講師 Fukuhiro Ueda (Arithmetic Geometry)

My research interests lie in Arithmetic Geometry and Number Theory. I currently study p-adic Hodge theory, Galois representations and K theory.

In number theory, especially in Langlands Program, a central question is: Which Galois representations come from algebraic geometry? It is conjectured by Fontaine and Mazur that the key condition is "potentially log-crystalline". In the mid 1990's, a highly nontrivial case of this conjecture was proved by Wiles, namely the Taniyama-Shimura conjecture. Today, the Fontaine-Mazur conjecture in dimension two for the rational field is settled, as a result of various works in the past decades, including our work [3].

In fact, the condition "log-crystalline" was rooted in the study of comparison between p-adic étale cohomology and crystalline cohomology, the so-called comparison theorem in p-adic Hodge theory, initially known as Grothendieck's mysterious functor, which was proved in various generalities. In [1], we have adapted the approach of pro-etale site to prove the comparison for cohomologies with non-trivial coefficients, and also in the relative setting. For comparison theorems over more general bases, and for the integral versions of these results, the use of higher categories becomes inevitable. Such an approach also naturally leads us to the study of motives and K-theory. My current focus is the calculation of étale cohomology of arithmetic schemes via K-theory and higher class field theory.

P-adic Hodge theory also has applications to (families of) automorphic forms. In [5] we obtain a construction of eigenvarieties in dimension two over arbitrary number fields via p-adic Hodge theory. In [4], we have managed to construct pieces of eigenvarieties in the Siegel-Hilbert setting.

[1] Crystalline comparison isomorphisms in p-adic Hodge theory: the absolutely unramified case, Algebra and Number Theory, 2019 (7), 1509-1581. (Joint with J. Tong)

[2] The overconvergent Eichler-Shimura morphisms for modular curves, preprint. (Joint with H. Diao)

[3] The Breuil-Mezard conjecture for non-scalar split residual repre-

sentations, Annales Scientifiques de l'Ecole Normale Superieure 48, 2015 (4), 1381-1419. (Joint with Y. Hu)

[4] C.-P. Mok and F. Tan, Overconvergent family of Siegel-Hilbert modular forms, Canadian Journal of Mathematics 67, 2015 (4), 893-922. (Joint with C.-P. Mok)

[5] Families of p-adic Galois representations. MIT thesis, 2011.