Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Electrophoresis of a polyelectrolyte attached to a solid object: A strong influence of the attachment point MYKYTA V. CHUBYNSKY, GARY W. SLATER, University of Ottawa — In some applications of electrophoresis, a polyelectrolyte (such as the DNA) is attached to an electrically neutral object of an irregular shape (e.g., a globular protein). Because of the hydrodynamic interactions (HI) between the polymer and the object, the amount by which the polymer is slowed down should depend on the shape of the object, especially near the attachment point, and not only on its drag coefficient. To study this effect, we compute the electrophoretic mobility of a short neutral tube closed at one end with a charged polymer attached to the closed end, either inside or outside the tube. Both the polymer and the tube are represented as sets of beads and the HI are pre-averaged. For a short polymer that would occupy only a small part of the tube, the mobility is much lower when the polymer is inside than when it is outside. The mobility ratio depends exponentially on the tube length and exceeds an order of magnitude already when the length of the tube equals its width. As the polymer size is increased and the coil size approaches the tube length, the mobility in the case of inside attachment starts to grow rapidly and then quickly approaches that in the case of outside attachment.

Mykyta V. Chubynsky
University of Ottawa

Date submitted: 14 Nov 2014 Electronic form version 1.4