p-ADIC ASPECTS OF THE KUDLA PROGRAM CONFERENCE

JUNE 15-19, 2026

- **Adel Betina**

  Eigenvarieties for non-cuspidal automorphic forms over PEL Shimura varieties

  We construct eigenvarieties parametrizing overconvergent p-adic automorphic forms including Eisenstein families for unitary and symplectic groups. This is achieved by refining the method of Andreatta–Iovita–Pilloni for cuspidal automorphic forms and a deep study of the Hodge–Tate period map at the boundary of a toroidal compactification. The main novelty is the construction of subsheaves of the p-adic automorphic sheaves of Andreatta-Iovita-Pilloni by imposing a condition on the sections at the boundary. This talk is based on joint work with Brasca and Rosso.

- **Romain Branchereau**

  Generating series of modular symbols for SL_n

  In the 1980's, Kudla and Millson constructed modular forms whose Fourier coefficients are intersection numbers of totally geodesic cycles in orthogonal locally symmetric spaces. I will present an analogous construction for modular symbols in the symmetric space of SL_n, combining the original ideas of Kudla–Millson with the recent construction of Eisenstein classes by Bergeron–Charollois–Garcia. In the case of SL_2, I will discuss the relationship with work of Li and of Borisov–Gunnells.

- **Jan Bruinier**

  Special cycles and Maass forms on Shimura curves

  By work of Maass and Katok-Sarnak, the average values of Maass forms of weight zero on modular curves over CM points (and geodesic cycles) of fixed discriminant can be interpreted as the Fourier coefficients of weight 1/2 Maass forms. We report on joint work with Yingkun Li and Martin Möller on an analogue of this result in genus 2. For instance, we study refined CM traces of Maass forms on Shimura curves and their relationship to coefficients of genus 2 Siegel Maass forms. This also leads to a new approach towards results of Rickards on counts of pairs of optimal embeddings of quadratic orders into an Eichler order.

- **Michael Daas**

  Refined singular moduli through p-adic Galois deformations

In the 1980's, Gross and Zagier studied the norms of the differences between singular moduli. Analogous questions on Shimura curves allow for purely p-adic investigations through their p-adic uniformisations. In earlier work, infinitesimal deformations of Galois representations were used to compute the norms of the differences between these singular moduli without relying on their connection to geometry. We explain how more intricate deformations can be used to obtain results beyond the norm, supporting purely p-adic methods to prove the algebraicity of conjecturally algebraic p-adic quantities. This is joint work with Yingkun Li.

- **Henri Darmon**

  Real multiplication and the p-adic Kudla program

  We will discuss a general framework for a theory that ostensibly plays the role of the theory of complex multiplication, but with imaginary quadratic fields replaced by real quadratic fields. We will show how non-trivial evidence for this theory can be obtained by transposing some well known and rather classical calculations of Gross and Zagier from the archimedean to the p-adic setting. This suggests that the dictionary between the archimedean and p-adic worlds might be fruitfully applied to the Kudla program and may reveal unexpected features that go squarely beyond a routine transposition from one setting to the other.

- **Luis García**

  Vertex algebras and special cycles

  Shimura varieties of orthogonal and unitary type come equipped with a large collection of Shimura subvarieties giving rise to so-called special cycles. Classical work of Kudla and Millson relates these cycles to the theta correspondence, proving in particular that their cohomology classes can be arranged into generating series that turn out to be modular forms. One might wonder if underlying the modularity phenomenon is some vertex algebra. During the talk I will explain a construction of a relative vertex algebra over these Shimura varieties and will discuss some progress towards the character of its global sections with the Kudla-Millson generating series.

- **Lennart Gehrmann**

  The Gross–Kohnen–Zagier theorem for plectic points

  Plectic points are tensors of p-adic points on elliptic curves that are conjectured to control the arithmetic of higher rank Mordell–Weil groups. Their construction relies on the choice of an auxiliary quadratic CM extension of the base field. I will report on joint work with Michele Fornea and Martí Roset Julià, in which we prove that the generating series of plectic points is a modular form of parallel weight 3/2 that is in Shimura correspondence with the Hilbert modular form attached to the elliptic curve in question. This generalizes the classic result of Gross-Kohnen-Zagier concerning the generating series of Heegner

points on modular Jacobians. As a corollary, one deduces that the group generated by plectic points has rank at most one.

- **Ben Howard**

  Kudla-Millson forms on toroidal compactifications

  Kudla and Millson constructed modular forms valued in the cohomology of orthogonal and unitary Shimura varieties. I will explain that these have canonical extensions to modular forms valued in the cohomology of toroidal compactifications. This is joint work with Francois Greer and Salim Tayou.

