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WORKSHOP ON GEOMETRY AND TOPOLOGY OF THREE-DIMENSIONAL MANIFOLDS NOVOSIBIRSK, AUGUST 16–29, 2005

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Abstract. The workshop took place at Sobolev Institute of Mathematics, Siberian Branch of Russian Academy of Sciences. It was a part of the INTAS project "Complexity, algorithms, and computer methods in geometric topology" in which teams from Pisa, Frankfurt, Chelyabinsk, and Novosibirsk are involved.

Since many years, there is a fruitful cooperation between research groups in Pisa (Prof. Carlo Petronio), Frankfurt (Prof. Wolfgang Metzler), Chelyabinsk (Prof. Sergei Matveev) and Novosibirsk (Prof. Alexander Mednykh) in 3-manifolds, 2-complexes and algorithmic questions of low-dimensional topology. Two years ago joint project of these four teams "Complexity, algorithms, and computer methods in geometric topology" became the winner of international competition in frame of INTAS. This project is devoted to the theory of 3-manifolds, which is considered now as an essential part of contemporary topology and geometry. The theory is oriented to creation of mathematical models for the Universe. One of the main problems of the theory is the Poincaré conjecture, which was designated by Clay Institute as one of ten millennium problems. Recently Russian mathematician from St. Petersburg Grisha Perelman suggested to mathematical community a solution of the problem. Now it is widely accepted that most probably his solution is correct. The arguments of the proof of the Poincaré conjecture in their final stage are based

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on results of two Siberian mathematicians V. A. Toponogov and V. A. Sharafutdinov from Sobolev Institute of Mathematics. This was one of the reasons why Siberia became the place of annual INTAS meeting "Workshop on geometry and topology of 3-manifolds", 15–26 August 2005.

The first week of the conference was held in one of the most beautiful places of the Altai Mountain called Lake Teletskoje. The second week took place in the Academic town near Novosibirsk.

The Altai part of the workshop began with a meeting of students in mathematics from the Gorno-Altaisk University with the majority of the conference participants in a resort close to Lake Teletskoje. The students listened to several mathematics lectures per day, and the mathematicians discussed conference topics in advance. The lectures of Professors Vladislav Aseev and Andrei Tetenov were devoted to modern aspects of the fractal theory. In his lecture Prof. Sergei Matveev described a few elegant solutions of remarkable problems from algebraic geometry. Prof. Alexander Mednykh devoted his lecture to volumes of polyhedra in the Euclidean, hyperbolic and spherical spaces. Prof. Wolfgang Metzler gave a lecture on the history and the present changes in mathematical university education in Germany. The enchanting landscape and the development of personal contacts added a lot to the friendly atmosphere and success of the subsequent conference.

The research cooperation is of vital importance for all participants. Joint INTAS project just indicates this evident fact. Mathematicians with algebraic, topological and in particular geometric competence are strongly represented in Novosibirsk, and Frankfurt group will certainly have future longtime contacts with them. Recently, Sergei Matveev and Cynthia Hog-Angeloni have developed a decomposition method for 3-manifolds which resulted from a futile attempt of Siddharta Gadgil to extend the algorithmic $\mathbb{S}^3$-recognition to the recognition of balanced presentations of the trivial group. We hope that this decomposition yields geometric applications as well as those to decision problems related to the Andrews-Curtis conjecture. Janina Glock and Cynthia Hog-Angeloni have worked on the uniqueness of 3-dimensional thickenings of 2-complexes; the present goal is to gain new insight from our knowledge about 2-complexes for 3-manifold theory (rather than investing the latter.) Graduate students of Sergei Matveev pursue similar ideas. Simon King took up a discussion in our seminar on Turaev-Viro-like invariants modelled for the Andrews-Curtis-problem. The consideration of corresponding ideals and their Groebner bases so far has produced new invariants of 3-manifolds and framed 2-complexes. The talk of Wolfgang Metzler about the status of the relative generalized Andrews-Curtis conjecture focussed on length considerations; nevertheless geometric and algebraic strategies were throughout present in the discussions. In particular the algebraic results of Valerij Bardakov on free groups and their automorphisms are a valuable completion of what Cochran, Orr and Teichner at present achieve in ongoing work. The same holds for the results of S. Melikhov and D. Repovs whom we met on other occasions during this summer. Our general impression was that international meetings of this type still need a particular attention and financial support. The chairmen of the different sessions (let us mention A. Mednykh and C. Gordon) also represented this international qualification by giving substantial input to a big variety of mathematical aspects. Even in times of electronic communication unnecessary duplication of efforts cannot be excluded and can be prevented only by personal contact. Novosibirsk is equipped with all facilities for such a meeting.

Russian colleagues invested all possible efforts to guarantee a warm atmosphere and take care of any technical problem. They as well as the young students emphasized how glad they were that mathematicians from Italy, the US and Germany had come all the way to Siberia to meet their Russian colleagues.

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