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Maximilian S Metti*, Pennsylvania State University, Mathematics Department, State College, PA 16802, and **Jinchao Xu, Chun Liu** and **Xiaozhe Hu**. *Applications and Discretizations of the Poisson-Nernst-Planck Equations*.

Electrostatic systems are a subclass of electromagnetic systems, where several charge carriers interact with one another through an electric field and the magnetic field is assumed to be static in time. Such systems are of significant interest in the study and design of modern electronic devices, electrochemistry, and biology. Electrostatics are often described by the Poisson-Nernst-Planck (PNP) equations, which are a strongly-coupled system of nonlinear equations. In this talk, we present several applications of the PNP equations to electronic devices and discuss some possible modifications to this mathematical model. Furthermore, a discretization of the PNP equations is proposed and analyzed, establishing stability of the discrete problem by leveraging the nonlinear nature of the equations. A numerical solver for these equations is then described along with some numerical results. (Received February 20, 2015)