**, 615–653 (1991)
- L. Pontryagin — [1] The theory of topological commutative groups. *Ann. Math.* **35**, 361–388 (1934)
- G.D. Poole, J.D. Reid — [1] Abelian groups quasi-injective over their endomorphism rings. *Can. J. Math.* **24**, 617–621 (1972)
- L. Procházka — [1] Über die Spaltbarkeit der Faktorgruppen torsionsfreier abelscher Gruppen endlichen Ranges [Russian]. *Czechoslov. Math. J.* **11**, 521–557 (1961). — [2] A note on quasi-isomorphism of torsion free abelian groups of finite rank. *Czechoslov. Math. J.* **15**, 1–8 (1965)
- H. Prüfer — [1] Untersuchungen über die Zerlegbarkeit der abzählbaren primären abelschen Gruppen. *Math. Z.* **17**, 35–61 (1923). — [2] Theorie der abelschen Gruppen. I. Grundeigenschaften. *Math. Z.* **20**, 165–187 (1924); II. Ideale Gruppen. *Math. Z.* **22**, 222–249 (1925)
- P. Puusemp — [1] On the torsion subgroups and endomorphism semigroups of abelian groups. *Algebras Groups Geom.* **14**, 407–422 (1997)
- R. Rado — [1] A proof of the basis theorem for finitely generated abelian groups. *J. Lond. Math. Soc.* **26**, 74–75 (1951); 160
- K.M. Rangaswamy — [1] Abelian groups with endomorphic images of special types. *J. Algebra* **6**, 271–280 (1967). — [2] Representing Baer rings as endomorphism rings. *Math. Ann.* **190**, 167–176 (1970). — [3] Abelian groups with self-injective endomorphism rings, in *Proceedings of the Second International Conference on the Theory of Groups*. *Lecture Notes in Mathematics*, vol. 372 (Springer, Berlin, 1974), pp. 595–604. — [4] An aspect of purity and its dualisation in abelian groups and modules. *Symposia Math.* **23**, 307–320 (1979). — [5] Separable abelian groups as modules over their endomorphism rings. *Proc. Am. Math. Soc.* **91**, 195–198 (1984). — [6] A homological characterization of abelian B_2 -groups. *Proc. Am. Math. Soc.* **121**, 409–415 (1994). — [7] A property of B_2 -groups. *Comment. Math. Univ. Carolin.* **35**, 627–631 (1994)
- L. Rédei, T. Szele — [1] Die Ringe “ersten Ranges”. *Acta Sci. Math. Szeged* **12A**, 18–29 (1950)
- R. Ree, R.J. Wisner — [1] A note on torsion-free nil groups. *Proc. Am. Math. Soc.* **7**, 6–8 (1956)
- G.A. Reid — [1] Almost free abelian groups, *Lecture notes*, Tulane University, New Orleans, 1967
- J.D. Reid — [1] A note on torsion-free abelian groups of infinite rank. *Proc. Am. Math. Soc.* **13**, 222–225 (1962). — [2] On quasi-decompositions of torsion-free abelian groups. *Proc. Am. Math. Soc.* **13**, 550–554 (1962). — [3] On the ring of quasi-endomorphisms of a torsion-free group, in *Topics in Abelian Groups* (Chicago, 1963), Scott, Foresman & Co. pp. 51–68. — [4] Quasi-pure-injectivity and quasi-pure-projectivity, in *Abelian Group Theory*. *Lecture Notes in Mathematics*, vol. 616 (1977) pp. 219–227. — [5] Abelian groups finitely generated over their endomorphism rings, in *Abelian Group Theory*. *Lecture Notes in Mathematics*, vol. 874 (Springer, Berlin, 1981), pp. 41–52. — [6] Abelian groups cyclic over their endomorphism rings, in *Abelian Group Theory*. *Lecture Notes in Mathematics*, vol. 1006 (Springer, Berlin, 1983), pp. 190–203
