

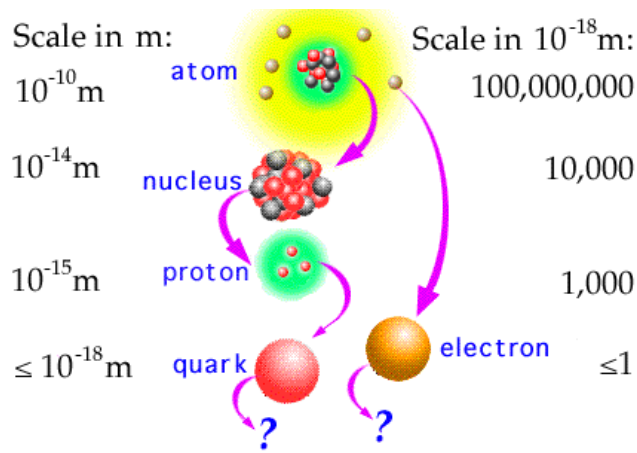
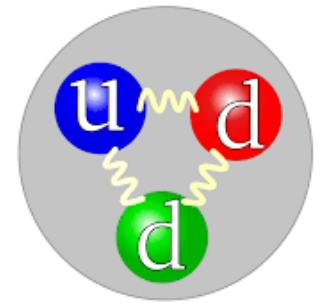
Simulating QCD with 2+1-flavors of clover fermions

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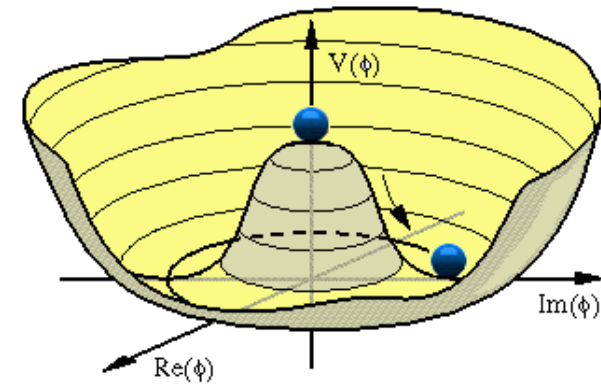
For the Jlab/W&M/LANL/MIT/Marseille effort



Elementary Particles

Quarks	<i>u</i> up	<i>c</i> charm	<i>t</i> top	Force Carriers
	<i>d</i> down	<i>s</i> strange	<i>b</i> bottom	
Leptons	ν_e electron neutrino	ν_μ muon neutrino	ν_τ tau neutrino	<i>g</i> gluon
	<i>e</i> electron	μ muon	τ tau	<i>Z</i> Z boson
				<i>W</i> W boson
				I II III

Three Families of Matter



Jlab/W&M/LANL/MIT/Marseille lattice generation of 2+1-flavor clover lattices

- 13 ensembles
- PBC/APBC and 1 hit of stout smearing
- Tadpole improved C_{SW} that is close to non-perturbative value
- $\sim 92\%$ acceptance rate in the Metropolis step
- Autocorrelations range from 20 ---200 lattices??trajectories
- No evidence of frozen topology in the 13 ensembles

Analysis: Bhattacharya, Gupta, He, Park, Yoo, Yoon. “In preparation”

