**Transformed E&M I materials**

**Laplace’s Equation & Poisson’s Equation**

**Uniqueness**

**(Griffiths Chapter 3)**

**STUDENT DIFFICULTIES**

**What is Laplace’s Equation? (\*\*\*)**

* Students often did not recognize Laplace’s equation as a special case of Poisson’s equation.
* In student interviews students often confused Laplace’s Equation with Poisson’s Equation, couldn’t remember Laplace’s equation (at least two thought that it was ) and where it was valid (where ρ=0).
* Many did not know that we were solving Laplace’s equation in these different solution methods, such as separation of variables and method of images. Thus, it’s important to emphasize throughout the chapter – not just at the beginning – that each of these methods are one way to solve Laplace’s Equation, and what Laplace’s equation is.
* At least one student was unsure whether Laplace’s Equation was a law of nature or not, and whether it was always true.
* Most did not recognize (at least without some prompting) that Laplace’s Equation arises from the differential form of Gauss’s Law where there is zero charge.

**Uniqueness (\*)**

* In interviews, many students did not relate Uniqueness theorem to Laplace’s equation. They knew that it had something to do with if you find a solution, it’s the solution, but didn’t remember what “it” was the solution *to*.
* Students often approach separation of variables problems algorithmically and do not attempt to make sense of the steps. This is particularly problematic when trying to use this technique in novel situations.