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Preparing students for the second quantum revolution

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Quantum mechanics is a profound theory that impacts our understanding of phenomena from the very smallest to the very largest scales. Its principles were founded in a need to understand a range of phenomena evident in the natural world, such as the observed spectroscopic properties of atoms and molecules. However, as quantum devices rapidly grew in societal impact in the previous century, a new perspective emerged of the potential for quantum systems to efficiently process information, if only they could be controlled. It was realized that many of the nonintuitive aspects such as locality and realism could actually be tested in experiment by virtue of Bell's inequalities. We are now at a point where students need to be prepared to contribute to the second quantum revolution, where the basic quantum constituents can be manipulated at the level of individual elements. I will present recent efforts to develop a comprehensive interactive quantum sequence with the aim to move from a teaching approach based on the historical development of the subject to a more modern perspective. I will emphasize some of the conceptual difficulties that face students approaching this subject material.