



International  
Scientific Conference

# Algebraic and Geometric Methods of Analysis

26-30 may 2020  
Odesa, Ukraine

## LIST OF TOPICS

- Algebraic methods in geometry
- Differential geometry in the large
- Geometry and topology of differentiable manifolds
- General and algebraic topology
- Dynamical systems and their applications
- Geometric problems in mathematical analysis
- Geometric and topological methods in natural sciences

## ORGANIZERS

- Ministry of Education and Science of Ukraine
- Odessa National Academy of Food Technologies
- Institute of Mathematics of the National Academy of Sciences of Ukraine
- Odessa I. I. Mechnikov National University
- Taras Shevchenko National University of Kyiv
- International Geometry Center
- Kyiv Mathematical Society

## PROGRAM COMMITTEE

<b>Chairman: Prishlyak A.</b> ( <i>Kyiv, Ukraine</i> )	<b>Kiosak V.</b> ( <i>Odesa, Ukraine</i> )	<b>Pokas S.</b> ( <i>Odesa, Ukraine</i> )
<b>Balan V.</b> ( <i>Bucharest, Romania</i> )	<b>Kirillov V.</b> ( <i>Odesa, Ukraine</i> )	<b>Polulyakh E.</b> ( <i>Kyiv, Ukraine</i> )
<b>Banakh T.</b> ( <i>Lviv, Ukraine</i> )	<b>Konovenko N.</b> ( <i>Odesa, Ukraine</i> )	<b>Sabitov I.</b> ( <i>Moscow, Russia</i> )
<b>Bolotov D.</b> ( <i>Kharkiv, Ukraine</i> )	<b>Lyubashenko V.</b> ( <i>Kyiv, Ukraine</i> )	<b>Savchenko A.</b> ( <i>Kherson, Ukraine</i> )
<b>Borysenko O.</b> ( <i>Kharkiv, Ukraine</i> )	<b>Maksymenko S.</b> ( <i>Kyiv, Ukraine</i> )	<b>Sergeeva A.</b> ( <i>Odesa, Ukraine</i> )
<b>Cherevko Ye.</b> ( <i>Odesa, Ukraine</i> )	<b>Matsumoto K.</b> ( <i>Yamagata, Japan</i> )	<b>Shelekhov A.</b> ( <i>Tver, Russia</i> )
<b>Fedchenko Yu.</b> ( <i>Odesa, Ukraine</i> )	<b>Mormul P.</b> ( <i>Warsaw, Poland</i> )	<b>Volkov V.</b> ( <i>Odesa, Ukraine</i> )
<b>Karlova O.</b> ( <i>Chernivtsi, Ukraine</i> )	<b>Mykhailyuik V.</b> ( <i>Chernivtsi, Ukraine</i> )	<b>Zarichnyi M.</b> ( <i>Lviv, Ukraine</i> )
	<b>Plachta L.</b> ( <i>Krakov, Poland</i> )	

## ADMINISTRATIVE COMMITTEE

- Egorov B., chairman, rector of the ONAFT;
- Povarova N., deputy chairman, Pro-rector for scientific work of the ONAFT;
- Mardar M., Pro-rector for scientific-pedagogical work and international communications of the ONAFT;
- Fedosov S., Director of the International Cooperation Center of the ONAFT;
- Kotlik S., Director of the P.M. Platonov Educational-scientific institute of computer systems and technologies "Industry 4.0";
- Svytyy I., Dean of the Faculty of Computer Systems and Automation.

## ORGANIZING COMMITTEE

Kirillov V.  
Konovenko N.  
Fedchenko Yu.

Maksymenko S.  
Cherevko Ye.

Osadchuk E.  
Prus A.

ІНТЕРНАЦІОНАЛЬНИЙ ЦЕНТР СПІВРОБІТНИЦТВА

# On integrability of geodesic flows on 3-dimensional manifolds

Alexey Bolsinov

(School of Mathematics, Loughborough University, Leicestershire, LE11 3TU, UK)

*E-mail:* A.Bolsinov@lboro.ac.uk

The goal of the talk is to discuss the behaviour of geodesics on 3-manifolds  $M$  with  $SL(2, \mathbb{R})$  geometry, one of the eight natural geometries according to Thurston, appearing on three-dimensional manifolds. It has been known that the corresponding geodesic flows cannot be integrable, however, this particular case has not been studied in detail. The situation turned out quite interesting: we have observed (joint work with Alexander Veselov and Yiru Ye [6]) that the phase space  $T^*M$  contains two open domains, complementary to each other and having common boundary, with integrable and chaotic behaviour of geodesics. In the integrable domain, we have integrability in the class of real-analytic integrals, whereas in the chaotic domain the geodesic flow has positive topological entropy. As a specific example, we study in more detail the geodesic flow on the modular 3-manifold  $M = SL(2, \mathbb{R})/SL(2, \mathbb{Z})$  homeomorphic to the complement of a trefoil knot  $\mathcal{K}$  in 3-sphere.

