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Electrophoresis of DNA-protein conjugates: hydrodynamic end effects and electrostatic interactions MYKYTA V. CHUBYNSKY, GARY W. SLATER, Department of Physics, University of Ottawa, Canada — DNA fragments can be separated by length in free solution by attaching them to neutral or positively charged "drag-tags" (e.g., proteins), a technique known as end-labeled free-solution electrophoresis (ELFSE). We first extend a previous theory of ELFSE for neutral drag-tags to the case of weakly charged drag-tags. The simplest variant of the theory assumes that all parts contribute equally to the mobility (no end effects) and that both the DNA and the drag-tag are fully flexible and do not interact. We analyze the influence of these assumptions. We obtain the exact (within the Kirkwood-Riseman approximation) form of the function describing the end effects for flexible polymers. The main significance of the end effects is the $N^{-3/4}$ (instead of N^{-1}) form of the correction to the mobility for large DNA lengths N. We also show that the end effects are weaker for semiflexible and stiff polymers. Using a simple model, we study how the conformation of the drag-tag changes due to the electrostatic interaction with the DNA and how this influences the mobility.

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