Abstract Submitted for the 55th Annual Meeting Division of Plasma Physics November 11-15, 2013, Denver, CO

Category Number and Subject: 14.1 High-School Research

[ ] Theory [X] Experiment

Modeling of Radiative Divertor Dynamics and Control,* N.A. Sutton-Smolin, *Canyon Crest Academy*; D.A. Humphreys, T.W. Petrie, *GA*; M.E. Fenstermacher, *LLNL* — A simple control-level model has been constructed for analysis and design of divertor radiation control. The intent is to represent dynamics sufficient to enable design of controllers for divertor radiation, target heat flux, and eventually detachment state. Experimental observations were used to qualitatively characterize the responses of various plasma quantities. Based on the model, a controller was developed for regulating divertor heat flux with PID control algorithms. Four inputs were used: core fueling rate, impurity species flow rates to both core and divertor, and core heating power. High accuracy dynamic control was demonstrated in simulation for core electron density, core stored energy, and divertor target heat flux, simultaneously. The model assumes fully ionized argon gas, uses confinement times inferred from experiment, and describes divertor radiation with a heuristic function of core electron and divertor impurity densities. Simplified control-level models enable design and study of different approaches to integrated core-divertor radiation control.

*Supported by the US DOE under DE-FC02-04ER54698 and DE-AC52-07NA27344.