

HEFTY Collaborative Efforts and Heavy-Flavor in Equilibrium Matter

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In-medium properties of heavy flavor particles and implication of these on HF probes of QCD matter => WG-1

How HEFTY works as a collaboration ?



WG-1: HF Spectral and Transport Properties in Hot QCD Matter

Task: Provide a theoretical foundation for HF properties in QCD matter by synergizing novel and refined lattice-QCD computations with EFTs and quantum many-body theory.

Members: Mukherjee, Petreczky (convener), Rapp, Jorge DaSilva (PD, BNL), Hai-Tao Shu (PD, BNL), Zhanduo Tang (GS, TAMU)

MS-1: Complete set of bottomonium spectral functions in sQGP with uncertainties

On track, to be met by the end of year 2

Complex potential at $T > 0$, Bazavov et al, PRD 109 (2024) 074504

T-matrix analysis of Wilson line correlators, Tang et al, arXiv:2310.18864, Eur. Phys. J. A (in print)

T-matrix analysis of bottomonium spectral functions, Tang et al, work in progress

MS-3: Lattice-based microscopic description of open and hidden HF in sQGP

On track, to be met by the end of year 3

Heavy quark diffusion coefficient, Altenkort et al, PRL 130 (2023) 231902; PRL 132 (2024) 051902; DaSilva et al, work in progress

Charm fluctuations and correlations, Bazavov, PLB 850 (2024) 138520

MS-7: Complete set of nonperturbative quarkonium transport coefficients

On track, to be met by the end of year 5

T-matrix analysis of Wilson line correlators and bottomonium correlators, Heavy quark diffusion coefficient

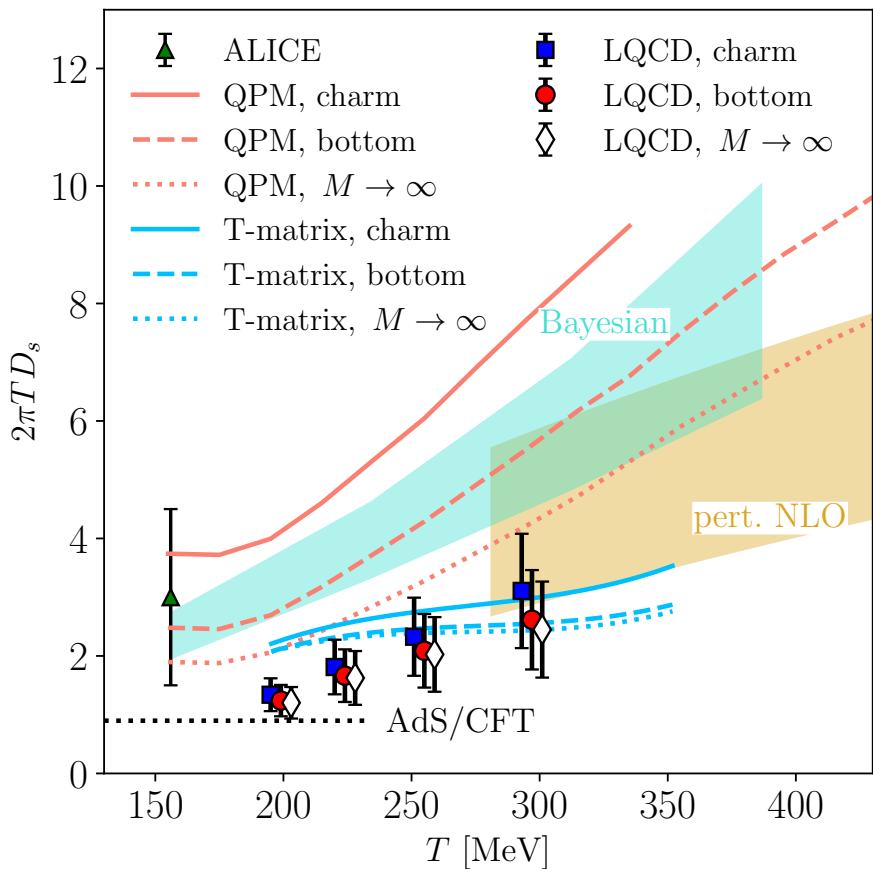
Heavy quark diffusion coefficient from lattice QCD

