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## The timelike pion form factor and other applications of $I = 1$ $\pi\pi$ scattering

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The timelike pion form factor is a rare example of a form factor that can be measured on the lattice in the timelike region without analytic continuation from the spacelike region. The most precise experimental results disagree near the  $\rho$  resonance, leading to diverging estimates of hadronic vacuum polarization. We will present a calculation of the timelike pion form factor using a physical pion mass ensemble, carefully controlling for systematic uncertainties in the generalized eigenvalue problem following the strategy described by Blossier et al (2009). Along the way, we will also show results for the resonance mass  $m_\rho$ , the coupling  $g_{\rho\pi\pi}$ , and the reconstructed vector-vector correlator, the latter of which can be used to improve the estimate of the hadronic vacuum polarization contribution to the muon's anomalous magnetic moment,  $a_\mu^{\text{hvp}}$ .

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