Danny Caballero – Colloquium 12/5/2017

Title: Using physics education research to explore how students learn to engage with scientific tools and practices

Abstract: To learn physics well, students must learn canonical physics ideas and how to put them into use, as well as develop an understanding of how physics is done. That is, students must learn the modern tools and central practices of physics. In this talk, I will discuss how these tools and practices are needed in physics education and will explain how physics education research has helped us to better understand how students learn and engage with these tools and practices. I will dive deeply into computational modeling, which has revolutionized how modern physics is done. While computational modeling is a crucial tool of practicing physicists, most modern physics curricula do not reflect its importance and utility. I will discuss the urgent need to construct such curricula in physics and present research that investigates the challenges in doing so. These challenges are present at a variety of scales -- from the largest (institutional structures) to the smallest (student understanding of a concept). Over time, this research will help us understand and develop institutional/departmental incentives, effective teaching practices, evidence-based course activities, and valid assessment tools. This work has been supported by Michigan State University's CREATE for STEM Institute, the Howard Hughes Medical Institute, the National Science Foundation (DUE-1431776, DUE-1504786, DUE-1524128, DRL-1741575), the Norwegian Agency for Quality Assurance in Education (NOKUT), and the Norwegian Research Council.