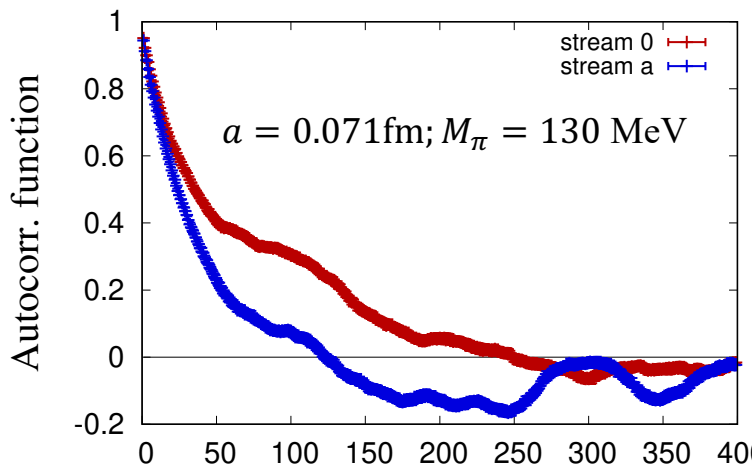
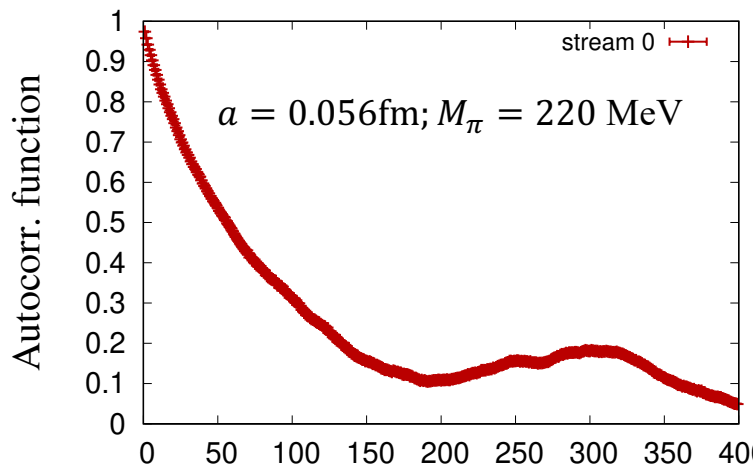
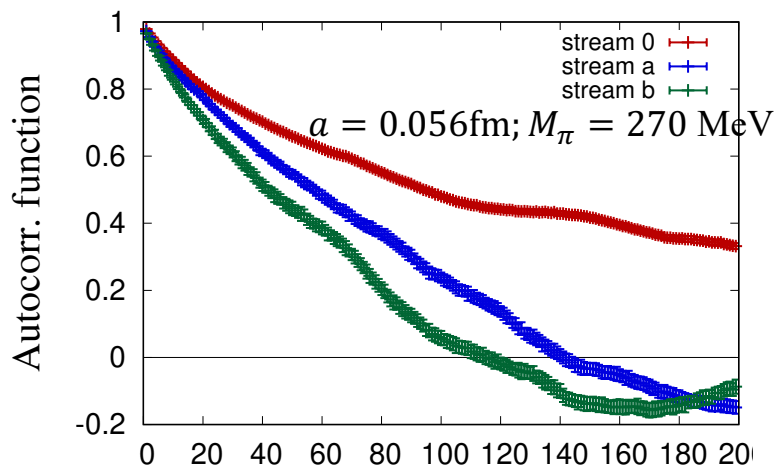
