



4th year colloquium

# A tale of two rabbits: how identical materials are helping us unlock the secrets of "static electricity"

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"Static electricity" is ubiquitous. Commonly associated with everyday things like balloons rubbed on hair or shocks from doorknobs, it nevertheless plays a central role in a wide array of natural phenomenon, from lightning to pollination to planet formation. The name "static electricity" is a misnomer. For two neutral objects to acquire static electricity, charged species must move between them during contact or rubbing. Yet despite centuries of study we have no idea what charged species are transferred (electrons vs. ions), let alone why. The main reason for our ignorance is that experiments to probe static electricity are plagued by unpredictability. Whatever mechanism(s) lay behind it, they are so sensitive and subtle that repeated experiments even in the same lab often don't reproduce the same result. Our group is trying a new approach, which is to focus on the charge exchange between "identical" materials. Though counterintuitive, this has long been known to occur, despite any obvious symmetry breaking. I will discuss two such 'same-material' experiments that are helping us resolve the mysteries of static electricity. In the first, we use acoustic levitation to study the charging of an  $\text{SiO}_2$  sphere colliding against an  $\text{SiO}_2$  plate. We find that the atmospheric and thermal history of a sample causes it to charge with a defined sign, pointing to surface adsorbates and adsorption hysteresis as the symmetry breaking parameter. In the second, we study charge exchange between samples of a soft polymer, PDMS. Here, we are led to the surprising conclusion that contact itself breaks symmetry, causing initially samples to self-organize into "triboelectric series." Our results shed new light on why the cause of static electricity is so frustratingly unpredictable, and in doing so give hope that rhyme and reason are within reach.

**Friday, May 17, 2024 11:00am - 12:00pm**

Raiffeisen Lecture Hall

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