Northwestern research team turns theory of static electricity on its head

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Image: Chris Darling/Wikipedia

(PhysOrg.com) -- Bartosz Grzybowski, a physical chemist at Northwestern University, and his team of colleagues offer evidence in a paper published in *Science*, that shows that what scientists have believed to be true about the causes behind the creation of static electricity, is wrong. Instead of one object winding up with more or less electrons as a result of rubbing together, they claim, there is an actual transfer of slight amounts of actual material.

Scientists have been studying the cause of static electricity for thousands of years, going back to the early Greeks, but in spite of such work, little is known about the phenomena as Grzybowski points out in the paper. The accepted view is that there is a simple exchange of ions, leading to

an imbalance in one or the other object, causing it to be attracted to other objects. Thinking there had to be more to it, Grzybowski decided to look a little closer.

Using Kelvin probe force microscopy, a technique whereby scientists are able to measure the level of charge on various parts of the surface of an object, he and his team were able to see that such charges on nearly any object are far less uniform than has been assumed. They found what they describe as a patchwork of both positive and negative charged clumps sitting randomly on the surface of the objects studied, and it is these clumps they believe that are transferred between objects when they come into contact with one another; bits of balloon, for example, actually adhere to a child's hair when rubbed, leaving behind an imbalance in the electrical patchwork on the balloon, which results in an attraction between the balloon and other objects, such as a sweater or wall.

As for an explanation of why their exists patches of positive and negative charges on objects, the authors can only speculate, suggesting that differences in the properties of differing objects and the resulting tearing away of each other's patches when touched randomly would seem to explain the seeming randomness of the placement of the patches on the surfaces of those objects.

And while this research does definitively show that clumps of patches are indeed transferred between objects as a result of touching, not everyone is convinced that it fully answers the question of why static electricity is created, some going so far as to suggest that there may be other properties at work as well.

More information: The Mosaic of Surface Charge in Contact Electrification, *Science*, Published Online 23 June 2011. DOI:10.1126/science.1201512

ABSTRACT

When dielectric materials are brought into contact and then separated, they develop static electricity. For centuries, it has been assumed that such contact charging derives from the spatially homogeneous material properties (along the material's surface) and that within a given pair of materials, one charges uniformly positively and the other negatively. We demonstrate that this picture of contact charging is incorrect. While each contact-electrified piece develops a net charge of either positive or negative polarity, each surface supports a random “mosaic” of oppositely charged regions of nanoscopic dimensions. These mosaics of surface charge have the same topological characteristics for different types of electrified dielectrics and accommodate significantly more charge per unit area than previously thought.