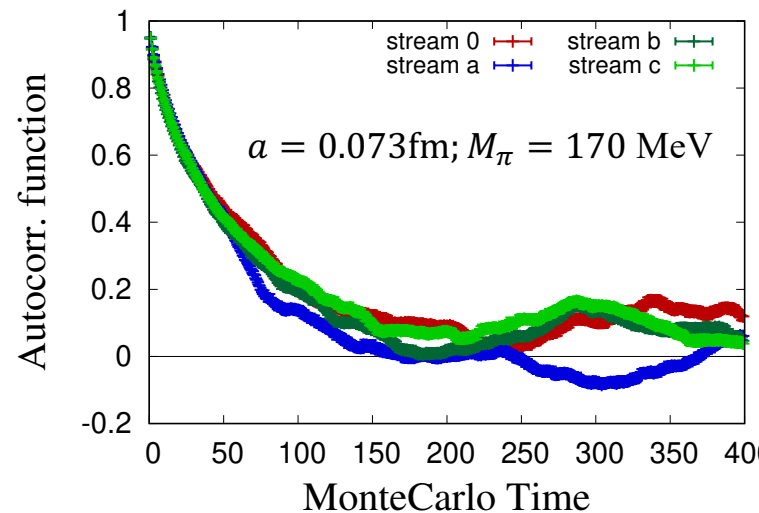
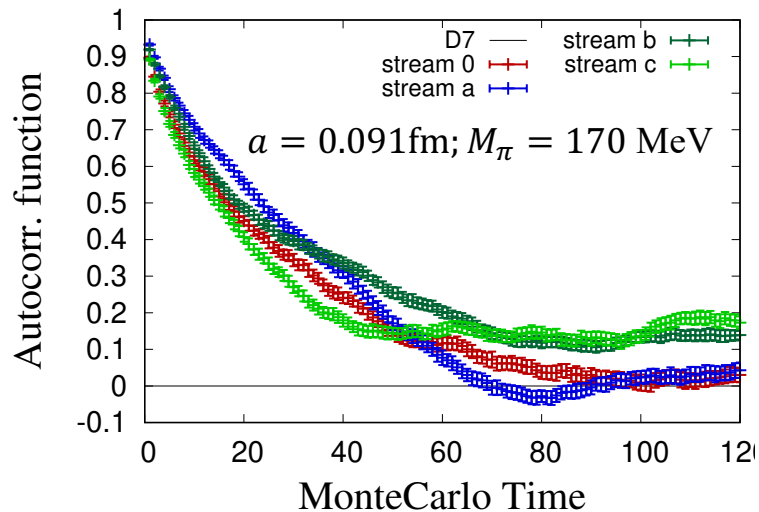
2+1 flavor Clover lattices