BNL press release and DOE NP highlight

<https://science.osti.gov/np/Highlights/2023/NP-2023-08-b>

Altenkort et al (HotQCD), *PRL* 130 (2023) 231902

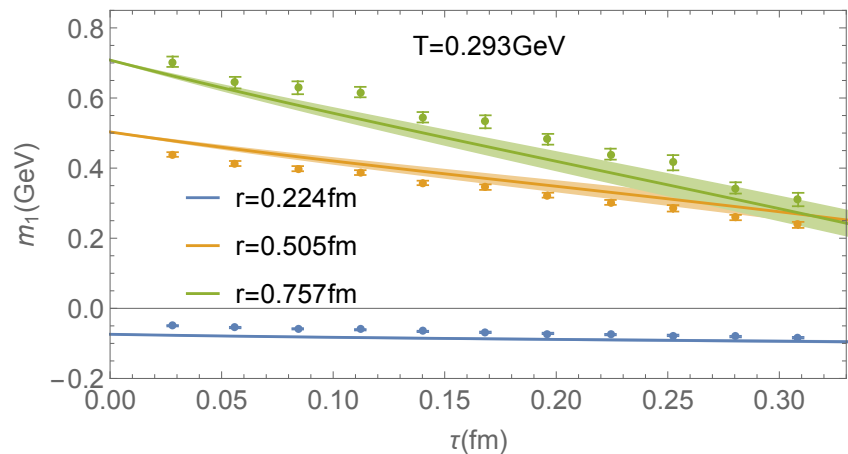
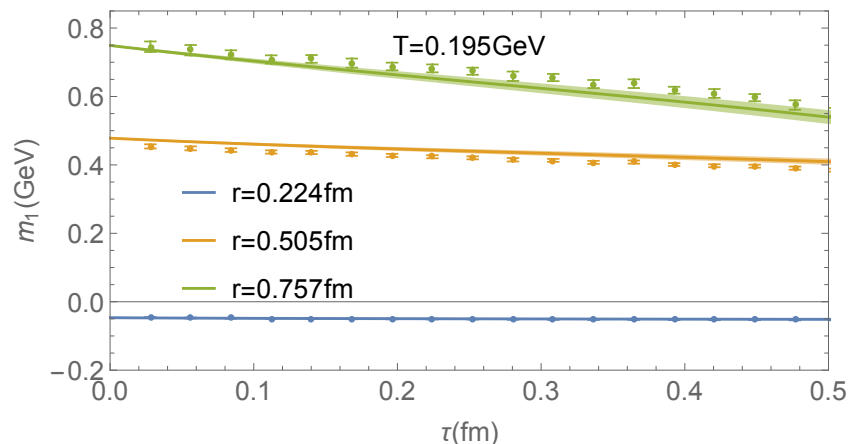
PRL 132 (2024) 051902



So far results with unphysical $m_{u,d}$ and limited temperatures. Need to extend the T -range and consider physical $m_{u,d}$ Jorge Dasilva, work in progress

T-matrix Analysis of Static Wilson Line

Correlators, Z. Tang, M. Mukherjee, P. Petreczky, R. Rapp, , *arXiv:2310.18864*, *Eur. Phys. J. A* (in print)



Bottomonium spectral functions from combined T-matrix approach and lattice

Collaborative work between TAMU and BNL, uses T-matrix approach as a tool to understand and interpret Euclidean correlation functions obtained in IQCD

led by Zhanduo Tang (GS, TAMU)

Screening is much weaker than previously thought and does not cause quarkonium melting (unlike in MS scenario)

Bazavov et al, Phys. Rev. D 109 (2024) 074504

Tang et al, arXiv:2310.18864, Eur. Phys. J. A (in print)

T-matrix approach greatly helps the interpretation of the lattice results and leads to estimates bottomonium melting temperature and thermal width (reaction rates)