- F. Richman — [1] Thin abelian groups. *Pac. J. Math.* **27**, 599–606 (1968). — [2] A class of rank 2 torsion-free groups, in *Studies on Abelian Groups* (Dunod, Paris, 1968), pp. 327–333. — [3] Extensions of p -bounded groups. *Arch. Math.* **21**, 449–454 (1970). — [4] Detachable p -groups and quasi-injectivity. *Acta Math. Acad. Sci. Hungar.* **27**, 71–73 (1976). — [5] An extension of the theory of completely decomposable torsion-free abelian groups. *Trans. Am. Math. Soc.* **279**, 175–185 (1983). — [6] Butler groups, valued vector spaces and duality. *Rend. Sem. Mat. Univ. Padova* **72**, 13–19 (1984). — [7] The constructive theory of torsion-free abelian groups. *Commun. Algebra* **18**, 3913–3922 (1990)
- F. Richman, E.A. Walker — [1] Primary abelian groups as modules over their endomorphism rings. *Math. Z.* **89**, 77–81 (1965). — [2] Extending Ulm’s theorem without group theory. *Proc. Am. Math. Soc.* **21**, 194–196 (1969). — [3] Modules over PID’s that are injective over their endomorphism rings, in *Ring Theory. Proceedings of the Park City Conference* (Academic, New York, 1972), pp. 363–372. — [4] Homological dimension of abelian groups over their

- endomorphism rings. Proc. Am. Math. Soc. **54**, 65–68 (1976). — [5] Valuated groups. J. Algebra **56**, 145–167 (1979). — [7] Cyclic Ext. Rocky Mt. J. Math. **11**, 611–615 (1981)
- L.A. Rogers — [1] Ulm's theorem for partially ordered structures related to simply presented abelian p -groups. Trans. Am. Math. Soc. **227**, 333–343 (1977)
- J. Rotman — [1] Mixed modules over valuation rings. Pac. J. Math. **10** (1960), 607–623. — [2] Torsion-free and mixed abelian groups. Ill. J. Math. **5**, 131–143 (1961). — [3] On a problem of Baer and a problem of Whitehead in abelian groups. Acta Math. Acad. Sci. Hungar. **12**, 245–254 (1961). — [4] Sheaves and abelian groups. Symposia Math. **13**, 11–20 (1974)
- J. Rotman, T. Yen — [1] Modules over a complete discrete valuation ring. Trans. Am. Math. Soc. **98**, 242–254 (1961)
- S.V. Rychkov — [1] On direct products of abelian groups [Russian]. Dokl. Akad. Nauk SSSR **252**, 301–302 (1980). — [2] The problem of splitting of pure extensions of abelian groups and axiomatic set theory [Russian]. Uspekhi Mat. Nauk **40**, 195–196 (1985). — [3] Indecomposable abelian p -groups that are almost direct sums of cyclic groups [Russian]. Mat. Zametki **43**, 705–712 (1988); Math. Notes **43**, 405–408 (1988). — [4] Abelian k -separable groups [Russian], in *Abelian Groups and Modules*, vol. 7 (Tomsk. Gos. Univ., Tomsk, 1988), pp. 110–120
- S.V. Rychkov, A.A. Fomin — [1] Abelian groups with a countable number of subgroups [Russian], in *Abelian Groups and Modules*, vol. 10 (Tomsk. Gos. Univ., Tomsk, 1991), pp. 99–105
- S.V. Rychkov, B. Thomé — [1] Slender groups and related concepts. Commun. Algebra **14**, 333–387 (1986)
- G. Sabbagh — [1] How not to characterize the multiplicative group of fields. J. Lond. Math. Soc. **1**, 369–370 (1969)
- L. Salce — [1] I_λ -groups and almost totally injective groups. Ann. Univ. Ferrara Sez. VII **25**, 197–204 (1979). — [2] Cotorsion theories for abelian groups. Symposia Math. **23**, 11–32 (1979)
- L. Salce, F. Menegazzo — [1] Abelian groups whose endomorphism ring is linearly compact. Rend. Sem. Mat. Univ. Padova **53**, 315–325 (1975)