I will try to talk about these results in the context of a more general problem on topological obstructions to integrability of geodesic flows on smooth manifolds following papers by V. V. Kozlov [1], I. A. Taimanov [6, 4] and L. Butler [3, 5].

This work was supported by the Russian Science Foundation grant no. 17-11-01303 “Topological and algebraic aspects of the theory of integrable systems: new trends and applications”.

## REFERENCES

- [1] V.V. Kozlov *Topological obstructions to the integrability of natural mechanical systems*. Soviet Math. Dokl. **20** (1979), 1413-1415.
- [2] I.A. Taimanov *Topological obstructions to integrability of geodesic flows on non-simply-connected manifolds*. Math. USSR Izv. **30** (1988), 403-409.
- [3] L. Butler *A new class of homogeneous manifolds with Liouville-integrable geodesic flows*. C. R. Math. Acad. Sci. Soc. R. Can. **21**(1999), no. 4, 127-131.
- [4] A.V. Bolsinov, I.A. Taimanov *Integrable geodesic flows with positive topological entropy*. Invent. Math. **140** (2000), 639-650.
- [5] L.T. Butler *Invariant fibrations of geodesic flows*. Topology **44:4** (2005), 769-789.
- [6] A.V. Bolsinov, A.P. Veselov, Y. Ye *Chaos and integrability in  $SL(2, \mathbb{R})$ -geometry* (in progress)

## ЗМІСТ

<b>G. M. Abdishukurova, A. Ya. Narmanov</b> <i>On the geometry of submersions</i>	<b>3</b>
<b>B. N. Apanasov</b> <i>Hyperbolic 4-cobordisms, Teichmuller spaces and quasiregular mappings in space</i>	<b>5</b>
<b>Aymaz I., Kansu M.</b> <i>Representation of gravi-electromagnetism using matrix algebra</i>	<b>7</b>
<b>V. Bilet, O. Dovgoshey</b> <i>Uniqueness of pretangent spaces at infinity</i>	<b>9</b>
<b>Bolotov D.</b> <i>Foliations of 3-manifolds with small module of mean curvature</i>	<b>10</b>
<b>Bolsinov A. V.</b> <i>On integrability of geodesic flows on 3-dimensional manifolds</i>	<b>11</b>
<b>E. Bonacci</b> <i>Algebraic and geometric questions about the EM helix</i>	<b>12</b>
<b>Borisenko A. A., Sukhorebska D. D.</b> <i>Geodesics on regular tetrahedra in spherical space</i>	<b>13</b>
<b>F. Bulnes</b> <i>Motivic hypercohomology solutions in field theory II</i>	<b>14</b>
<b>I. Denega</b> <i>Estimate of maximum of the products of inner radii of mutually non-overlapping domains</i>	<b>16</b>
<b>A. Dudko, V. Pivovarchik</b> <i>Inverse problem for tree of Stieltjes strings</i>	<b>18</b>
<b>N. Glazunov</b> <i>Formal groups and algebraic cobordism</i>	<b>20</b>
<b>O. Gok</b> <i>A note on tensor product of Archimedean vector lattices</i>	<b>22</b>
<b>E. Gül.</b> <i>Trace Regularization Problem On a Banach Space</i>	<b>24</b>
<b>O. Ye. Hentosh</b> <i>Centrally extended generalization of the superconformal loop Lie algebra and integrable heavenly type systems on supermanifolds</i>	<b>26</b>
<b>B. Hladysh, A. Prishlyak</b> <i>Structure of functions on an oriented 2-manifold with the boundary</i>	<b>28</b>
<b>D. A. Juraev</b> <i>The Cauchy problem for matrix factorizations of the Helmholtz equation in a multidimensional bounded domain</i>	<b>30</b>
<b>A. Kachurovskii</b> <i>Fejer Sums and the von Neumann Ergodic Theorem</i>	<b>31</b>
<b>B. N. Khabibullin, R. R. Muryasov</b> <i>Mixed volumes/areas and distribution of zeros of holomorphic functions</i>	<b>33</b>
<b>B. Klishchuk, R. Salimov</b> <i>On the behavior at infinity of one class of homeomorphisms</i>	<b>35</b>
<b>A. Kravchenko, S. Maksymenko</b> <i>Automorphisms of cellular divisions of 2-sphere induced by functions with isolated critical points</i>	<b>37</b>
<b>A. Kushner, E. Kushner, R. Matviichuk</b> <i>Dynamics and exact solutions of linear PDEs</i>	<b>39</b>