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Student ability to relate quantum formalism to real-world phenomena: An example from relative phase in superposition states TONG WAN, University of Washington, PAUL J. EMIGH, Oregon State University, PETER S. SHAFFER, University of Washington — In quantum mechanics, the probability amplitudes are complex and the relative phases in a superposition state can have measurable effects. We have been probing student ability to relate quantum formalism to real-world phenomena in the context of superposition states. In particular, we examine the extent to which students are able to make a connection between relative phase and experimental results. We present data from student written work on questions involving complex numbers either in the context of superposition or as purely mathematical exercises. The data shows that many students do not recognize the role of relative phase in superposition states, even though they can correctly answer corresponding questions that require algebraic procedures only. This suggests that many students do not make physical meaning with mathematical expression in the context of superposition. The findings motivate future work on how to help students relate formalism to physical phenomena.

Tong Wan
University of Washington

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