- E. Sławińska — [1] Construction of a directly indecomposable abelian group of the power higher than that of the continuum. Bull. Acad. Polon. Sci. Cl. III **5**, 701–703 (1957); Bull. Acad. Polon. Sci. Cl. III **7**, 23–26 (1959). — [2] Proof that every countable and reduced torsion-free abelian group is slender. Bull. Acad. Polon. Sci. Cl. III **7**, 143–144 (1959). — [3] On the isomorphism of decompositions of torsion-free abelian groups into complete direct sums of groups of rank one. Bull. Acad. Polon. Sci. Cl. III **7**, 145–149 (1959). — [4] On two problems concerning endomorphism groups. Ann. Univ. Sci. Budapest **2**, 65–66 (1959)
- C.L. Schochet — [1] A Pext primer: pure extensions and \lim^1 for infinite abelian groups. NYJM Monographs, vol. 1 (State University of New York, Albany, 2003)
- P. Schultz — [1] The endomorphism ring of the additive group of a ring. J. Aust. Math. Soc. **15**, 60–69 (1973). — [2] When is an abelian p -group determined by the Jacobson radical of its endomorphism ring? in *Abelian Group Theory and Related Topics, Contemporary Mathematics*, vol. 171 (1994), pp. 385–396. — [3] Automorphisms which determine an abelian p -group, in *Abelian Groups, Module Theory, and Topology*. Lecture Notes in Pure and Applied Mathematics, vol. 201 (Dekker, New York, 1998) pp. 373–379. — [4] Automorphism groups of abelian groups, in *Abelian Groups, Rings and Modules, Contemporary Mathematics*, vol. 273 (American Mathematical Society, Providence, RI, 2001) 51–62. — [5] Self-splitting abelian groups. Bull. Aust. Math. Soc. **64**, 71–79 (2001)
- A.M. Sebel'din — [1] Conditions of the isomorphism of completely decomposable torsion-free abelian groups with isomorphic rings of endomorphisms [Russian]. Mat. Zametki **11**, 403–408 (1972). — [2] Homomorphism groups of complete direct sums of torsion-free abelian groups of rank 1 [Russian]. Tomsk. Gos. Univ., Tomsk **1**, 121–122 (1974). — [3] Determination of abelian groups by their semigroups of endomorphisms [Russian], in *Abelian Groups and Modules*, vol. 10 (Tomsk. Gos. Univ., Tomsk, 1991), pp. 125–133
- S. Shelah — [1] Infinite abelian groups, Whitehead problem and some constructions. Isr. J. Math. **18**, 243–256 (1974). — [2] Existence of rigid-like families of abelian p -groups, in *Model Theory and Algebra*. Lecture Notes in Mathematics, vol. 498 (Springer, Berlin, 1975),

- pp. 384–402. — [3] Whitehead groups may not be free even assuming CH. I: *Isr. J. Math.* **28**, 193–204 (1977). II: *Isr. J. Math.* **35**, 257–285 (1980). — [4] A combinatorial theorem and endomorphism rings of abelian groups. II: *Abelian Groups and Modules*. CISM Courses Lectures, vol. 287 (Springer, Berlin, 1984), pp. 37–86
- S. Shelah, L. Strüngmann — [1] It is consistent with ZFC that B_1 -groups are not B_2 . *Forum Math.* **15**, 507–524 (2003). — [2] A characterization of $\text{Ext}(G, Z)$ assuming $(V = L)$. *Fund. Math.* **193**, 141–151 (2007)
- M. Shiffman — [1] The ring of automorphisms of an abelian group. *Duke Math. J.* **6**, 579–597 (1940)
- A.Z. Shlyifer — [1] Solvability of automorphism groups of abelian groups, in *Abelian Groups and Modules*, vol. 7 ((Tomsk. Gos. Univ., Tomsk, 1988), pp. 148–155
- K. Shoda — [1] Über die Automorphismen einer endlichen abelschen Gruppe. *Math. Ann.* **100**, 674–686 (1928)
