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## Talk announcement

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# High order exponentially fitted discretizations for convection diffusion problems

We introduce a class of numerical methods for convection diffusion equations in arbitrary spatial dimensions. Targeted applications include the Nernst-Plank equations for transport of species in a charged media and the space-time discretizations of such equations. The numerical schemes that we consider are descendants of the popular, one-dimensional, first order, exponentially fitted Scharfetter-Gummel method in semiconductor devices modeling (1969). We illustrate how such exponentially fitted methods are derived in several simple, typical, and instructive cases. We also reveal intricate connections with other families of discretization spaces usually used as building blocks in the Finite Element Exterior Calculus. These findings lead, in a natural way, to higher order exponentially fitted discretizations in any spatial dimensions. We state several theoretical results regarding stability and errors for the resulting numerical schemes. Distinctive features of the proposed methods are: (1) monotonicity (in the lowest order case); (2) errors depending on the flux (a function often smoother than the solution). Our numerical tests verify the theory on examples from space-time formulation of parabolic problems. This is a joint work with R. E. Bank (UCSD) and P. S. Vassilevski (LLNL).