GEOMETRIC TOPOLOGY SEMINAR

Where: Math Department of the Higher School of Economics, Room 215

When: Thursdays from 14:00 to 16:50 (in practice, we usually finish earlier).

What: We invite 1) research talks in geometric topology and occasionally in other fields; 2) decently prepared expository talks on selected topics. "Decently prepared" means that the speaker is expected to read and understand what he/she intends to present before the talk, not during the talk. The "selected topics" are listed below.

For students: The seminar is affiliated with the Scientific Education Center (SEC = НОЦ) of the Steklov Math Institute and students who give a talk will earn credit at the SEC. Math Department of the HSE recognizes SEC's credits.

For non-HSE participants: To pass the security please name the Geometric Topology Seminar and show your passport or another photo ID. In case of problems with the security please call Ash Lightfoot (+7 925 8897129).

For all: Tea and refreshments will be provided after the talk or during a break.

Contacts: Please feel free to contact Sergey Melikhov (melikhov@mi.ras.ru) or Ash Lightfoot (Room 309, HSE; alightfoot@hse.ru) to be included in the mailing list, to submit an abstract of a talk or for any other queries related to the seminar.

A bit of history: The Geometric Topology Seminar has been meeting since the 1950s at the Steklov Math. Institute. Until the early 70s it was led by L. V. Keldysh, and the participants included A. B. Sossinsky, A. V. Chernavsky and M. A. Shtan'ko (more details: Russ. Math. Surv. 60 (2005), 589–614). In the late 70s the seminar was resumed under E. V. Shchepin; active participants included A. Chigogidze, A. Dranishnikov, M. Zarichnyi in the 80s, P. Akhmetiev, N. Brodsky, P. Semyonov, A. Skopenkov in the 90s, and P. Akhmetiev, A. Chernavsky, O. Frolkina, E. Kudryavtseva, S. Melikhov, M. Skopenkov in the 00s. From 2011, abstracts of talks are posted at mathnet.ru.

Selected topics:

1) Topology of links+

"Links+" means knots, links, link maps, ornaments, links modulo local knots, links up to self C_k-equivalence and other geometric objects of classical topology. "Classical topology" is understood in a restrictive sense, excluding twists like geometric structures on manifolds and virtual crossings (thus objects like virtual or legendrian knots are not included in "links+").

"Topology of" means that we are interested in actually understanding links+ (in some cases), i.e. in proving something about them in closed terms (of classical topology) or in classifying them by algebraic invariants. Also, we are interested in understanding those invariants that are at least expected to be useful for these purposes in the foreseeable future (but not those beautiful and deep invariants that nobody currently knows how to use).

For example:

• T. Cochran, K. Orr, P. Teichner, *Knot concordance, Whitney towers and L^2-signatures,* Ann. of Math., 157 (2003), 433–519 (arxiv) and followup work

• R. Schneiderman, P. Teichner, *The group of disjoint 2-spheres in 4-space*, 2017 (arxiv)

• R. Koytcheff, I. Volic, *Milnor invariants of string links, trivalent trees, and configuration space integrals,* 2017 (arxiv)

• S. Chmutov, M. Polyak, *Elementary combinatorics of the HOMFLYPT polynomial,* Int. Math. Res. Notices (2009) (arxiv) and M. Brandenbursky, *Link invariants via counting surfaces,* Geom. Dedicata 173 (2014), 243–270 (arxiv)

• O. Viro, *Quantum relatives of the Alexander polynomial,* Алгебра и анализ 18 (2006), 63–157 (arxiv) and Y. Bao, Z. Wu, *The Alexander polynomial for a balanced bipartite graph and its MOY-type relations,* 2017 (arxiv)

• P. Kirk, C. Livingston, Z. Wang, *The Gassner representation for string links,* Comm. Cont. Math. 3 (2001), 87–136 (arxiv) and T. Tsukamoto, A. Yasuhara, *A factorization of the Conway polynomial and covering linkage invariants,* J. Knot Theory Ram. 16 (2007), 631–640 (arxiv)

• A. B. Merkov, *Vassiliev invariants classify plane curves and doodles,* Матем. сб., 194:9 (2003), 31–62 (link)

2) The Andrews–Curtis conjecture and related topics

Topics in homotopy, simple homotopy and 3-deformation of 2-complexes, possibly with applications to 4-manifolds or 3-manifolds. For example, something from the books

• *Two-Dimensional Homotopy and Combinatorial Group Theory,* Cambridge U. Press, 1993

• *Advances in Two-Dimensional Homotopy and Combinatorial Group Theory,* Cambridge U. Press, 2018

3) Algebraic K-theory of spaces and related topics

For example:

• A. Hatcher, *Higher simple homotopy theory,* Ann. of Math. 102 (1975), 101–137 (link) and M. Steinberger, *The classification of PL fibrations,* Michigan Math J., 33 (1986), 11–26 (link)

• F. Waldhausen, B. Jahren, J. Rognes, *Spaces of PL Manifolds and Categories of Simple Maps,* Princeton U. Press, 2013 (link)

4) Higher-dimensional algebra and Homotopy type theory

For example:

• *Homotopy Type Theory: Univalent Foundations of Mathematics,* Princeton U. Press, 2013 (link)

• J.-L. Loday, *Homotopical syzygies,* Contemp. Math. 265 (2000), 99–127 (link)

• R. A. Brown, *Generalized group presentation and formal deformations of CW complexes,* Trans. Amer. Math. Soc. 334 (1992), 519–549 (link) and A. Mutlu, T. Porter, *Free crossed resolutions from simplicial resolutions with given CW-basis,* Cahiers Topol. Geom. Diff. Categ. 40 (1999), 261–283 (link)

5) Injective metric spaces and related topics

For example:

• J. R. Isbell, *Six theorems about injective metric spaces,* Comm. Math. Helv. 39 (1964), 439–447 (link), J. H. Mai, Y. Tang, *An injective metrization for collapsible polyhedra,* Proc. Amer. Math. Soc., 88 (1983), 333–337 (link) and J. Culbertson, D. P. Guralnik, P. F. Stiller, *Injective metrizability and the duality theory of cubings*, 2015 (arxiv)

• M. Develin, B. Sturmfels, *Tropical convexity,* Doc. Math. 9 (2004), 1–27 & 205–206 (arxiv)

• V. Turaev, *Trimming of metric spaces and the tight span,* 2017 (arxiv)