- T. Skolem — [1] On the existence of a multiplicative basis. *Norske Vid. Selsk. Forh.* **2**, 4–7 (1947)
- A. Yu. Soifer — [1] A theorem on direct decompositions of abelian groups [Russian]. *Mat. Zametki* **14**, 879–884 (1973); *Math. Notes* **14**, 1064–1067 (1973)
- E. Specker — [1] Additive Gruppen von Folgen ganzer Zahlen. *Portugaliae Math.* **9**, 131–140 (1950)
- R.O. Stanton — [1] An invariant for modules over a discrete valuation ring. *Proc. Am. Math. Soc.* **49**, 51–54 (1975). — [2] Decomposition bases and Ulm’s theorem, in *Abelian Group Theory*. Lecture Notes in Mathematics, vol. 616 (Springer, Berlin, 1977), pp. 39–56. — [3] Almost affable abelian groups. *J. Pure Appl. Algebra* **15**, 41–52 (1979)
- J. Stelzer — [1] A cancellation criterion for finite rank torsion-free abelian groups. *Proc. Am. Math. Soc.* **94**, 363–368 (1985)
- J. Stepráns — [1] A characterization of free abelian groups. *Proc. Am. Math. Soc.* **93**, 347–349 (1988)
- A.E. Stratton — [1] Mixed modules over an incomplete discrete valuation ring. *Proc. Am. Math. Soc.* **21**, 201–218 (1970)
- R.W. Stringall — [1] Decompositions of abelian p -groups. *Proc. Am. Math. Soc.* **28**, 409–410 (1971)
- L. Strüngmann — [1] On problems by Baer and Kulikov using $V = L$. III. *J. Math.* **46**, 477–490 (2002). — [2] Baer cotorsion pairs. *Isr. J. Math.* **151**, 29–51 (2006). — [3] On endomorphism rings of B_1 -groups that are not B_2 -groups. *Proc. Am. Math. Soc.* **137**, 3657–3668 (2009)
- F.A. Szász — [1] Die abelschen Gruppen, deren volle Endomorphismenringe die Minimalbedingung für Hauptideale erfüllen. *Monatshefte Math.* **65**, 150–153 (1961). — [2] Über Artinsche Ringe. *Bull. Acad. Polon. Sci. Cl. III* **11**, 351–354 (1963)
- G. Szekeres — [1] Countable abelian groups without torsion. *Duke Math. J.* **15**, 293–306 (1948)
- T. Szele — [1] Zur Theorie der Zeroringe. *Math. Ann.* **121**, 242–246 (1949). — [2] Gruppentheoretische Beziehungen der Primkörper. *Mat. Aineiden Aika.* **13**, 80–85 (1949). — [3] Ein Analogon der Körpertheorie für abelsche Gruppen. *J. Reine Angew. Math.* **188**, 167–192 (1950). — [4] On direct decompositions of abelian groups. *J. Lond. Math. Soc.* **28**, 247–250 (1953). — [5] On the basic subgroups of abelian p -groups. *Acta Math. Acad. Sci. Hungar.* **5**, 129–141 (1954). — [6] Nilpotent Artinian rings. *Publ. Math. Debrecen* **4**, 71–78 (1955). — [7] On quasi-decomposable abelian groups. *Acta Math. Acad. Sci. Hungar.* **7**, 109–114 (1956). — [8] On a topology in endomorphism rings of abelian groups. *Publ. Math. Debrecen* **5**, 1–4 (1957)
- T. Szele, L. Fuchs — [1] On Artinian rings. *Acta Sci. Math. Szeged* **17**, 30–40 (1956)
- W. Szmielew — [1] Elementary properties of abelian groups. *Fund. Math.* **41**, 203–271 (1955)
- S.G. Tellman — [1] Images of induced endomorphisms in $\text{Ext}(H, G)$. *Acta Sci. Math. Szeged* **23**, 290–291 (1962)
- S. Thomas — [1] Borel superrigidity and the classification problem for torsion-free abelian groups of finite rank, in *International Congress of Mathematicians*, vol. II (European Mathematical Society, 2006), pp. 93–116. — [2] The classification problem for finite rank Butler groups, in *Models, Modules and Abelian groups* (W. de Gruyter, Berlin, 2008), pp. 329–338

