Citations   From References: 2   From Reviews: 0

MR2721625 (2011i:57028) 57N15 55R91 57S30
Hughes, Bruce [Hughes, C. Bruce] (1-VDB); **Khan, Qayum** (1-VDB)
Dihedral manifold approximate fibrations over the circle. (English summary)
Geom. Dedicata **148** (2010), 205–243.

When a manifold W admits a free action of the infinite cyclic group C_∞, one expects the quotient M to fiber over S^1 so that the infinite cyclic covering $\overline{M}$ induced from the universal covering $\mathbb{R} \to S^1$ is W. When $\dim(W) > 4$, work of T. A. Chapman gave this idea a precise formulation, which states that the following conditions (among others) are equivalent: (1) W is finitely dominated and admits a cocompact, free, discontinuous C_∞-action, (2) there is a proper bounded fibration $W \to \mathbb{R}$, (3) there exists a C_∞-action on W and C_∞-manifold approximate fibration $W \to \mathbb{R}$, and (4) there exists a manifold approximate fibration $M \to S^1$ with corresponding infinite cyclic covering $\overline{M}$ homeomorphic to W.

The main results of the paper extend these to corresponding conditions with the infinite dihedral group D_∞ in the role of C_∞. To prove them, the authors employ a considerable amount of machinery of the theory of approximate fibrations and stratified fibrations. In particular, they draw on various techniques and results of Chapman (crediting S. Ferry with independent discovery of many of the same ideas), and of D. S. Coram and P. Duvall. Geometric concepts also come into play; in particular, the authors develop a condition on a triangulated metric space, called finite isometry type, which makes precise the idea that the local geometry of a space has finite variation. The paper is very carefully written, with considerable detail in the arguments and extensive referencing of the needed results from the literature.

{For further information pertaining to this item see [C. B. Hughes and Q. Khan, Geom. Dedicata **164** (2013), 395; MR3054635].}

REVISED (April, 2016)
Current version of review. Go to earlier version. *Darryl McCullough*

References

1. Beshears, A.: G-isovariant structure sets and stratified structure sets. Dissertation. Vanderbilt University, (1997) MR2695560
2. Bridson, M.R., Haefliger, A.: Metric spaces of non-positive curvature, volume 319 of Grundlehren der Mathematischen Wissenschaften [Fundamental Principles of Mathematical Sciences]. Springer, Berlin (1999) MR1744486
3. Chapman, T.A.: Approximation results in Hilbert cube manifolds. Trans. Am. Math. Soc. **262**(2), 303–334 (1980) MR0586720
4. Chapman, T.A.: Approximation results in topological manifolds. Mem. Am. Math. Soc. **34**(251), iii+64 (1981) MR0634341
5. Chapman, T.A., Ferry, S.: Approximating homotopy equivalences by homeomorphisms. Am. J. Math. **101**(3), 583–607 (1979) MR0533192
6. Coram, D., Duvall, P.: Approximate fibrations and a movability condition for maps. Pac. J. Math. **72**(1), 41–56 (1977) MR0467745
7. Coram, D.S.: Approximate fibrations—a geometric perspective. In: Shape theory and geometric topology (Dubrovnik, 1981), Volume 870 of Lecture Notes in Math., pp. 37–47. Springer, Berlin, (1981) MR0643521

8. Coram, D.S., Duvall, P.F. Jr.: Approximate fibrations. Rocky Mt. J. Math. **7**(2), 275–288 (1977) MR0442921

9. Edwards, R.D., Kirby, R.C.: Deformations of spaces of imbeddings. Ann. Math. (2) **93,** 63–88 (1971) MR0283802

10. Farkas, D.R.: Crystallographic groups and their mathematics. Rocky Mt. J. Math. **11**(4), 511–551 (1981) MR0639438

11. Farrell F.T.: The obstruction to fibering a manifold over a circle. In: Actes du Congrès International des Mathématiciens (Nice, 1970), Tome 2, pp. 69–72. Gauthier-Villars, Paris (1971) MR0423376

12. Farrell, F.T.: The obstruction to fibering a manifold over a circle. Indiana Univ. Math. J. **21,** 315–346, (1971/1972) MR0290397

13. Ferry, S.: Approximate fibrations over S^1. Hand-written manuscript

14. Hughes, B.: Products and adjunctions of manifold stratified spaces. Topol. Appl. **124**(1), 47–67 (2002) MR1926134

15. Hughes, B., Prassidis, S.: Control and relaxation over the circle. Mem. Am. Math. Soc. **145**(691), x+96 (2000) MR1686654

16. Hughes, B., Ranicki, A.: Ends of complexes, volume 123 of Cambridge Tracts in Mathematics. Cambridge University Press, Cambridge (1996) MR1410261

17. Hughes, C.B.: Local homotopy properties in spaces of approximate fibrations. Dissertation. University of Kentucky, (1981) MR2631557

18. Hughes, C.B.: Approximate fibrations on topological manifolds. Mich. Math. J. **32**(2), 167–183 (1985) MR0783571

19. Hughes, C.B.: Spaces of approximate fibrations on Hilbert cube manifolds. Compositio Math. **56**(2), 131–151 (1985) MR0809863

20. Hughes, C.B., Taylor, L.R., Williams, E.B.: Bundle theories for topological manifolds. Trans. Am. Math. Soc. **319**(1), 1–65 (1990) MR1010410

21. Hughes, C.B., Taylor, L.R., Williams, E.B.: Bounded homeomorphisms over Hadamard manifolds. Math. Scand. **73**(2), 161–176 (1993) MR1269255

22. Illman, S.: Smooth equivariant triangulations of G-manifolds for G a finite group. Math. Ann. **233**(3), 199–220 (1978) MR0500993

23. Jaworowski, J.W.: Extensions of G-maps and Euclidean G-retracts. Math. Z. **146**(2), 143–148 (1976) MR0394550

24. Kirby, R.C., Siebenmann, L.C.: Foundational essays on topological manifolds, smoothings, and triangulations. Princeton University Press, Princeton, NJ, (1977). With notes by John Milnor and Michael Atiyah, Annals of Mathematics Studies, No. 88 MR0645390

25. Mardešić, S., Segal, J.: Shape theory, volume 26 of North-Holland Mathematical Library. North-Holland Publishing Co., Amsterdam, (1982). The inverse system approach MR0676973

26. Prassidis, S.: Equivariant approximate fibrations. Forum Math. **7**(6), 755–779 (1995) MR1359424

27. Ratcliffe, J.G.: Foundations of hyperbolic manifolds, volume 149 of Graduate Texts in Mathematics. 2nd edn. Springer, New York (2006) MR2249478

28. Siebenmann, L.C.: A total Whitehead torsion obstruction to fibering over the circle. Comment. Math. Helv. **45,** 1–48 (1970) MR0287564

29. tom Dieck, T.: Transformation groups, volume 8 of de Gruyter Studies in Mathematics. Walter de Gruyter & Co, Berlin (1987) MR0889050

Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.