1125-11-155 **Catherine M Hsu*** (`cathyh@uoregon.edu`), University of Oregon, Department of Mathematics, Fenton Hall, Eugene, OR 97403. *Higher Congruences between Newforms and Eisenstein Series.*

This project concerns modular forms and congruences between them. More specifically, using commutative algebra and computational techniques, we aim to determine "depths" of congruences between weight 2 newforms and certain Eisenstein series in order to gain information about the structure of the associated Hecke algebra. Indeed, given a level N, we first use a modified Sturm bound to compute the depths of congruences between newforms of level M dividing N and the Eisenstein series of weight 2 and level N given by

$$E_{2,N}(z) = \sum_{d|N} \mu(d) d E_2(dz),$$

where μ is the Möbius function and E_2 is the weight 2 Eisenstein series for $\mathrm{SL}(2, \mathbb{Z})$ normalized so that the Fourier coefficient of q is 1. Because of the close relationship between congruences modulo p of newforms and completions of the Hecke algebra at certain maximal ideals, our computations, combined with a commutative algebra result of Berger, Klosin, and Kramer, will then give us an upperbound for the p-adic valuation of index of the Eisenstein ideal in the Hecke algebra. Moreover, we hope to use these computations to find examples of levels where the Eisenstein ideal is not locally principal. This work is currently in progress and partially joint with Krzysztof Klosin. (Received August 11, 2016)