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The physics of the American five-string banjo

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We report on a systematic study of the American five-string banjo, which was undertaken in an effort to understand the dynamics of this complex instrument. The deflection shapes of the membranous head were studied and catalogued using time-averaged electronic speckle pattern interferometry. The impedance presented to the strings was measured using laser Doppler vibrometry coupled with an integrated force sensor and harmonic driver. Additionally, time resolved spectral analysis of the plucked strings was used to quantify the characteristic decay of the coupled string/membrane system, while time-resolved interferometric studies of the membrane have led to a better understanding of the motion after a string is plucked. All of these investigations help to reveal the importance of the various parameters that affect the sound of this unusual instrument.