Report on: Symposium on Topology - 1999/2000

This symposium was extended to cover the full period of the grant, namely 1 August 1999 to 31 July 2002, with main activities taking place in the academic years 1999/2000 and 2001/2002. It was especially useful to be able to do this, because shortly after the symposium commenced one of the co-organisers (Victor Pidstrigatch) moved to Germany and later Stavros Garoufalidis moved to Warwick and was able to use symposium funds to organise a very well-attended and well-received workshop in Quantum Topology (7) below. To support the symposium the Mathematics Department gave a temporary lectureship to Max Forester, who is now an EPSRC research fellow. Research related to the symposium centred around a series of eight concentrated periods of activity (listed below) with background activity in the form of weekly seminars and longer term visitors.

1. EPSRC/LMS Instructional Conference for Graduate Students :
    30 August-3 September 1999
2. Introductory Workshop on Topology :
    6-17 September 1999
3. Two-day meeting on Low-Dimensional Topology :
    6-7 January 2000
4. Workshop on Topology Geometry and Physics :
    8-15 April 2000
5. Workshop on Geometry and Topology :
    9-22 July 2000
6. Workshop on Topology, Operads and Quantisation :
    10-14 December 2001
7. Workshop on Quantum Topology :
    18-22 March 2002
8. Workshop on Geometric Topology :
    1-12 July 2002

The appendices to this report contain full details of programmes and participants for (2) to (8). Appendices are numbered to match the list above.

Note Activity (1) was supported by the LMS and a separate grant from the EPSRC. It is included in this report because it was part of the planned activity of the symposium and ran straight into the Introductory Workshop.

The symposium was extremely successful in its main aim of bringing first class topologists together to work on the central problems in the area. The long (and incomplete) list of papers advanced by the interaction enabled by the symposium (see below) and the very positive feedback (also below) both testify to this fact. The money spent by the EPSRC on this symposium is clearly money very well spent and we are extremely grateful.

Output from the symposium

Many pieces of work were advanced significantly during the symposium period and new projects begun both between visitors and between local people and visitors. Below is a list of preprints published at Warwick and on arxiv.org as well as articles submitted to journals, so far as they are known to the organisers. It contains papers which our visitors listed on feedback forms as arising from or as having been significantly advanced by their stay at Warwick. The list is partial because it is not possible to ensure that participants fill in these feedback forms with appropriate

care!

1. H Akiyoshi, M Sakuma, *Comparing two convex hull constructions of cusped hyperbolic manifolds (I)*, to appear in the Proceedings of the Workshop ``Kleinian groups and hyperbolic 3-manifolds'', held in Warwick, 2002, London Math. Soc. Lecture Note Series, Warwick preprint 10/2002
2. H Akiyoshi, M Sakuma, M Wada, Y Yamshita, *Comparing two convex hull constructions of cusped hyperbolic manifolds (II)*, ibid, Warwick preprint 11/2002
3. H Akiyoshi, H Miyachi, M Sakuma, *A refinement of McShane's identity for quasifuchsian punctured torus groups*, Warwick preprint 21/2002
4. Jorgen Ellegaard Andersen, *Asymptotic faithfulness of the quantum SU(n) representations of the mapping class groups*, Invent. Math. to appear, `arXiv:math.QA/0204084`
5. Ivelina Julianova Bobtcheva, Maria Grazia Messia, *HKR-type invariants of 4-dimensional thickenings and 2-dimensional CW-complexes*, `arXiv:math.QA/0206307`
6. S Boyer, B Wiest, D Rolfsen, *Orderable 3-manifold groups*, to appear
7. M Cahen, S Gutt, J Horovitz, J Rawnsley, *Moduli space of symplectic connections of Ricci type on T^{2n}; a formal approach*, J Geom Phys, to appear, `arXiv:math.SG/0201167`
8. John Crisp, Luis Paris, *Artin groups of type B and D*, to appear
9. John Crisp, Luis Paris, *Representations of the braid group by automorphisms of groups, invariants of links, and Garside groups*, to appear
10. Mieczyslaw K Dabkowski, Jozef H Przytycki, *Burnside obstructions to the Montesinos-Nakanishi 3-move conjecture*, Geom. Topol. 6(2002) 355-360, `arXiv:math.GT/0205040`
11. Adam Epstein, *Topological matings of quadratic polynomials*, in preparation
12. Paul Feehan, *PU(2) monopoles and 4-manifold invariants*, to appear
13. R Fenn, M Jordan, L Kaufmann, *The Birack: an Invariant of Virtual Knots and Links*, to appear
14. R Fenn, A Bartholomew, *New Polynomials for (Virtual) Knots and Links*, in preparation
15. Roger Fenn, Colin Rourke, Brian Sanderson, *The classification of classical links*, in preparation
16. Max Forester, *On the isomorphism problem for generalized Baumslag-Solitar groups*, to appear
17. David Gabai, *Smale conjecture for hyperbolic 3-manifolds: ${\rm Isom}(M^3)\simeq{\rm Diff}(M^3)$*, J. Differential Geom. 58 (2001) 113-149
18. C McA Gordon, *Dehn fillings of large hyperbolic 3-manifolds*, J. Differential Geom. 58 (2001) 263-308
19. C McA Gordon, *Non-integral toroidal Dehn surgeries*, to appear
20. C McA Gordon, DD Long, A Reid *Surface subgroups of Coxeter groups*, to appear
21. Bill Harvey, Mustafa Korkmaz, *Homomorphisms between mapping class groups*, in preparation
22. JDS Jones, *On the definition of operads*, to appear in Contemp Math. (2003)
23. Ebru Keyman, *Ordering on singular braids*, in preparation
24. Simon King, *The size of triangulations supporting a given link*, to appear, Geom. Topol. 5 (2001), 369-398, `arXiv:math.GT/0007032`
25. Simon King, *How to make triangulations of S^3 polytopal*, `arXiv:math.GT/0009216`
26. John Klein, *Moduli of suspension spectra*, to appear
27. John Klein, *On embeddings up to homotopy in the sphere*, to appear
28. Eun Soo Lee, *The support of Khovanov invariants for alternating knots*, `arXiv:math.GT/0201105`

