

1172-37-171

**Jianing Chen\*** ([jianing.chen@student.nmt.edu](mailto:jianing.chen@student.nmt.edu)), 801 Leroy PI, Socorro, NM 87801, **Yiwei Wang**, Hangzhou, Zhejiang 310018, Peoples Rep of China, **Lijun Zhang**, Qingdao, Shandong 266510, Peoples Rep of China, and **Mingji Zhang**, Socorro, NM 87801. *Mathematical analysis of Poisson-Nernst-Planck models with permanent charges and boundary layers: Studies on individual fluxes.*

We study the qualitative properties of the individual fluxes with boundary layers via the one-dimensional Poisson-Nernst-Planck system, which includes small permanent charges together with one cation and one anion through a membrane channel. Our main interest is to examine the effects of the nonlinear interaction among multiple system parameters such as permanent charges, channel geometry, boundary conditions (concentrations and potentials) and boundary layers. Our result shows that the individual fluxes depend sensitively on those system parameters and indicates that the small positive permanent charge cannot strengthen the flux of cation while reduce that of anion. The nonlinear interplays between those system parameters are characterized in detail, from which one can gain a better understanding of the internal dynamics of ionic flows through membrane channels. Critical electric potentials which play unique and crucial roles in studying ionic flow properties are identified. Numerical simulations are further performed and numerical results are consistent with our analytical ones. (Received August 25, 2021)