- G.M. Tsukerman — [1] Rings of endomorphisms of free modules [Russian]. *Sibirsk. Mat. Ž.* **7**, 1161–1167 (1966)
- M. Turgi — [1] A sheaf-theoretical interpretation of the Kurosh theorem, in *Abelian Group Theory*. Lecture Notes in Mathematics, vol. 616 (Springer, Berlin, 1977), pp. 173–196
- M.A. Turmanov — [1] On pureness in abelian groups. *J. Sci. Math.* **137**, 5336–5345 (2006)
- H. Ulm — [1] Zur Theorie der abzählbar-unendlichen abelschen Gruppen. *Math. Ann.* **107**, 774–803 (1933)
- C. Vinsonhaler — [1] Torsion-free abelian groups quasi-projective over their endomorphism rings. II. *Pac. J. Math.* **74**, 261–265 (1978); *Pac. J. Math.* **79**, 564–565 (1979). — [2] *E*-rings and related structures, in *Non-Noetherian commutative ring theory*. Mathematics and its Applications, vol. 520 (Kluwer Academic, Dordrecht, 2000), pp. 387–402
- C. Vinsonhaler, S. Wallutis, W.J. Wickless — [1] A class of $B^{(2)}$ -groups. *Commun. Algebra* **33**, 2025–2035 (2005)
- C. Vinsonhaler, W.J. Wickless — [1] Torsion-free abelian groups quasi-projective over their endomorphism rings. *Pac. J. Math.* **68**, 527–535 (1977). — [2] The injective hull of a separable p -group as an E -module. *J. Algebra* **71**, 32–39 (1981). — [3] Balanced projective and cobalanced injective torsion-free groups of finite rank. *Acta Math. Acad. Sci. Hungar.* **46**, 217–225 (1985). — [4] Dualities for torsion-free abelian groups of finite rank. *J. Algebra* **128**, 474–487 (1990)
- B. Wald — [1] On κ -products modulo μ -products, in *Abelian Group Theory*. Lecture Notes in Mathematics, vol. 1006 (Springer, Berlin, 1983), pp. 362–370
- C.P. Walker — [1] Properties of Ext and quasi-splitting of abelian groups. *Acta Math. Acad. Sci. Hungar.* **15**, 157–160 (1964). — [2] Relative homological algebra and abelian groups. III. *J. Math.* **10**, 186–209 (1966). — [3] Projective classes of completely decomposable abelian groups. *Arch. Math.* **23**, 581–588 (1972)
- E.A. Walker — [1] Cancellation in direct sums of groups. *Proc. Am. Math. Soc.* **7**, 898–902 (1956). — [2] Quotient categories and quasi-isomorphisms of abelian groups, in *Proceedings of the Colloquium on Abelian Groups* (Akadémiai Kiadó, Budapest, 1964), pp. 147–162. — [3] Ulm's theorem for totally projective groups. *Proc. Am. Math. Soc.* **37**, 387–392 (1973). — [4] The groups P_β . *Symposia Math.* **13**, 245–255 (1974)
- K.D. Wallace — [1] On mixed groups of torsion-free rank one with totally projective primary components. *J. Algebra* **17**, 482–488 (1971)
- J.D. Waller — [1] Generalized torsion complete groups, in *Studies on Abelian Groups* (Dunod, Paris, 1968), pp. 345–356
- R.B. Warfield, Jr. — [1] Homomorphisms and duality for torsion-free groups. *Math. Z.* **107**, 189–200 (1968). — [2] A Krull-Schmidt theorem for infinite sums of modules. *Proc. Am. Math. Soc.* **22**, 460–465 (1969). — [3] An isomorphic refinement theorem for abelian groups. *Pac. J. Math.* **34**, 237–255 (1970). — [4] Simply presented groups, in *Proceedings of the Special Semester on Abelian Groups* (University of Arizona, Tucson, 1972). — [5] The uniqueness of elongations of abelian groups. *Pac. J. Math.