

RESEARCH STATEMENT

YASHA SAVELYEV

Broadly speaking I work in geometry-topology, with much of my work exploring interrelations of algebraic topology with differential geometry, and in particular symplectic geometry via Floer, Gromov-Witten theory, Fukaya categories, Hofer geometry and in part dynamical systems.

My recent research is along four distinct lines.

- (1) In symplectic geometry I have been working on developing the global Fukaya category. Here the basic object is a symplectic manifold (M, ω) , ω a closed non-degenerate differential 2-form. And this has a fascinating infinite dimensional transformation group of Hamiltonian symplectomorphisms $Ham(M, \omega)$, with a natural bi-invariant Finsler norm called the Hofer metric. One culmination of my program is the proof, [6], of one sense of a conjecture of Teleman on existence of natural “continuous” action of the group of Hamiltonian symplectomorphisms $Ham(M, \omega)$ on the Fukaya category of (M, ω) . In particular this leads to new invariants of smooth manifolds, new Chern-Gauss-Weil type curvature bounds for singular connections, and other applications, [7]. The theory of the global Fukaya category is a deep generalization of my earlier work on quantum characteristic classes, [10], [13], [14], [11], [9], [12]. These quantum characteristic classes have been very recently related by Chi Hong Chow, et al [2],[1], [3] to the theory of Lagrangian correspondences and holomorphic quilts, and he resolved some problems of algebraic geometry. Cheuk Yu Mak, et al [4] develop some connections to quantum K -theory.
- (2) Also, in symplectic geometry I am working on the development of the theory of locally conformally symplectic or *lcs* manifolds, which suitably generalize both symplectic and contact manifolds. The idea is to use tools like (pseudo)-holomorphic curves, to find “rigidity phenomena” in *lcs* geometry analogous to, for example, the Gromov non-squeezing theorem, and the Weinstein “conjecture” in symplectic/contact geometry. Here my main contribution is toward developing the statement and partial verification of an analogue of the Weinstein conjecture dubbed “conformal symplectic Weinstein conjecture”, [15]. This has an intriguing connection with the theory of elliptic curves of complex algebraic geometry, see also [5]. I have also studied the non-squeezing problem in *lcs* geometry in [16].
- (3) At the intersection of algebraic topology with differential geometry, I have introduced and developed the notion of a “smooth simplicial set”, which in particular leads to a solution of a long-standing problem of the construction of the universal Chern Weil homomorphism for Frechet Lie groups (under the condition the group have the homotopy type of CW complex), [17].
- (4) Finally, I have been fascinated for many years by some problems in logic. I have learned the subject in large part by email correspondence with

the philosopher-logician Peter Koellner ¹. My contribution here has been the first generalization of the (crucially) second incompleteness theorem of Gödel to stably computably enumerable formal systems, strictly generalizing the classical setting of computably enumerable formal systems, [8].

REFERENCES

- [1] C. H. CHOW, *Peterson-lam-shimozono's theorem is an affine analogue of quantum chevalley formula*, 2021.
- [2] ———, *Quantum characteristic classes, moment correspondences and the hamiltonian groups of coadjoint orbits*, 2021.
- [3] C. H. CHOW AND N. C. LEUNG, *Quantum k-theory of g/p and k-homology of affine grassmannian*, 2022.
- [4] E. GONZÁLEZ, C. Y. MAK, AND D. POMERLEANO, *Affine nil-hecke algebras and quantum cohomology*, 2022.
- [5] Y.-G. OH AND Y. SAVELYEV, *Pseudoholomorphic curves on the lcs-ification of contact manifolds*, <https://arxiv.org/pdf/2107.03551.pdf>, Accepted by Advances in geometry, (2022).
- [6] Y. SAVELYEV, *Global Fukaya category I*, (in revision) IMRN, arXiv:1307.3991, <http://yashamon.github.io/web2/papers/fukayaI.pdf>.
- [7] ———, *Global Fukaya category II: singular connections, quantum obstruction theory and other applications*, <https://arxiv.org/abs/1408.3250>.
- [8] Y. SAVELYEV, *Incompleteness for stably computable formal systems*, arXiv:2208.04752, <http://yashamon.github.io/web2/papers/stableincompleteness.pdf>.
- [9] Y. SAVELYEV, *On the Hofer geometry injectivity radius conjecture*, math arXiv.
- [10] ———, *Quantum characteristic classes and the Hofer metric*, Geom. Topol., 12 (2008), pp. 2277–2326.
- [11] ———, *Virtual Morse theory on $\Omega\text{Ham}(M, \omega)$* , J. Differ. Geom., 84 (2010), pp. 409–425.
- [12] ———, *Gromov k-area and jumping curves in \mathbb{CP}^n* , Algebr. Geom. Topol., 12 (2012), pp. 2317–2327.
- [13] ———, *Bott periodicity and stable quantum classes*, Sel. Math., New Ser., 19 (2013), pp. 439–460.
- [14] ———, *Morse theory for the Hofer length functional*, Journal of Topology and Analysis, 06, Issue No. 2 (2014).
- [15] Y. SAVELYEV, *A conformal symplectic Weinstein conjecture*, <http://front.math.ucdavis.edu/1609.08991>, (2021).
- [16] ———, *Locally conformally symplectic deformation of Gromov non-squeezing*, <https://arxiv.org/abs/2208.09404>, (2021).
- [17] ———, *Smooth simplicial sets and universal Chern-Weil homomorphism*, <https://arxiv.org/abs/2112.13272>, (2022).

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¹Whose kindness has been astonishing.