An approach to irregular singular G-connections on curves via the Bruhat-Tits building

In this talk, I describe a new approach to the study of irregular singular G-connections on curves (for complex reductive G) using methods of representation theory. This approach is based on a geometric version of the Moy-Prasad theory of minimal K-types (or fundamental strata) for representations of p-adic groups. In the geometric theory, one associates a fundamental stratum–data defined in terms of an appropriate point in the Bruhat-Tits building–to a formal G-connection. Intuitively, this stratum plays the role of the "leading term" of the connection, and it can be used to define its slope, the analogue of the depth of a p-adic representation. These methods are well-suited to studying various geometric and combinatorial properties of G-connections. For example, they allow one to construct well-behaved moduli spaces of G-connections on $\mathbb{P}^1$. I will also describe some applications to the geometric Langlands program, where (unlike the classical situation), fundamental strata can be associated to objects on both the Galois and automorphic side of the correspondence. In particular, I will discuss a construction of new rigid local systems with a "cuspidal" irregular singularity; these include de Rham analogues of Yun's generalized Kloosterman sheaves associated to epipelagic representations.

This is in part joint work with C. Bremer and M. Kamgarpour.