Sideways Science

In our Conversation for this issue, Klaus von Klitzing made an insightful comment about discoveries in science, and elaborated on his views.[1] Great discoveries are typically not made by setting milestones, but rather by finding something unexpected along the way, realizing that it is interesting, and understanding it—as he put it, working toward a goal but then "going sideways." This was the case for his discovery of the Quantum Hall Effect as well as for many others' key breakthroughs.

Each of these aspects of "sideways" is critical: watching closely enough to get a glimpse of something interesting, knowing that it is unusual, and working to understand it. Part of our excitement in going into unexplored territory in the nanoscale world is that we have the hope and even expectation of finding new phenomena, structures, and properties.

Yet, with our still primitive ability to measure the nanoscale world, it is much like being put in a new environment and having only our sense of smell on which to rely. The mix may be complex and rich, but separating out the origins of all the odors, choosing one as a focus, and then determining both what it is and why it has that smell would likely be far beyond our abilities. We need not only all of our own senses but the other enhanced measurement and analytical tools that we have developed for the macroscopic and microscopic worlds. We continue to learn how to focus these techniques on the nanoscale objects of our study as well as to exploit the scale of this world to develop new tools. Several of the articles in this issue focus on using such near-field effects to advantage, and to understanding the nanoscale tools at our disposal.[2–6] We can expect to see many significant advances in this area in the future.

Our current approach to understanding the nanoscale world is often one of pragmatism; we look at highly simplified systems. We try to study one structure and one phenomenon, but still, we often lack the ability to confirm that we have created the precise structure that we have targeted. I look forward to the day when we are able to work on more complex systems and to understand them in all their exquisite detail with all of their interactions, complexity, and entanglements intact.

Our Conversation brought up another issue. Is there a way to target discoveries? Can we steer our research into areas with a greater chance of unearthing new phenomena? Is there some guidance that we can offer those supporting research—funding agencies, foundations, companies—on where to invest their (often our) money?

Surely, looking where others have not and developing and applying new tools are parts of a successful approach. Another was brought up by von Klitzing: look for what we do not understand. It may be that there are prosaic explanations for what we find, or it may be something new. Getting to the depths of the problems that we study and the discoveries along the way in terms of preparation, measurements, and understanding will serve us well in both the identification of what is new and the elucidation of why and what it is.

I wish you happy exploring. I look forward to reading of your adventures on these pages.

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Editor-in-Chief

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