

# Iwahori-Hecke modules and smooth representations of the $p$ -adic $SL_2(F)$ in characteristic $p$

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Let  $p$  be a prime number and  $F$  be a non-archimedean local field with finite residue class field of characteristic  $p$ . In characteristic  $p$ , Iwahori-Hecke modules of a  $p$ -adic reductive group naturally show up in the study of (irreducible) smooth representations of this group as spaces of invariant vectors under the action of a given pro- $p$ -Iwahori subgroup. Understanding these modules can provide useful information about the aforementioned representations, that are still very mysterious (excepted for a few groups like  $GL_2(\mathbb{Q}_p)$  or  $SL_2(\mathbb{Q}_p)$ , for which irreducible smooth representations are at least fully described).

In this talk, we will focus on the case of the special linear group  $SL_2(F)$  : we will give an overview of the main results available in this case, and explain some methods and techniques that were developed to understand irreducible smooth representations and Iwahori-Hecke modules of  $p$ -adic groups in characteristic  $p$ . In particular, we will give a classification of these objects and explain how they connect together. If there is enough time left, we will furthermore explain some recent results we proved about the spaces of extensions between simple Iwahori-Hecke modules and their counterpart in representation theory.