Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

**Phase diagram of solution of oppositely charged polyelectrolytes**
RUI ZHANG, B. I. SHKLOVSKII, William I. Fine Theoretical Physics Institute, University of Minnesota — We study a solution of long polyanions (PA) with shorter polycations (PC) and focus on the role of Coulomb interaction. A good example is solutions of DNA and PC which are widely studied for gene therapy. In the solution, each PA attracts many PCs to form a complex. When the ratio of total charges of PA and PC in the solution, $x$, equals to 1, complexes are neutral and they condense in a macroscopic drop. When $x$ is far away from 1, complexes are strongly charged. The Coulomb repulsion is large and free complexes are stable. As $x$ approaches to 1, PCs attached to PA disproportionate themselves in two competing ways. One way is inter-complex disproportionation, in which PCs make some complexes neutral and therefore condensed in a macroscopic drop while other complexes become even stronger charged and stay free. The other way is intra-complex disproportionation, in which PCs make one end of a complex neutral and condensed in a small droplet while the rest of the complex forms a strongly charged tail. Thus each complex becomes a "tadpole." We get a phase diagram of PA-PC solution in a plane of $x$ and inverse screening radius of the monovalent salt, which includes phases with both kinds of disproportionation.

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Date submitted: 05 Dec 2004 Electronic form version 1.4