Jlab/W&M/LANL/MIT/Marseille

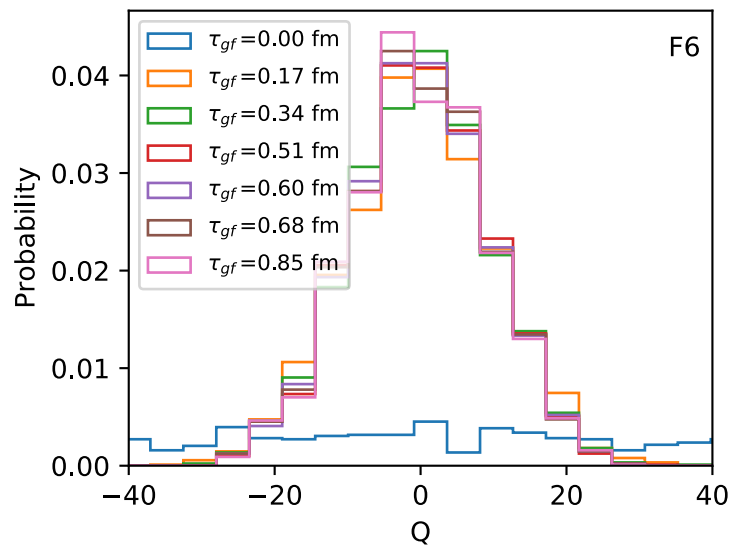
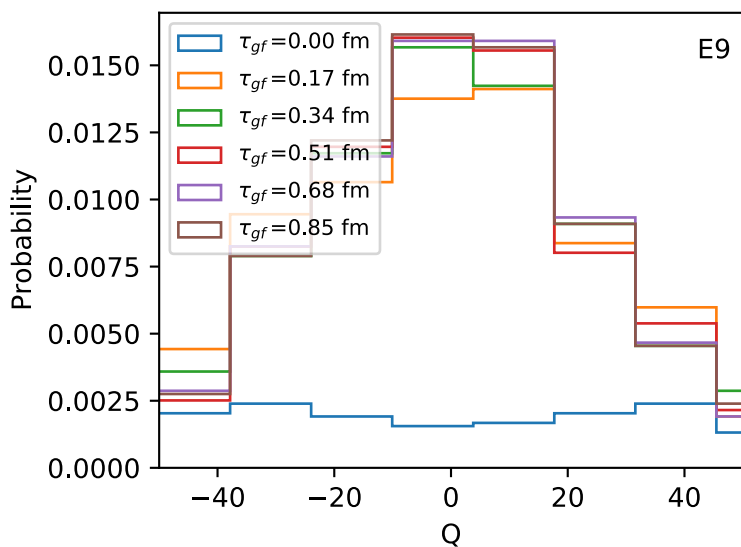
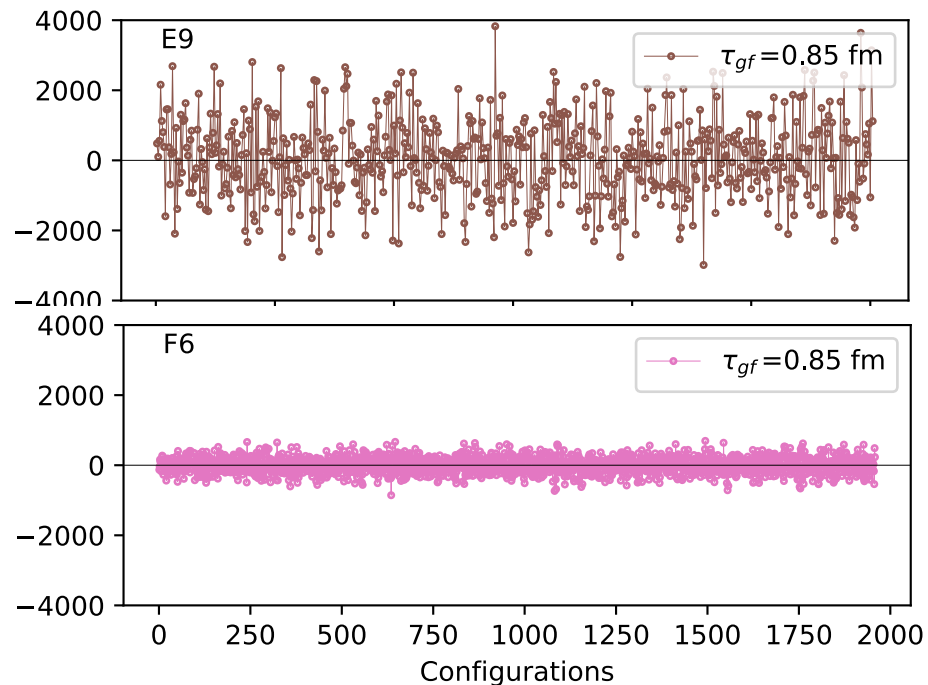
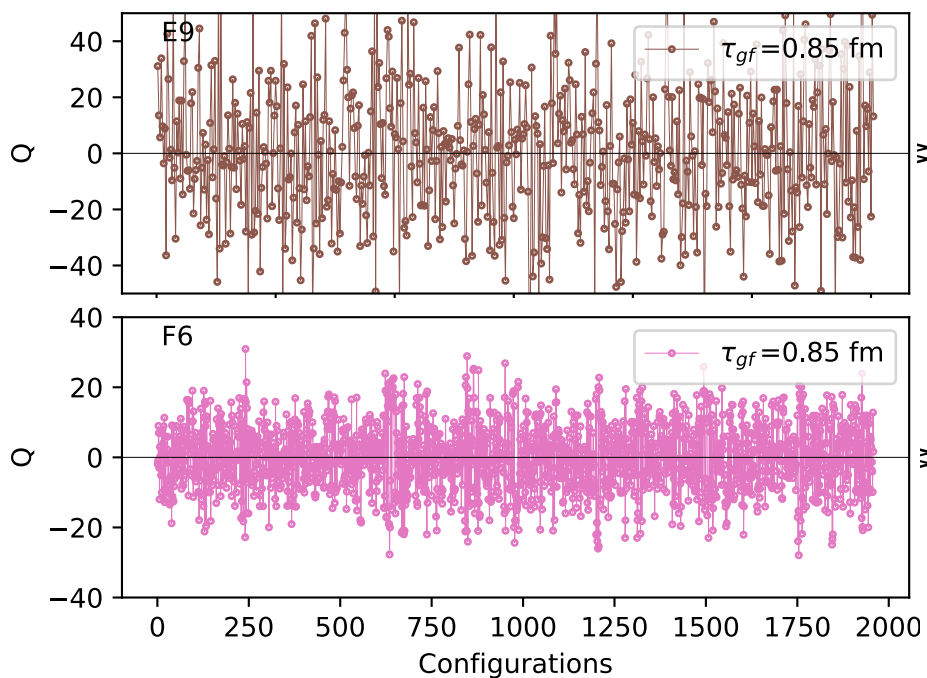
ID	β	a (fm)	M_π (MeV)	L^3	T	$M_\pi L$	Lattices	N_{HP}	N_{LP}	τ
<i>a127m285</i>	6.1	0.127	285(5)	32^3	96	5.85	3014/4000	12,056	385,792	{8, 10, 12, 14}
<i>a094m270</i>	6.3	0.094	269(3)	32^3	64	4.1	2469/2469	7,407	237,024	{10, 12, 14, 16}
<i>a094m270L</i>	6.3	0.094	269(3)	48^3	128	6.16	4510/5500	18,040	577,280	{8, 10, 12, 14, 16, 18}
<i>a091m170</i>	6.3	0.091	169(2)	48^3	96	3.7	4012/4012	16,048	513,536	{8, 10, 12, 14, 16}
<i>a091m170L</i>	6.3	0.091	170(2)	64^3	128	5.1	4000/5000	20,000	640,000	{8, 10, 12, 14, 16}
<i>a073m270</i>	6.5	0.073	272(3)	48^3	128	4.18	4720/4720	18,880	604,160	{11, 13, 15, 17, 19}
<i>a071m170</i>	6.5	0.071	166(2)	72^3	192	4.4	4000/5000	24,000	384,600	{13, 15, 17, 19, 21}
<i>a093m220X</i>	6.3	0.093	220	48^3	128	5.0	2006/2500	8,024	256,768	{10, 12, 14, 16, 18}
<i>a093m220</i>	6.3	0.093	220	48^3	128	5.0	2000/5500	8,000	256,000	{10, 12, 14, 16, 18}
<i>a072m220</i>	6.5	0.072	220	64^3	192	5.2	2000/3000	12,000	192,000	{13, 15, 17, 19, 21}
<i>a070m130</i>	6.5	0.070	128	96^3	192	4.4	2500/2500	15,000	240,000	{13, 15, 17, 19, 21}
<i>a056m280</i>	6.7	0.056	279(2)	64^3	192	4.8	2700/5000	16,200	259,200	{15, 18, 21, 24, 27}
<i>a056m220</i>	6.7	0.056	220	72^3	192	4.5	2550/3000	15,300	244,800	{18, 21, 24, 27, 30}
<i>a055m170</i>	6.7	0.056	170	96^3	192	4.5				Under generation with other resources
<i>a055m135</i>	6.7	0.055	170	128^3	256	4.8				