Zhanduo Tang, Hai-Tao Shu, Swagato Mukherjee, Peter Petreczky, Ralf Rapp

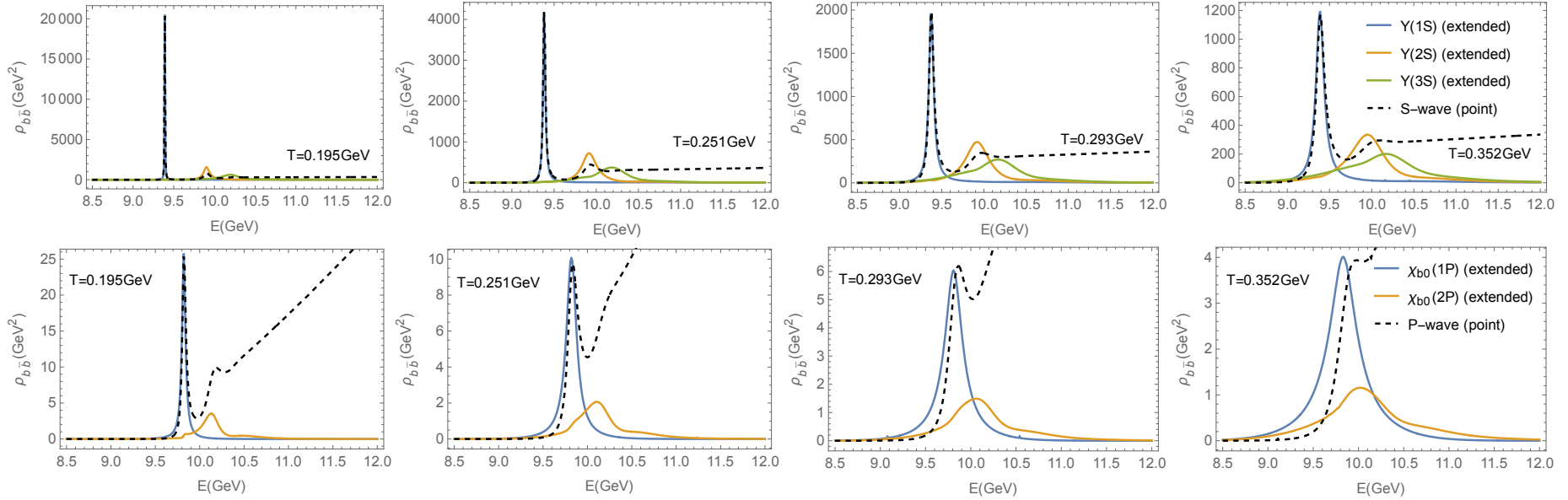
Improved T-matrix calculations gives more reliable estimates for the HQ transport coefficient