* **52**, 289–304 (1974). — [6] A classification theorem for abelian p -groups. *Trans. Am. Math. Soc.* **210**, 149–168 (1975). — [7] Classification theory of abelian groups. I: Balanced projectives. *Trans. Am. Math. Soc.* **222**, 33–63 (1976). II: Local theory, in *Abelian Group Theory*. Lecture Notes in Mathematics, vol. 874 (Springer, Berlin, 1981), pp. 322–349. — [8] The structure theory of mixed abelian groups, in *Abelian Group Theory*. Lecture Notes in Mathematics, vol. 616 (Springer, Berlin, 1977), pp. 1–38. — [9] Cancellation of modules and groups and stable range of endomorphism rings. *Pac. J. Math.* **91**, 457–485 (1980)
- M.C. Webb — [1] The endomorphism ring of homogeneously decomposable separable groups. *Arch. Math.* **31**, 235–243 (1978)
- B.D. Wick — [1] A projective characterization for SKT-modules. *Proc. Am. Math. Soc.* **80**, 39–43 (1980). — [2] A classification theorem for SKT-modules. *Proc. Am. Math. Soc.* **80**, 44–46 (1980)
- W.J. Wickless — [1] Abelian groups which admit only nilpotent multiplications. *Pac. J. Math.* **40**, 251–259 (1972). — [2] T as an \mathcal{E} -submodule of G . *Pac. J. Math.* **83**, 555–564 (1979)

- G.V. Wilson — [1] Modules with the summand intersection property. *Commun. Algebra* **14**, 21–38 (1986).
- K.G. Wolfson — [1] Baer rings of endomorphisms. *Math. Ann.* **143**, 19–28 (1961). — [2] Isomorphisms of the endomorphism rings of a class of torsion-free modules. *Proc. Am. Math. Soc.* **14**, 589–594 (1963)
- S.M. Yahya — [1] p -pure exact sequences and the group of p -pure extensions. *Ann. Univ. Sci. Budapest* **5**, 179–191 (1962)
- A.V. Yakovlev — [1] Direct decompositions of torsion-free abelian groups of finite rank [Russian]. *Zap. Nauchn. Sem. Leningr. Otdel. Mat. Inst. Steklov* **160**, 272–285 (1987); *J. Sov. Math.* **52**, 3206–3216 (1990). — [2] Torsion-free abelian groups of finite rank and their direct decompositions [Russian]. *Zap. Nauchn. Sem. Leningr. Otdel. Mat. Inst. Steklov.* **175** (1989); *Koltsa i Moduli* **3**, 135–153, 165; *J. Sov. Math.* **57**, 3524–3533 (1991). — [3] Direct decompositions of mixed abelian groups [Russian]. *Vestnik St. Petersburg Univ. Math.* **43**, 3–11 (2010)
- H. Yamabe — [1] A condition for an abelian group to be a free abelian group with a finite basis. *Proc. Jpn. Acad.* **77**, 205–207 (1951)
- P.D. Yom — [1] A characterization of a class of Butler groups. I. *Commun. Algebra* **25**, 3721–3734 (1997); II: *Abelian Group Theory and Related Topics, Contemporary Mathematics*, vol. 171 (American Mathematical Society, Providence, RI, 1994), pp. 419–432
- H. Zassenhaus — [1] Orders as endomorphism rings of modules of the same rank. *J. Lond. Math. Soc.* **42**, 180–182 (1967)
- E.C. Zeeman — [1] On direct sums of free cycles. *J. Lond. Math. Soc.* **30**, 195–212 (1955)
- B. Zimmermann-Huisgen — [1] On Fuchs' Problem 76. *J. Reine Angew. Math.* **309**, 86–91 (1979)
- B. Zimmermann-Huisgen, W. Zimmermann — [1] Algebraically compact rings and modules. *Math. Z.* **61**, 81–93 (1978)
- L. Zippin — [1] Countable torsion groups. *Ann. Math.* **36**, 86–99 (1935)
- F. Zorzitto — [1] Discretely normed abelian groups. *Aequationes Math.* **29**, 172–174 (1985)

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