Lattice: after every 4 trajectories

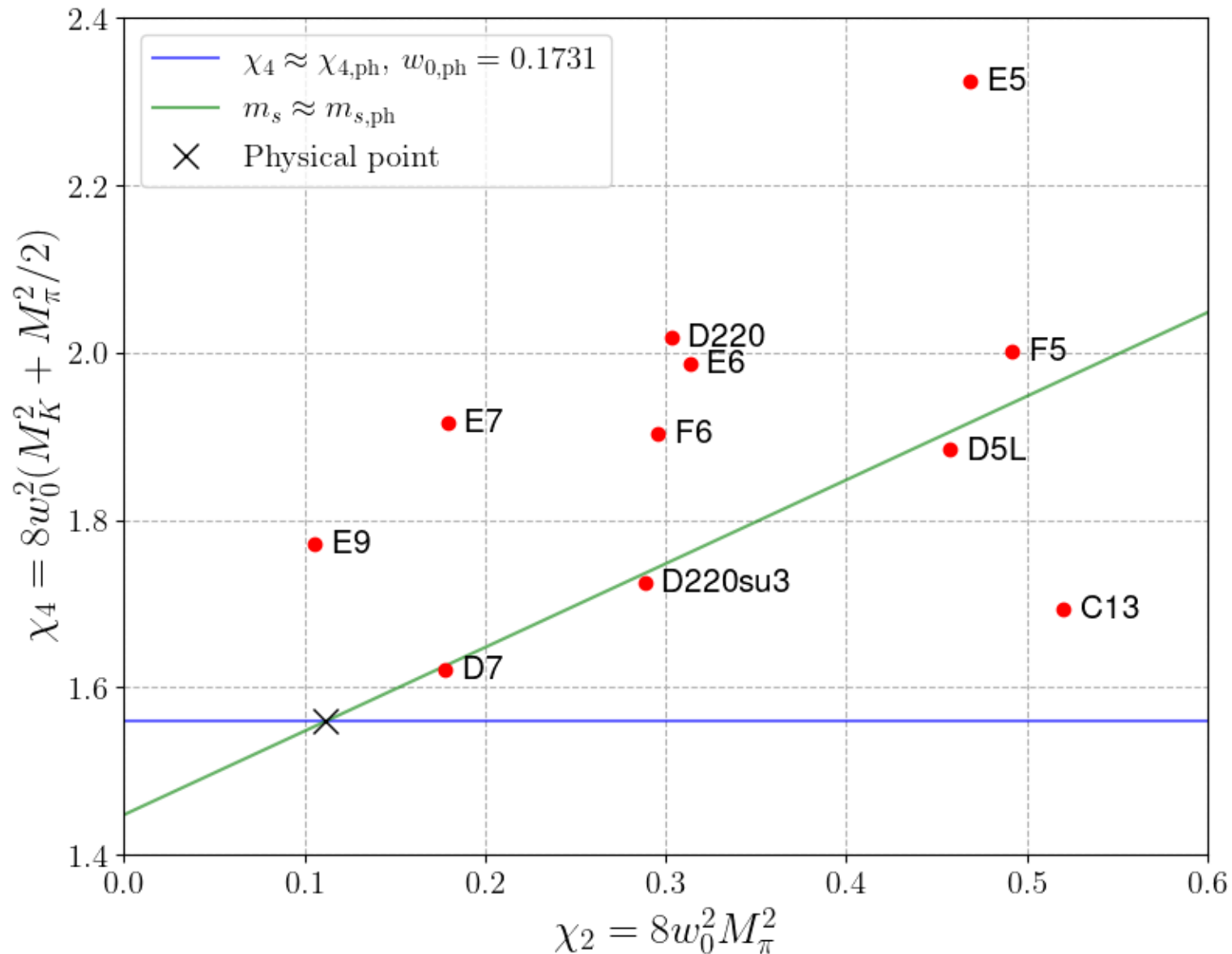
Autocorrelations (w_0):



