Title:	Realization of Diverse Waveform Converters from a Single Nanoscale Lateral p–n Junction Cu2S–CdS Heterostructure
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Abstract:	A differentiator is an electronic component used to accomplish mathematical operations of calculus functions of differentiation for shaping different waveforms. Differentiators are used in numerous areas of electronics, including electronic analog computers, wave-shaping circuits, and frequency modulators. Conventional differentiators are fabricated using active operational amplifiers or using passive resistor–capacitor combinations. Here, we report that a single Cu2S–CdS heterostructure acts as a differentiator for performing numerical functions of input waveform conversion into different shapes. When a rectangular wave signal is applied through the tip of a conductive atomic force microscope, a spikelike wave signal is obtained from the Cu2S–CdS heterostructure. The Cu2S–CdS differentiator is able to convert a sine wave signal into a cosine wave signal and a triangular wave signal into a square wave signal similar to the classical differentiators. The finding of a nanoscale differentiator at extremely small length scales may have profound applications in different domains of electronics.
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