

Muon Anomalous Magnetic Moment

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Outline

1. Introduction
2. a_μ in Standard Model
3. Low Energy $e^+e^- \rightarrow hadrons$ and a_μ
4. τ Lepton Decays and CVC
5. Experiment vs. Theory
6. Future of a_μ
7. Conclusions

1 Introduction

1.1 Brief History

Various aspects in [1]

Last experiment [2]

1.2 a_μ and New Physics

Review in [3]

2 a_μ in Standard Model

2.1 QED terms in a_μ

Various aspects in [4]

Review in [1]

Recent review [5]

2.2 Electroweak terms in a_μ

Earlier results in [6]

Recent calculation [7]

2.3 Hadronic terms in a_μ

Various calculations in [4, 8, 9, 10]

Last calculation of the light-by-light terms [11]

3 Low Energy $e^+e^- \rightarrow hadrons$ and a_μ

Precise results below 1.4 GeV [12]

Precise results from 2 to 5 GeV [13]

4 τ Lepton Decays and CVC

Detailed calculations in [9]

5 Experiment vs. Theory

See, e.g., [9]

6 Future of a_μ

Idea of radiative return (ISR) [14]

ISR at BaBar [15]

ISR at KLOE [16]

7 Conclusions

Current status and plans in [17]

References

- [1] V.W. Hughes and T. Kinoshita, *Rev. Mod. Phys.* **71** (1999) S133.
- [2] G.W. Bennett et al., *Phys. Rev. Lett.* **92** (2004) 161802.
- [3] A. Czarnecki and W.J. Marciano, *Phys. Rev. D* **64** (2002) 013014.
- [4] S. Eidelman and F. Jegerlehner, *Z. Phys. C* **67** (1995) 585.
- [5] M. Passera, hep-ph/0411168.
- [6] A. Czarnecki, B. Krause, W.J. Marciano, *Phys. Rev. Lett.* **76** (1995) 3267.
- [7] A. Czarnecki, W.J. Marciano, A. Vainshtein, *Phys. Rev. D* **67** (2003) 073006.
- [8] M. Davier, S. Eidelman, A. Höcker, Z. Zhang, *Eur. Phys. J. C* **27** (2003) 497.
- [9] M. Davier, S. Eidelman, A. Höcker, Z. Zhang, *Eur. Phys. J. C* **31** (2003) 503.
- [10] K. Hagiwara, A.D. Martin, D. Nomura, T. Teubner, *Phys. Lett. B* **557** (2003) 69.
- [11] K. Melnikov and A. Vainshtein, *Phys. Rev. D* **70** (2004) 113006.
- [12] R.R. Akhmetshin et al., *Phys. Lett. B* **578** (2004) 285.
- [13] J.Z. Bai et al., *Phys. Rev. Lett.* **88** (2002) 101802.
- [14] S. Binner, J.H. Kühn, k. Melnikov, *Phys. Lett. B* **459** (1999) 279.
- [15] B. Aubert et al., *Phys. Rev. D* **69** (2004) 011103.
- [16] A. Aloisio et al., *Phys. Lett. B* **606** (2005) 12.
- [17] D.W. Hertzog, hep-ex/0501053.