Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Sensitivity Analysis in Complex Plasma Chemistry Models[1]
MILES TURNER, Dublin City University — The purpose of a plasma chemistry model is prediction of chemical species densities, including understanding the mechanisms by which such species are formed. These aims are compromised by an uncertain knowledge of the rate constants included in the model, which directly causes uncertainty in the model predictions. We recently showed that this predictive uncertainty can be large—a factor of ten or more in some cases. There is probably no context in which a plasma chemistry model might be used where the existence of uncertainty on this scale could not be a matter of concern. A question that at once follows is: Which rate constants cause such uncertainty? In the present paper we show how this question can be answered by applying a systematic screening procedure—the so-called Morris method—to identify sensitive rate constants. We investigate the topical example of the helium-oxygen chemistry. Beginning with a model with almost four hundred reactions, we show that only about fifty rate constants materially affect the model results, and as few as ten cause most of the uncertainty. This means that the model can be improved, and the uncertainty substantially reduced, by focussing attention on this tractably small set of rate constants.

[1]Work supported by Science Foundation Ireland under grant08/SRC/I1411, and by COST Action MP1101 "Biomedical Applications of Atmospheric Pressure Plasmas."

Miles Turner
Dublin City University

Date submitted: 19 Jun 2015 Electronic form version 1.4