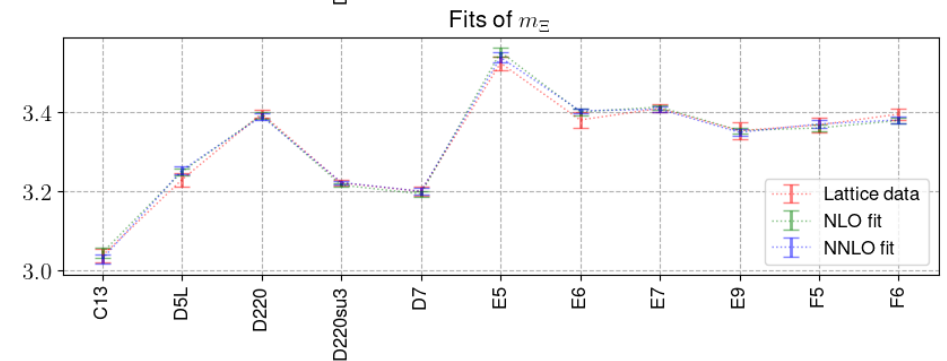
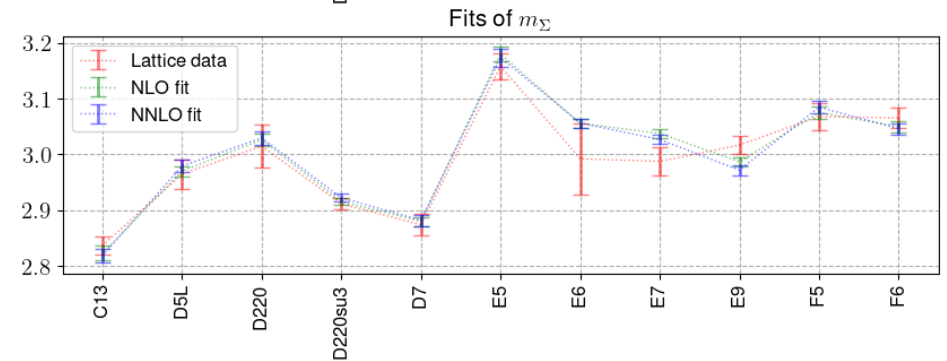
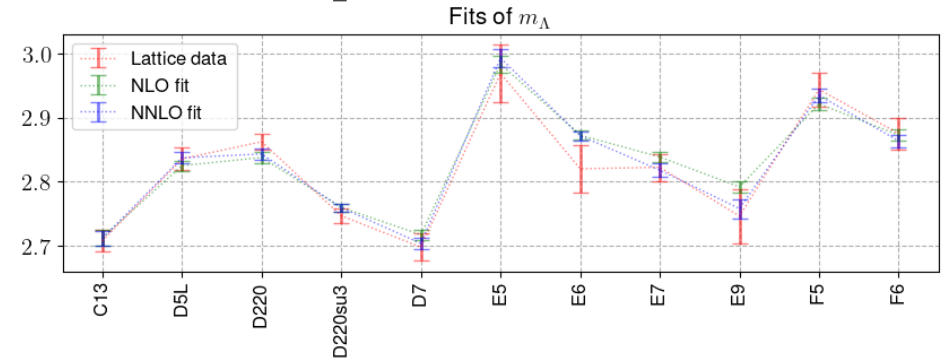
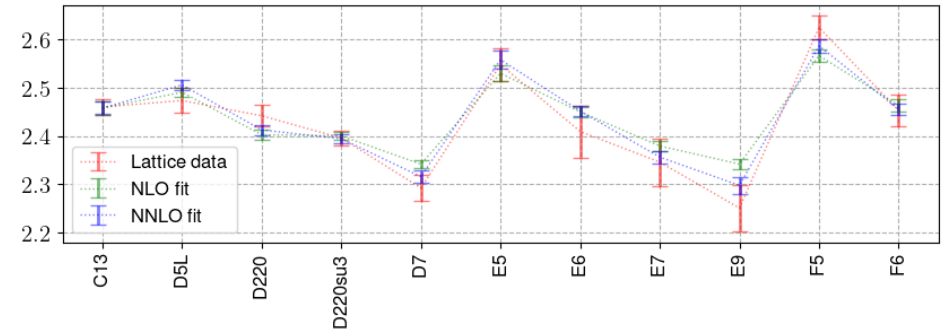
Topology: time history and distribution of Q and W



Light and strange quark masses



NLO and NNLO ChPT fits to octet baryons using w_0



Bhattacharya, Gupta,
He, Park, Yoo, Yoon
in preparation