Ultrafast Switching in Avalanche–driven Ferroelectrics by Supersonic Kink Movements

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Devices operating at GHz frequencies can be based on ferroelectric kink-domains moving at supersonic speed. The kinks are located inside ferroelastic twin boundaries and are extremely mobile. Computer simulation shows that strong forcing generates velocities well above the speed of sound. Kinks are accelerated from v=0 continuously with Döring masses in the order of skyrmion masses under constant strain rates. Moving kinks emit phonons at all velocities, the emission cones coincide with the Mach cones at supersonic speed. Kinks form avalanches with the emission of secondary kinks via a mother-daughter nucleation mechanism and may be observable in acoustic emission experiments.