Name: Nariya Kawazumi
Subjects: Topology, Complex Geometry
Keywords: Goldman-Turaev bialgebra, Riemann surfaces, moduli of Riemann surfaces, mapping class groups of surfaces

My primary interest is in clarifying the topology of Riemann surfaces through the following three infinite-dimensional Lie algebras, (i) the Goldman-Turaev bialgebra, (ii) the associated graded Lie algebra of the Johnson filtration on the Torelli group, and (iii) formal symplectic geometries introduced by Kontsevich. These algebras are connected by (generalized) Magnus expansions of free groups. Yusuke Kuno (Tsuda College) and I discovered that the free vector space over the paths in a surface connecting boundary points is an involutive Goldman-Turaev bimodule. This fact has some applications in the topological study of the mapping class groups of surfaces. On the other hand, I found a family of canonical Magnus expansions induced by complex structures on the surface. They define a flat connection on the Teichmuller space, whose holonomy is exactly the totality of the Johnson homomorphisms and yields the Morita-Mumford cohomology classes. The connection defines a new real-valued Teichmuller modular function. I am interested in discovering new connections between Magnus expansions and other geometric objects.

Requirement for master-course students:
In order to begin studying in the master course, students need to master the following;
0) Homological algebra over rings,
1) Fundamental groups of topological spaces (including the classification theorem of covering spaces and the van Kampen theorem) and
2) Singular (co)homology (including the Poincare-Lefschetz duality).
If they want to study more in the doctor course, they should learn the (Lyndon-) Hochschild-Serre spectral sequence for groups and/or Lie algebras during their master course.