29. Brian Mangum, Theodore Stanford, *Brunnian links are determined by their complements*, Algebr. Geom. Topol. 1 (2001) 143-152 `arXiv:math.GT/9912006`
30. Sergei Matveev, *Special spines and an invariant of 4-manifolds*, to appear
31. Paul Melvin, Blake Mellor, *A geometric interpretation of Milnor's triple linking numbers*, submitted to Geom. Topol. `arXiv:math.GT/0110001`
32. Paul Melvin, Rob Kirby, *Local surgery formulas for quantum invariants*, to appear
33. Justin Roberts, Simon Willerton, *The Rozansky-Witten weight systems*, to appear
34. Justin Roberts, Justin Sawon, Simon Willerton, *The Rozansky-Witten TQFT*, to appear
35. Colin Rourke, *Knotted triangulations of the three-ball*, in preparation
36. Colin Rourke, Brian Sanderson, *The compression theorem II: directed embeddings*, Geom. Topol. 5 (2001) 431-440, `arXiv:math.GT/003026`
37. Colin Rourke, Brian Sanderson, *The compression theorem III: applications*, for a preliminary version see section 5 onwards of `arxiv:math.GT/9712235:v2`
38. Colin Rourke, Brian Sanderson, *A proof of Eliashberg's folding theorem*, in preparation
39. Colin Rourke, Brian Sanderson, Adrian Varley, *The C^0-singularity theorem*, in preparation
40. David Spring, *Directed embeddings and the simplification of singularities*, Commun. Contemp. Math. 4 (2002) 107-144
41. Andras Stipsicz, *Commutators, Lefschetz fibrations and the signature of surface bundles*, Warwick preprint 16/2000
42. Andras Stipsicz, *Surface bundles: an interesting example*, Warwick pre\-print 15/2000
43. Andras Stipsicz, *A note on the transverse isotopy problem*, Warwick pre\-print 18/2000
44. A Voronov, *Notes on universal algebra*, Warwick preprint 26/2001, `arXiv:math.QA/0111009`
45. Andreas Zastrow, *Higher homology groups of planar sets do not behave anomalously*, to appear
46. Andreas Zastrow, *Higher homology groups of subsets of surfaces do not behave anomalously*, to appear

Feedback from participants

Participants also used the feedback forms to make general comments about the symposium activities and also (sometimes) to describe the research undertaken here. There were no negative comments whatsoever. Here is a selection of comments chosen for information or interest value.

> "*The enthusiasm of the lecturers focussed my attention on the talks. The expertise of the lecturers was visible in every single talk.*" Graduate student attending Instructional Conference

> "*The lecture were well prepared with the lecturers willing to answer questions and go over material again when necessary.*" Graduate student attending Instructional Conference

> "*The meeting was a welcome opportunity to learn at first hand of many recent results in Topology.*" Andrew Ranicki, September 1999

> "*Great place, great conference.*" Stefan Bauer, April 2000

"*Really great! The MRC provides excellent facilities. The workshop in Geometry and Topology was extremely successful. Altogether a very worthwhile visit.*" Cameron Gordon, June 2000

"*A well-organised workshop on Topology and Geometry. I had a wonderful time. The support staff at the Institute were always helpful and efficient. I enjoyed working here during the workshop.*" David Spring, July 2000

"*Great as usual.*" David Gabai, July 2000

"*I enjoyed my stay at the MRC and it was very fruitful both because of the good working conditions and the nice housing. The MRC houses are really great, both the location and the interior of the houses are unique and extremely nice.*" Andras Stipsicz, August 2000

