

Small Angle Initial State Radiation Analysis of the Pion Form Factor at BESIII

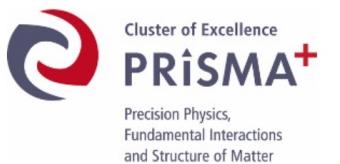
MENU 2023 in Mainz

International Conference on Meson-Nucleon Physics and the Structure of the Nucleon

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On behalf of the BESIII Collaboration

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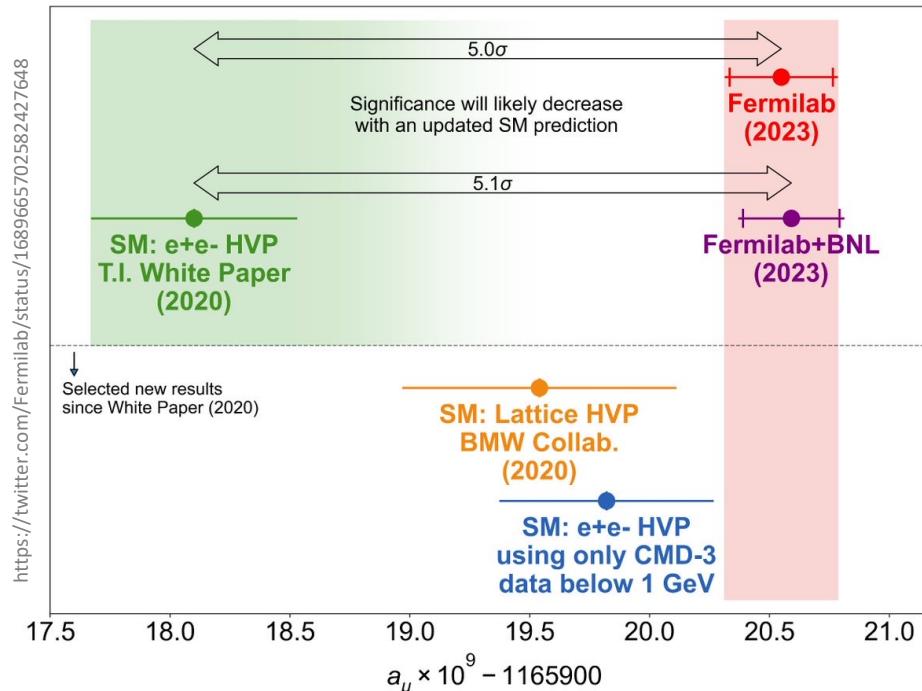


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Anomalous Magnetic Moment of the Muon

- Muon g-2 puzzle: $a_\mu = |g_\mu - 2|/2$
- Standard Model (SM) prediction: $a_\mu^{\text{SM}} = a_\mu^{\text{QED}} + a_\mu^{\text{QCD}} + a_\mu^{\text{weak}}$
- Direct measurement: Experimental average of BNAL & FNAL



