New Theory Initiative on Muonic Atom Spectroscopy

Theory consensus on the **Lamb shift and hfs** of muonic hydrogen, deuterium, ...; akin to the "*g-2* Theory Initiative"

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The anomalous magnetic moment of the muon in the Standard Model

Contribution	Section	Equation	Value $\times 10^{11}$	References
Experiment (E821)		Eq. (8.13)	116 592 089(63)	Ref. [1]
HVP LO (e^+e^-)	Section 2.3.7	Eq. (2.33)	6931(40)	Refs. [2–7]
HVP NLO (e^+e^-)	Section 2.3.8	Eq. (2.34)	−98.3(7)	Ref. [7]
HVP NNLO (e^+e^-)	Section 2.3.8	Eq. (2.35)	12.4(1)	Ref. [8]
HVP LO (lattice, $udsc$)	Section 3.5.1	Eq. (3.49)	7116(184)	Refs. [9–17]
HLbL (phenomenology)	Section 4.9.4	Eq. (4.92)	92(19)	Refs. [18–30]
HLbL NLO (phenomenology)	Section 4.8	Eq. (4.91)	2(1)	Ref. [31]
HLbL (lattice, uds)	Section 5.7	Eq. (5.49)	79(35)	Ref. [32]
HLbL (phenomenology + lattice)	Section 8	Eq. (8.10)	90(17)	Refs. [18–30,32]
QED	Section 6.5	Eq. (6.30)	116 584 718.931(104)	Refs. [33,34]
Electroweak	Section 7.4	Eq. (7.16)	153.6(1.0)	Refs. [35,36]
HVP (e^+e^-, LO + NLO + NNLO)	Section 8	Eq. (8.5)	6845(40)	Refs. [2–8]
HLbL (phenomenology + lattice + NLO)	Section 8	Eq. (8.11)	92(18)	Refs. [18–32]
Total SM Value	Section 8	Eq. (8.12)	116 591 810(43)	Refs. [2–8,18–24,31–36]
Difference: $\Delta a_\mu := a_\mu^{exp} - a_\mu^{SM}$	Section 8	Eq. (8.14)	279(76)	

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Muonic Atom Spectroscopy Theory Summaries — MASTS

Working groups, possible divisions

1. μH, μD, . . . , μX, Mu(?)
2. Lamb shift, fs, hfs
3. QED, QCD = (lattice, EFTs, data-driven)

Main outcome: full SM result!
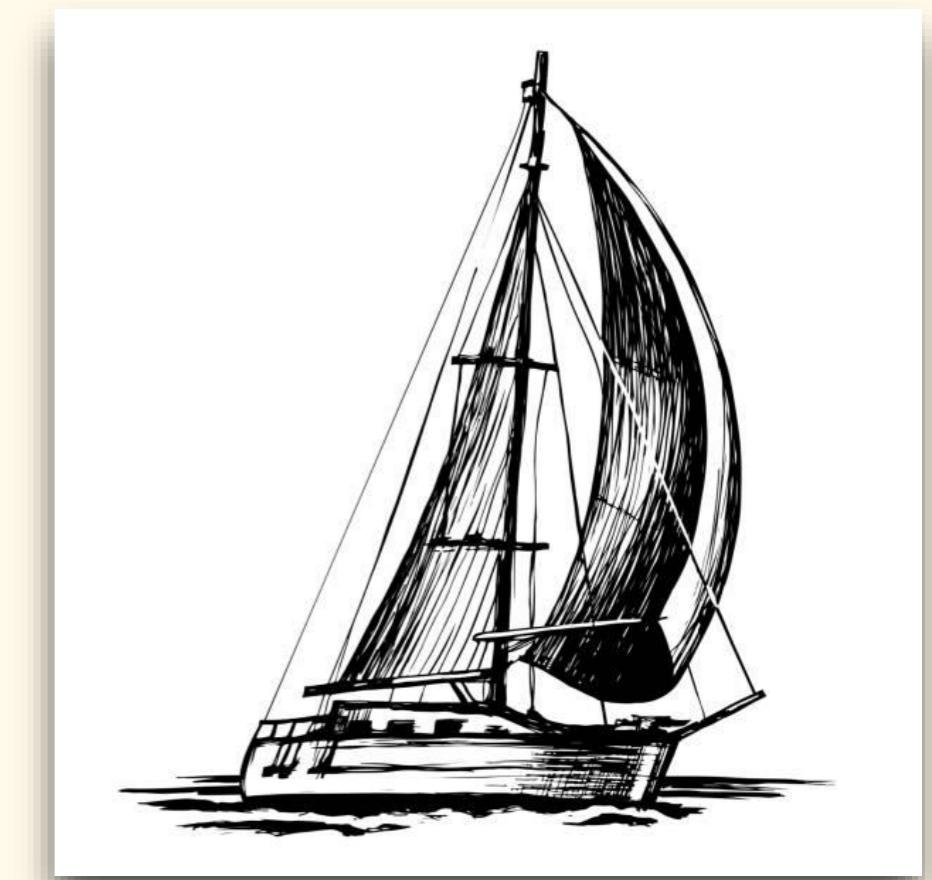
The 1st workshop:

   Satellite to "Nucleon Structure at Low Q", Crete, May 2022

   Dedicated MITP workshop in 2024?

Antognini, Hagelstein, Pascalutsa, ...