**Transformed E&M I materials**

**Polarization and Fields of Polarized Objects**

**Linear Dielectrics**

**(Griffiths Chapter 4)**

**STUDENT DIFFICULTIES**

**What is a dielectric? (\*\*)**

* Some students are not quite clear on what a dielectric is (or isn’t). What would be a nonlinear dielectric? Can you embed a charge in a dielectric, versus a conductor? Are semiconductors dielectrics?

**Bound surface versus volume charge**

* In the Traditional course, several students didn’t differentiate between rho-bound and sigma-bound in the homework, suggesting that they don’t have a firm grasp on what those numbers represent. Questioning of one student elicited memory of the instructors’ description of what sigma-bound is (the dangling positives/negatives from the dipoles), but there was a general sense that students were calculating things that they didn’t fully understand. A few weeks later, they also said they didn’t have a strong concept of bound charge. In the Transformed course, the students were forced to grapple with the concepts in clicker questions, and they showed much more of an understanding of what it was through interviews and homework.

**Initial E vs. Produced E (\*)**

* In several homework problems, students struggled with the difference between the E field that creates a polarization, and the E field created *by* the polarization, which sum together iteratively to create the final result. This requires a little care, but also can represent a difficulty in understanding just what polarization of a linear dielectric is; i.e., the response of a substance to an external electric field (not to its own electric field).