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Harmonic weak Maass forms: a geometric approach.

In this talk we provide a geometric framework for the study of the Fourier coefficients of harmonic weak Maass forms of integral weight, a space of smooth modular forms first introduced by Bruinier and Funke in the context of singular theta lifts. In this geometric framework harmonic weak Maass forms arise from the construction of differentials whose classes are exact in certain de Rham cohomology groups attached to modular forms. We show how this new interpretation naturally leads to strengthenings of theorems of Bruinier,Ono and Rhoades, by answering in the affirmative conjectures about the field of definitions of Fourier coefficients of harmonic weak Maass forms. We also produce Eichler-Shimura-style isomorphisms for the de Rham cohomology attached to modular forms, generalizing results of Bringmann, Guerzhoy, Kent and Ono to any level and field of definition.