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Nanotechnology and Quantum Mechanics: Bringing High School Physics into the 21st Century

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We are well into the 21st century, and yet, remarkably, in high school physics classes we only teach material that was developed by the end of the 19th century! How can this be true when physics underlies all scientific disciplines? There may be many answers, but a simple answer is that Newtonian mechanics, when dealing with physics on the human scale (the macroscopic world), is considered close enough! As a conceptual and theoretically minded person I don't think that this answer is adequate; we KNOW from modern physics that the world is different than we are used to encountering. However, on large scales the "weird" consequences of quantum mechanics (which indicates that energy is not continuous but instead comes in small "packets" known as quanta and that reality is really probabilistic instead of deterministic) are averaged out and, therefore, undetectable. However, at the nanometer (10^{-9} meters) –scale, quantum mechanics cannot be ignored and in fact begins to dominate. Nanotechnology literally opens up a world of possibility in that it offers an opportunity to give a tangible explanation and use for quantum mechanics.

(Developed for PSP Scholars Physics I and CAS Gifted Physics, I, grades 11-12, and APB Physics II, grade 12; recommended for Physics I and II, grades 11-12)