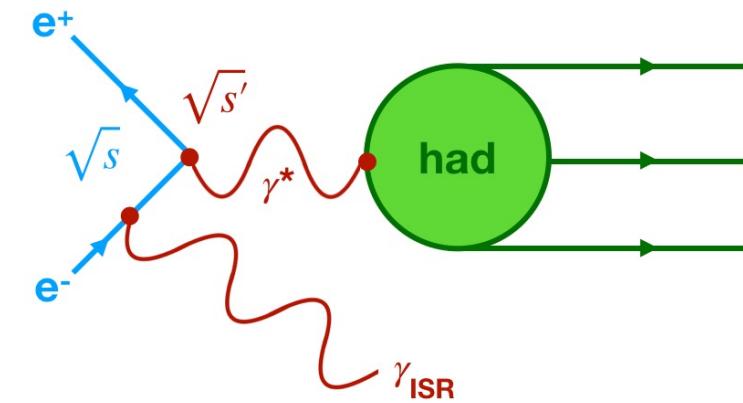
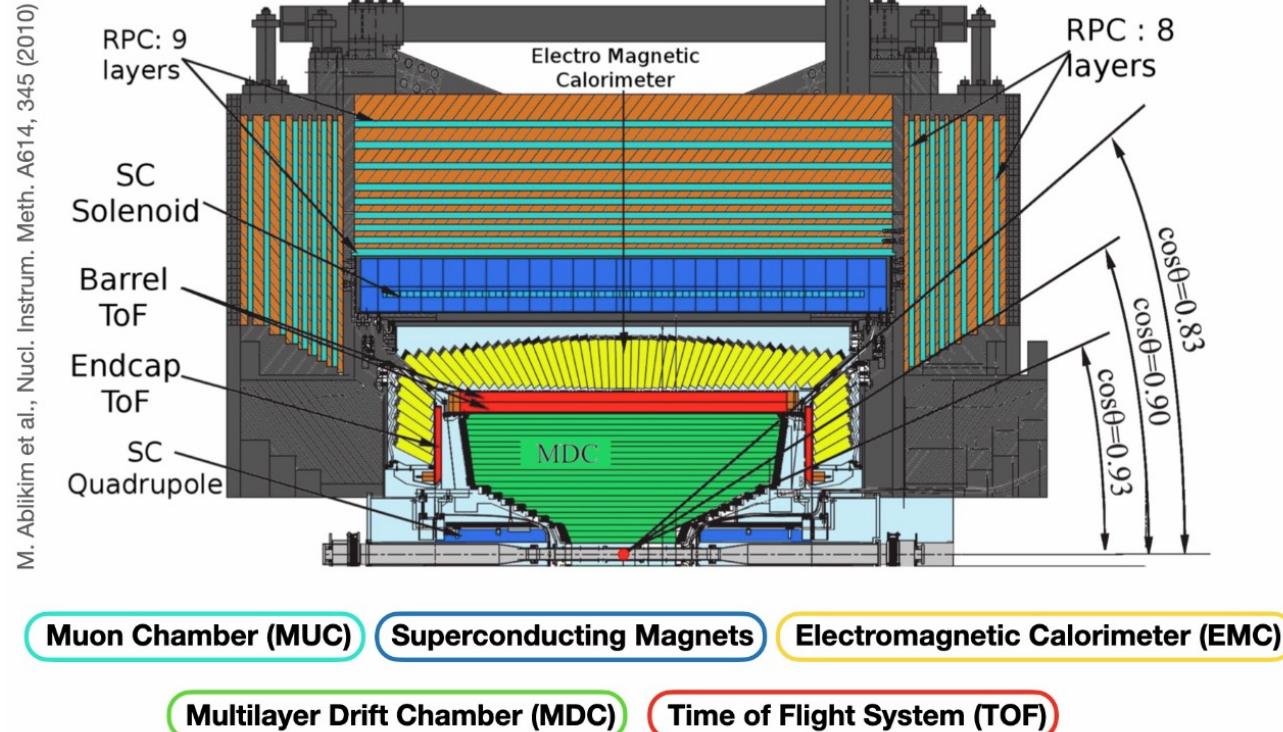
Discrepancy of 5.1σ !

Hadronic contributions dominate uncertainty for a_μ^{SM}

→ Hadronic Vacuum Polarization (HVP)
→ Most important channel: $\pi^+ \pi^-$

Reaction Channel $e^+e^- \rightarrow \pi^+\pi^-$ at BESIII

- BESIII: electron-positron collider with CM energies between 2.0 to 5.0 GeV
- Initial State Radiation technique to measure the pion FF above 0.8 GeV



Data set: 1.9 fb^{-1} at 3.77 GeV
(Upcoming data set: 20 fb^{-1})

Main Challenge: Pion-Muon Separation

- Signal: $e^+e^- \rightarrow \pi^+\pi^-\gamma_{\text{ISR}}$ & main background: $e^+e^- \rightarrow \mu^+\mu^-\gamma_{\text{ISR}}$
- Difficult to distinguish pions from muons at BESIII \rightarrow Multivariate Analysis
- **Boosted Decision Tree with Gradient Boost (BDTG)**

