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Spatially resolved ultrafast magnetic dynamics initiated at a complex oxide heterointerface.

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Static strain in complex oxide heterostructures has been extensively used to engineer electronic and magnetic properties at equilibrium. In the same spirit, deformations of the crystal lattice with light may be used to achieve functional control across heterointerfaces dynamically. Here, by exciting large-amplitude infrared-active vibrations in a $LaAlO_3$ substrate we induce magnetic order melting in a $NdNiO_3$ film across a heterointerface. Femtosecond resonant soft X-ray diffraction is used to determine the spatiotemporal evolution of the magnetic disordering. We observe a magnetic melt front that propagates from the substrate interface into the film, at a speed that suggests electronically driven motion. Light control and ultrafast phase front propagation at heterointerfaces may lead to new opportunities in optomagnetism.