

## CSAAPT Fall 2022 Semi-Virtual Meeting



Chesapeake Section of the  
American Association of Physics Teachers  
Fall 2022 Semi-Virtual Meeting  
October 22, 2022 in Falls Church, VA

Contribution ID: 14

Type: **talk (15-minute)**

# To Think Deeply of Simple Things: Reflections & Possible Results from an Ancient REU

*Saturday, October 22, 2022 3:15 PM (15 minutes)*

During summer of 2005 I worked with my dad who was a professor in mathematics at the University of Illinois (now emeritus) on a research project that was broadly in the area of inverse problems. An inverse problem in science is the process of calculating from a set of observations the causal factors that produced them. For example, calculating an image from MRI data or source reconstruction from a measured field. The project I proposed was what measurements of the electric field –where and how many –would be needed to uniquely determine the placement of the electric point charges that created it. This question is identical to the question: What is the zero set of an electric field from a finite set of point charges? This turns out to be a complex question. Some of the characteristics of the zero set are solved, for example that the zero set consists of a locally finite set of points and analytic curves (i.e. a two dimensional area cannot be all zero). However, other conjectures are still unproven. For example, if the charges are constrained to a plane, does this reduce the zero set to a finite set of points? Some high level results from this work will be presented and some personal reflections on the value of this experience for my understanding of theoretical research, and the research enterprise, that still shapes my thinking today.

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**Session Classification:** Afternoon Session 2B (Chair: Maria Gordon, Zoom Monitor: Elena Kuchina)