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Simulations of SPM tip nanoindentation

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Methods of scanning probe microscopy (SPM) offer wide possibilities for basic and applied research. For example, tip-enhanced optical spectroscopy on single molecules performed with STM and AFM techniques offers a unique view into the world of fundamental photophysics at nanoscale. All SPM techniques have in common the need for atomically sharp tips as the probe. After more than four decades of SPM use on various problems in atomic and molecular physics, there is a consensus in the field that preparation of atomically-sharp tips is not easy and it involves shaping the apex at the mesoscopic and atomic scales. In this work, we simulate the tip-shaping by molecular dynamics in order to pave ways to better understanding and to develop more rigorous approaches to the process. We also aim to develop an algorithm to extract nanoscopic characteristics of real tips treated by nanoindentations and find a link to the simulations. This could ultimately lead to the much desired automation of the tip-shaping process and a significant benefit to the efficiency of SPM measurements.

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