Zhanduo Tang, Swagato Mukherjee, Peter Petreczky, Ralf Rapp

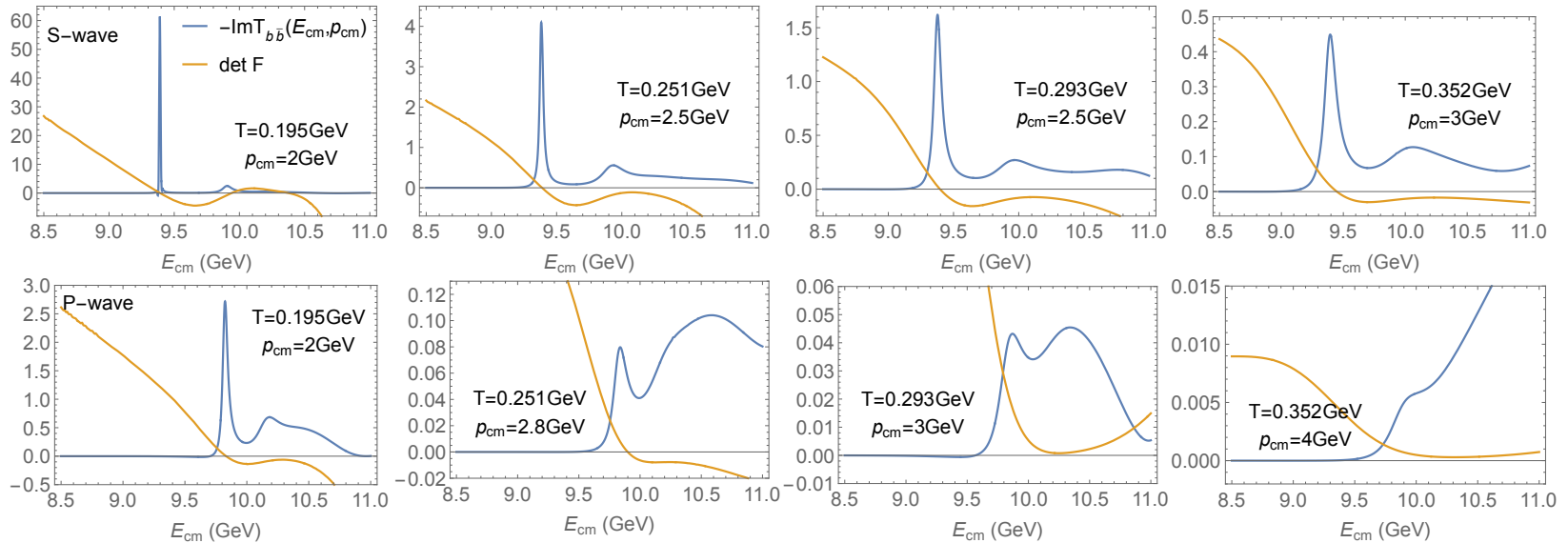
Collaborative Aspects of HEFTY

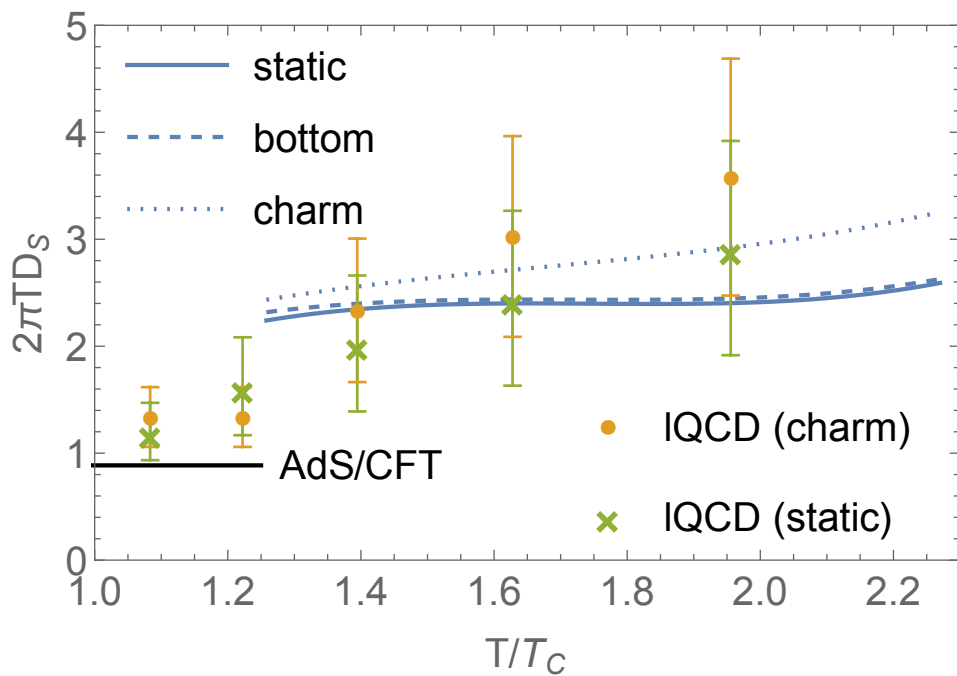
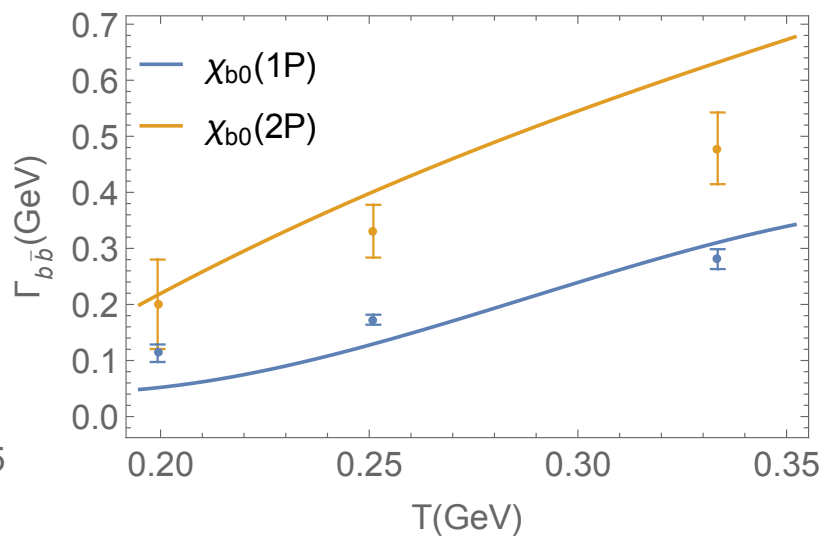
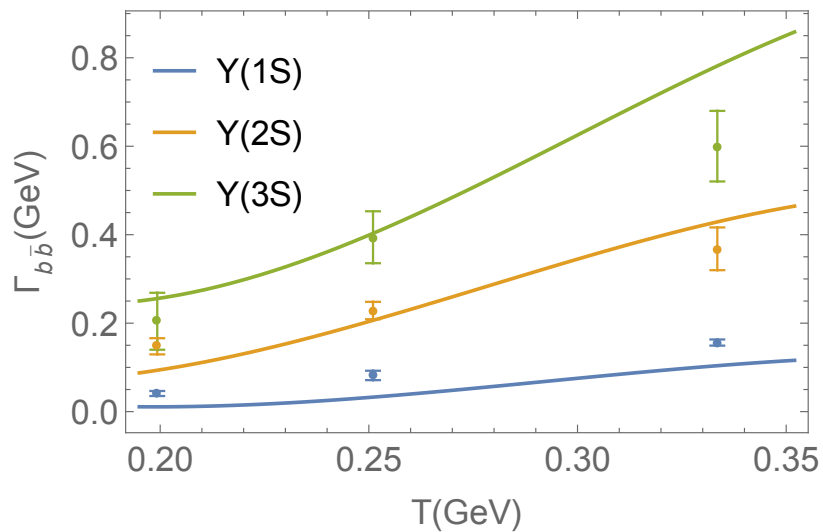
- Working group meetings with minutes, joint publications
see, <https://hefty.tamu.edu>
Tang, Mukherjee, Petreczky, Rapp, arXiv:2310.18864, Eur. Phys. J. A (in print)
Strickland, Thapa, Vogt, arXiv:2401.16704, submitted to Phys. Rev. C
- Quarterly PI meetings
- Annual collaboration meetings
 - 1) Santa Fe, June 26-28, 2024, <https://event.me/IML10g>
 - 2) LBNL, June 7-9, 2023, <https://conferences.lbl.gov/event/1235/>
- Exchange programs, e.g. Zhanduo Tang will visit BNL in the Summer of 2024
- HEFTY Summer School, Santa Fe, June 24-26, 2024
<https://event.me/IML10g>
- Bridge position in Kent State University, starting fall 2024
HEFTY PI discussed and interviewed all the candidates
- HEFTY Handbook on HF probes by the end of last year of the project