- **Francesco Iudica**

  A p-adic interpolation of the Cogdell lift

  The Cogdell lift is the analogue for Picard modular surfaces of the celebrated Hirzebruch-Zagier theorem. Roughly speaking, the lift takes a class in middle cohomology of a Picard modular surface, and lifts it to a Fourier series whose coefficients are intersection multiplicities of special cycles. Cogdell's result states that this Fourier expansion is in fact an elliptic modular form. In this talk, we apply Lœffler's formalism of spherical varieties to obtain a p-adic analytic version of Cogdell's theorem, where the classical special cycles are replaced by compatible families of cohomology classes in towers of Picard modular surfaces, whose generating series are Hida families of modular forms.

- **Paul Kiefer**

  A Λ-adic Funke–Millson lift

  Generalizing the construction of the Kudla-Millson theta function, Funke-Millson showed that the generating series of cohomology classes of Funke-Millson cycles with values in a local system is modular. We show that these Funke-Millson cycles can be put into a Λ-adic family and show that the corresponding generating series is a Λ-adic family of modular forms. In particular, we obtain a Λ-adic Funke-Millson lift. This is work in progress with Lennart Gehrmann.

- **Yingkun Li**

  Algebraicity of higher Green function at a CM point

  In the 1980's, Gross and Zagier conjectured that the value of certain higher Green functions at a CM point is algebraic in nature. In this talk, we will look at its generalization to the case of orthogonal Shimura varieties, and recent results that resolve some of these conjectures.

- **Judith Ludwig**

  Modular generating series from rigid analytic theta cocycles

  I will report on joint work with Isabella Negrini, Alice Pozzi, Sandra Rozensztajn and Hanneke Wiersema. In this work, we construct a modular generating series G from two real quadratic fields. We do this using the p-adic theory of rigid analytic theta cocycles (due to Darmon

and Vonk). We determine the expansion of G in a basis of newforms and find arithmetically interesting coefficients.

- **Vincent Pilloni**

  Companion forms and Frobenius lifting

  A mod p eigenform whose Galois representation is tame on inertia admits a companion form, this is a classical theorem of Gross, Coleman-Voloch, Faltings. We will give a new proof of this result, and discuss higher dimensional generalizations.

- **Martí Roset Julià**

  Rigid classes for $\mathrm{SL}(n)$ *and their values at special points*

  The theory of complex multiplication implies that the values of modular functions at CM points belong to abelian extensions of imaginary quadratic fields. In this talk, we propose a conjectural extension of this phenomenon to the setting of totally real fields. Generalizing work of Darmon, Pozzi, and Vonk, we construct rigid classes for $\mathrm{SL}(n)$ that play the role of modular functions and define their values at points associated with totally real fields. The construction of these classes originates from a topological source: the Eisenstein class of a torus bundle. If time permits, we will discuss work in progress on expressing the values of rigid classes for $\mathrm{SL}(n)$ as Fourier coefficients of derivatives of p-adic families of theta lifts. This is joint work with Peter Xu, and with Peter Xu and Romain Branchereau, respectively.

- **Sören Sprehe**

  Rigid meromorphic cocycles for $\mathbf{O}(2,2)$

  In their influential work on real quadratic singular moduli, Darmon and Vonk initiated the theory of *rigid meromorphic cocycles*. These objects are classes in the first cohomology group of the Ihara group $\mathrm{SL}_2(\mathbb{Z}[1/p])$ with values in the group of non-zero rigid meromorphic functions on the p-adic upper half plane $\mathcal{H}_p$. By defining the value of a rigid meromorphic cocycle at a real quadratic irrationality in $\mathcal{H}_p$, Darmon and Vonk assign to a pair of such points a p-adic number in $\mathbb{C}_p$. While the two irrationalities play a vastly different role in this construction, we expect it to behave like the difference of two classical singular moduli. In this talk, we will use the framework of Darmon, Gehrmann and Lipnowski and new insights on rigid meromorphic cocycles for the orthogonal group $\mathbf{O}(2,2)$ to give a two-variable and, in particular, symmetric construction of this function. This is based on joint work with Håvard Damm-Johnsen, Mike Daas and Lennart Gehrmann.

- **Liang Xiao**

  Arithmetic theta lifts in higher Chow groups

  In the celebrated theory of arithmetic theta liftings, a.k.a. the Kudla program, a key component is to prove the modularity of the generating series with values in (arithmetic) Chow cycles. In this talk, we report on a joint work in progress with Haocheng Fan, Wenxuan Qi, Peihang Wu,

and Yichao Zhang, in which we propose a parallel story for arithmetic theta lifts in higher Chow cycles. I will focus on explaining the basic framework, which involves a (somewhat) new proof of the modularity in the cycles case and a mild generalization of Borcherds products. Assuming a yet missing technical input on cohomology vanishing, this is expected to construct a modular generating series with values in higher Chow groups of orthogonal Shimura varieties. We conjecture that the regulator of these higher Chow group elements is related to the special values of L-functions, as predicted by Beilinson's conjecture.