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**Determining the Muon Mass in an Instructional Laboratory** CHRISTOPHER MAY, Reed College, BENJAMIN BRAU, University of California, Santa Barbara, JOHN ESSICK, Reed College — An instructional laboratory experiment to measure the muon mass $m_\mu c^2$ is described. Using coincidence-anticoincidence detection, the decay of a cosmic-ray muon into an electron (or positron) is observed in a multiplate spark chamber, and recorded with a triggered CCD detector. The energy $E_e$ of the charged decay-product particle is then determined by the number of chamber plates it traverses before being stopped. By running this apparatus under computer-control for several hours, the number distribution $N(E_e)$ of product-particles with energy $E_e$ is obtained. Based on the quantum electrodynamics analysis of muon decay, the muon mass can then be obtained either from the largest observed value for $E_e(= m_\mu c^2/2)$, the average energy of the distribution $(= 7m_\mu c^2/20)$, or fitting $N(E_e)$ to the predicted functional form of $E_e^2(1-4E_e/3m_\mu c^2)$. We present the results for $m_\mu c^2$ obtained from our apparatus by these three approaches and discuss the simulation we have developed to account for the observed skewing of $N(E_e)$ due to escape of some of the higher-energy product particles from the chamber.

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