Name **MATSUO, Atsushi**

Field : **Lie Algebras, Representation Theory, Differential Geometry**

Keywords : Infinite-dimensional Lie Algebras, Finite Simple Groups, Quantum Integrable Systems, Vertex Operators, Conformal Field Theory

Summary of Current Research I am working on mathematical structures underlying 2-dimensional conformal field theories, which are related to theoretical physics such as superstring theory in particle physics and solvable lattice models in quantum statistical mechanics. Although the area is closely related to physics, I am certainly working in mathematics rather than in physics.

In general, modern mathematical problems are usually related to many areas of mathematics simultaneously, and my field of research is not an exception. Lie Algebras and Representation Theory are the fields particularly related to mine among other areas of mathematics, and Differential Geometry would be the next. Below is a list of themes which I have worked so far.

- Conformal field theories on Riemann surfaces and vertex operator algebras.
- Automorphism groups of vertex operator algebras and the Monster simple group.
- Study of Axioms for vertex algebras.
- Flat structures associated with isolated singularities.
- q-Difference equations associated with representations of quantum affine algebras.
- Study of integnrable connections with Weyl group symmetries.
- Knizhnik-Zamolodchikov equations and generalized hypergeometric functions.

Requests to Students I will not require any prerequisites further than standard undergraduate courses in mathematics departments, but one or a few of the following will be useful in starting research under my supervision:

- Semi-simle Lie Algebras - Quantum Mechanics - Codes and Lattices
- Riemann Surfacs - Modular Forms - Characteristic Classes

Rouphly speaking, the surface of research activity in mathematics is to find a new theorem and to prove it. I would remind that broad knowledge, although being useful, may prevent one from recognizing a new theorem. Having said that, in my honest opinion, I would say that the most important in doing research in mathematics is to pursuit the truth by thinking as deep as possible, and hence to have abilities, such as those of verification, calculation and imagination etc., which will support his own mathematical consideration, besides health and physical strength.

Research areas of my students need not be the same as mine. Below is a list of themes of former students and postdocs.

- Triangulated categories and tensor categories
- Classification of framed vertex operator algebras
- Construction of 2-local subgroups of the Monster simple group
- Decompositions of the Moonshine Module
- Mirror symmetry of hypersurfaces
- Representation theory of generalized Kac-Moody algebras
- Classification of superconformal algebras
- Supersymmetry and holonomy groups
- Representation theory of quantum affine algebras