BACKUP

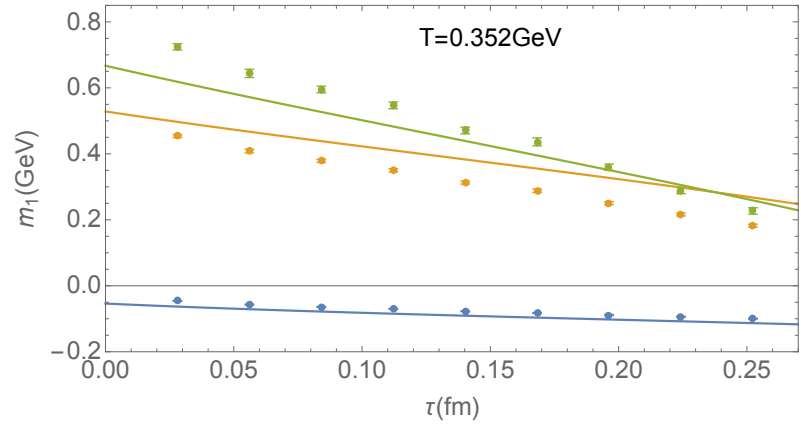
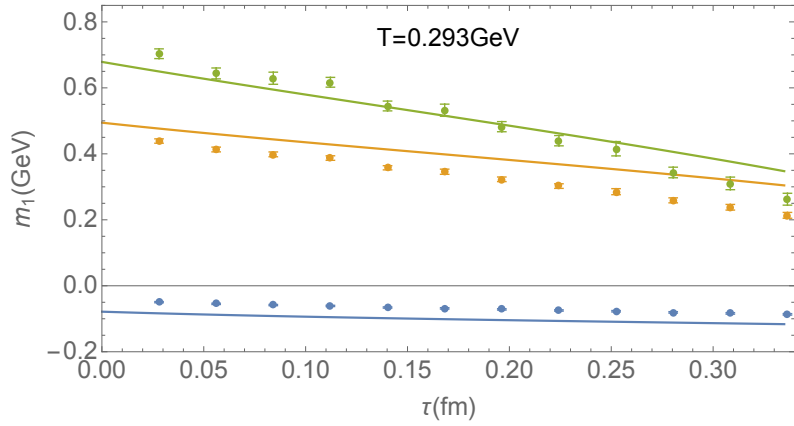
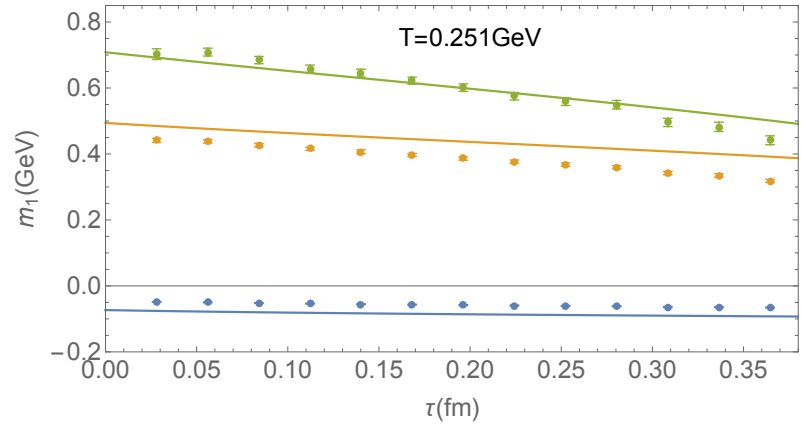
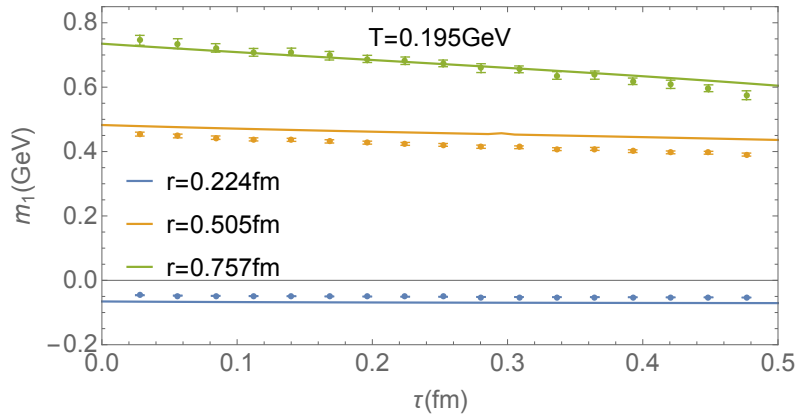


Zhanduo Tang, Swagato Mukherjee, Peter Petreczky, Ralf Rapp, work in progress





*Zhanduo Tang, Swagato Mukherjee,
Peter Petreczky, Ralf Rapp, work in progress*



Zhanduo Tang, Swagato Mukherjee, Peter Petreczky, Ralf Rapp, work in progress