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Investigating anomalous transport of electrolytes in charged porous media

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Surface charge is know to play an important role in microfluidics devices when dealing with electrolytes and their transport properties. Similarly, surface charge could play a role for transport in porous rock with submicron pore sizes. Estimates of the streaming potentials and electro osmotic are mostly considered in simple geometries both using analytic and numerical tools, however it is unclear at present how realistic complex geometries will modify the dynamics. Our work have focused on doing numerical studies of the full three-dimensional Stokes-Poisson-Nernst-Planck problem for electrolyte transport in porous rock. As the numerical implementation, we have used a finite element solver made using the FEniCS project code base, which can both solve for a steady state configuration and the full transient. In the presentation, we will show our results on anomalous transport due to electro kinetic effects such as the streaming potential or the electro osmotic effect.