"*The workshop in Geometry and Topology was great fun and very inspiring.*" Brian Magnum, July 2000

"*Very nice conference and atmosphere.*" Oliver Dasbach, July 2000

"*A very interesting conference on a high level.*" Simon King, July 2000

"*Congratulations to the woderful staff, Mrs. McAllister, Colin Rourke, Victor Pidstrigatch and John Jones for organising and running a great conference!*" Paul Feehan, July 2000

"*The workshop helped the finishing of the paper by Andersen [4]. This is a major result, which proves that the representation of the mapping class groups (of a fixed but arbitrary genus) that comes from the TQFT $SU(N)\_q$ (for all N and q, a complex root of unity) is faithful. Josef (Przytycki) used the workshop and the computing facilities at Warwick to simplify his original proof (of [10]).*" Stavros Garoufalidis, March 2002

"*The Workshop on Quantum Topology was very interesting: I have greatly appreciated the talks, the opportunity to discuss with colleagues and the hospitality of the Institute.*" Christian Blanchet, March 2002

"*This meeting was a first class affair. I gave a talk on my current research and this together with feed-back helped me to reformulate my ideas and push them further. In addition three of my current students attended and gained a great deal from the talks and ambience. Also one of my ex students from Turkey attended and gave a talk.*" Roger Fenn, July 2002

"*Part of the results of my second paper [9] were found after talking with some knot theorists in Warwick.*" Luis Paris, July 2002

"*I attended the workshop as a newcomer to the area of geometric topology. I found the talks to be very interesting and well presented. While I have no new results as a direct result of my participation, I feel that the conference allowed me to get a feel for what is happening in the area and to meet the many of the people working the area. I certainly feel that the workshop has inspired me to research in geometric topology.*" James Cruickshank, July 2002

"*The conference was, as always at Warwick topology meetings, very smoothly organised and the atmosphere very conducive to both working*

alone and, more importantly, to interacting with the other visitors and locals." Justin Roberts, July 2002

"*One thing I learned (from Colin Rourke and Martin Dunwoody's lectures) is the basic idea behind the recognition problem of S^3 and the inherent difficulty of an elementary approach to the PC. This is not likely, though, to lead to any publication. I also had some new ideas inspired by James Hughes' lecture on link homotopy and string links. In discussions with him later, we realized that the groups involved in the Milnor, as well as Lin-Habegger approach to classifying links up to homotopy, are bi-orderable groups!*" Dale Rolfsen, July 2002

"*During the workshop this summer, Rob Kirby and I continued our search for a topological/combinatorial approach to Ozsvath-Szabo Floer homology of 3-manifolds. In particular we are close to a combinatorial formula for the Maslov index of certain holomorphic disks that arise in the theory, and we spent our time investigating whether this formula (or some variant) is consistent with known results on the Euler characteristic of the OSFloer homology.*" Paul Melvin, July 2002

"*The workshop was highly enjoyable compared to others I have been to. The quality of the talks was uniformly very high. The wide range of topics meant that I learned many new things. I met several colleagues for the first time. I was glad to be able to talk about my work to an audience that had not heard about it before. And high marks for the live entertainment!*" Max Forester, July 2002

"*The second paper [46], as it is acknowledged by a footnote in the appropriate preprint, has been inspired by discussions that I had with David Spring during the first Warwick workshop.
Always having enjoyed my coming to Warwick, its unique discussion atmosphere, and its permanently accessible computing- and printing-network.*" Andreas Zastrow, July 2002

"*One of the problems I was studying at the time of the workshop (which has now resolved itself into two shortly-to-surface preprints) is the question of when a spectrum has the homotopy type of a suspension spectrum. The results of this investigation are now being applied to study embeddings up to homotopy of finite complexes K in the n-sphere (here we are interested in representing the functional stable dual $F(K,S^{n-1})$ as a suspension spectrum).*" John Klein, October 2002

"*In the conferences on `Geometry, Topology and Physics' that took place in Warwick in the year 2000 I began to understand techniques in topology that were usefull for my Phd thesis (`Generalised Einstein Equations on Kähler Manifolds', Imperial College, 2002).
The July 2002 conference was extremely interesting. In particular the talks given by Fenn, Kirby, Rolfsen, Rourke and Sanderson (covering topics that probably no one has ever thought as much as they had) were memorable. The discussions that took place after and during the talks were enlightening for me.
I am indebted to the organizers for setting up these conferences where young mathematicians had the opportunity to learn and discuss with some of the living legends in the subject.*" Daniel Pons, October 2002

Appendices :

Appendix 1: Flyer for 1999/2000 activities, flyer and programme for EPSRC/LMS Instructional Conference, August 1999
Appendix 2: Programme and participants' list for Introductory Workshop on Topology, September 1999
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Appendix 6: Flyer, programme and participants' list for workshop on Topology, Operads and Quantisation, December 2001
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Colin Rourke
Co-investigator
14 October 2002