

**POPULAR SCIENCE SUMMARY  
OF THE RESEARCH GRANT PROJECT  
SYMPLECTIC TOPOLOGY  
OF RATIONAL AND RULED 4-MANIFOLDS  
AND THEIR SYMPLECTIC MAPPING CLASS GROUPS**

VSEVOLOD SHEVCHISHIN

Symplectic geometry is a field of mathematics grown from classical mechanics such as the celestial mechanics. Its rapid modern development starts with the outstanding paper of Mikhail Gromov (1985) in which he introduced the theory of pseudoholomorphic curves. Using this powerful theory it was possible to solve vast number of problem and revolutionize the whole symplectic geometry. Most of modern techniques used in the symplectic geometry and topology are based on the theory of pseudoholomorphic curves.

The most important problems in symplectic geometry are: Classification and distinguishing special classes of symplectic manifolds, and description of the symplectomorphism group, and the symplectic mapping class group. Another circle of problem, specific to the symplectic geometry, is related to Lagrangian submanifolds, their classification and description of properties.

The goal of the proposed researches is to deepen our understanding of the geometry and topology of *symplectic rational and ruled 4-manifolds*. I am aiming to attack the following problems

- (1) Description and construction of a geometric presentation of the symplectic mapping class group in the monotone case and in some special non-monotone case.
- (2) Study the so called *elliptic twists*. Those are elements of the symplectic mapping class group of 4-manifolds discovered recently in my article [?].
- (3) Study of topology of non-orientable Lagrangian surfaces in symplectic rational and 4-manifolds and construction of new examples of such objects. Generalisation of recently discovered *symplectic triangle inequality* [?].
- (4) Classification of minimal rational symplectic 4-manifolds with anti-involutions. This is a symplectic version of 16-th Hilbert's problem about real structures on complex algebraic surfaces.

REFERENCES

- [1] SHEVCHISHIN, V., SMIRNOV, G.: *Elliptic symplectomorphisms of symplectic 4-manifolds*. Preprint, 27 pp., arXiv:1708.01518, accepted by J. Symplectic Geom.
- [2] SHEVCHISHIN, V., SMIRNOV, G.: *Symplectic triangle inequality*. Preprint, 27 pp., arXiv:1908.10895, to appear in Trans. AMS.

FACULTY OF MATHEMATICS AND COMPUTER SCIENCE, UNIVERSITY OF WARMIA AND MAZURY,  
UL. SŁONECZNA 54, 10-710 OLSZTYN, POLAND  
*Email address:* shevchishin@gmail.com