

HQM Lecture Week 2010: Theory Talks

Hendrik van Hees

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I suggest the following topics for the HQM Lecture week on “Heavy Probes in Heavy-Ion Collisions”. As literature, I tried to give preferably review-like articles but also some original articles which I also use in the preparation of my lectures.

If you need any help, don't hesitate to contact me via

`mailto:Hendrik.vanHees@theo.physik.uni-giessen.de`

1. Transport of heavy quarks in the QGP
Summary of transport approach to heavy-quark diffusion.
Literature: [RH09, Sve88, DH05, MPS98]
2. Microscopic models for scattering of heavy quarks; elastic vs. radiative energy loss, pQCD vs. non-perturbative/effective models
Literature: [RH09, MT05, HGR06, HMGR08, HMGR09, DGW05]
3. Coalescence and HQ phenomenology from single-electron observations; connection to transport properties of QGP
Literature: [RH09, FGS08]
4. Models for heavy quarkonia in vacuo and in matter; potential models, NRQCD
Literature: [JOS86, BPSV05, BGVP08, BPV09]
5. Heavy-quarkonium Suppression in Heavy-Ion Collisions; relation to confinement/deconfinement of the force
Literatur: [KS09, RH09, RG04, GLS⁺06]
6. (only if a 6th talk needed) AdS/CFT correspondance as model for gauge theories in the strong-coupling regime; $\eta/s \geq 1/(4\pi)$ boundary, application to heavy-quark energy loss
Literature: [Mal03, KSS05, HG08]

References

- [BGVP08] N. Brambilla, J. Ghiglieri, A. Vairo, P. Petreczky, Static quark-antiquark pairs at finite temperature, *Phys. Rev. D* **78** (2008) 014017
<http://dx.doi.org/10.1103/PhysRevD.78.014017>

- [BPSV05] N. Brambilla, A. Pineda, J. Soto, A. Vairo, Effective field theories for heavy quarkonium, *Rev. Mod. Phys.* **77** (2005) 1423
<http://dx.doi.org/10.1103/RevModPhys.77.1423>
- [BPV09] A. Bazavov, P. Petreczky, A. Velytsky, Quarkonium at Finite Temperature (2009), published in R. C. Hwa, X.-N. Wang (Ed.), *Quark Gluon Plasma 4*, World Scientific, p. 61
<http://arXiv.org/abs/0904.1748>
- [DGW05] M. Djordjevic, M. Gyulassy, S. Wicks, The charm and beauty of RHIC and LHC, *Phys. Rev. Lett.* **94** (2005) 112301
<http://link.aps.org/abstract/PRL/v94/e112301>
- [DH05] J. Dunkel, P. Hänggi, On the Theory of the Relativistic Brownian Motion. The 1+1-Dimensional Case, *Phys. Rev. E* **71** (2005) 016124
<http://link.aps.org/doi/10.1103/PhysRevE.71.016124>
- [FGS08] R. J. Fries, V. Greco, P. Sorensen, Coalescence Models For Hadron Formation From Quark Gluon Plasma, *Ann. Rev. Nucl. Part. Sci.* **58** (2008) 177
<http://dx.doi.org/10.1146/annurev.nucl.58.110707.171134>
- [GLS⁺06] L. Grandchamp, S. Lumpkins, D. Sun, H. van Hees, R. Rapp, Bottomonium production at RHIC and LHC, *Phys. Rev. C* **73** (2006) 064906
<http://link.aps.org/abstract/PRC/V73/E064906>
- [HG08] W. A. Horowitz, M. Gyulassy, Testing AdS/CFT Drag and pQCD Heavy Quark Energy Loss, *J. Phys. G* **35** (2008) 104152
<http://dx.doi.org/10.1088/0954-3899/35/10/104152>
- [HGR06] H. van Hees, V. Greco, R. Rapp, Heavy-quark probes of the quark-gluon plasma at RHIC, *Phys. Rev. C* **73** (2006) 034913
<http://link.aps.org/abstract/PRC/V73/E034913>
- [HMGR08] H. van Hees, M. Mannarelli, V. Greco, R. Rapp, Nonperturbative Heavy-Quark Diffusion in the Quark-Gluon Plasma, *Phys. Rev. Lett.* **100** (2008) 192301
<http://dx.doi.org/10.1103/PhysRevLett.100.192301>
- [HMGR09] H. van Hees, M. Mannarelli, V. Greco, R. Rapp, T-matrix approach to heavy quark diffusion in the QGP, *Eur. Phys. J.* **C61** (2009) 799
<http://dx.doi.org/10.1140/epjc/s10052-008-0838-5>
- [JOS86] S. Jacobs, M. G. Olsson, C. Suchyta, Comparing the Schrödinger and spinless Salpeter equations for heavy-quark bound states, *Phys. Rev. D* **33** (1986) 3338
<http://dx.doi.org/10.1103/PhysRevD.33.3338>
- [KS09] L. Kluberg, H. Satz, Color Deconfinement and Charmonium Production (2009), published in R. Bock (Ed.), *Landolt Börnstein, I/23*, Springer (2010), p. 6-1
<http://arXiv.org/abs/0901.3831>
- [KSS05] P. Kovtun, D. T. Son, A. O. Starinets, Viscosity in strongly interacting quantum field theories from black hole physics, *Phys. Rev. Lett.* **94** (2005) 111601
<http://dx.doi.org/10.1103/PhysRevLett.94.111601>

- [Mal03] J. M. Maldacena, Lectures on AdS/CFT (2003)
<http://arXiv.org/abs/hep-th/0309246>
- [MPS98] M. G. Mustafa, D. Pal, D. K. Srivastava, Propagation of charm quarks in equilibrating quark-gluon plasma, Phys. Rev. C **57** (1998) 889
<http://link.aps.org/abstract/PRC/V57/P00889>
- [MT05] G. D. Moore, D. Teaney, How much do heavy quarks thermalize in a heavy ion collision?, Phys. Rev. C **71** (2005) 064904
<http://link.aps.org/abstract/PRC/v71/e064904>
- [RG04] R. Rapp, L. Grandchamp, Theoretical overview on (hidden) charm in high-energy heavy-ion collisions, J. Phys. G **30** (2004) S305
<http://dx.doi.org/10.1088/0954-3899/30/1/036>
- [RH09] R. Rapp, H. van Hees, Heavy Quarks in the Quark-Gluon Plasma (2009), published in R. C. Hwa, X.-N. Wang (Ed.), Quark Gluon Plasma 4, World Scientific, p. 111
<http://arxiv.org/abs/0903.1096>
- [Sve88] B. Svetitsky, Diffusion of charmed quarks in the quark-gluon plasma, Phys. Rev. D **37** (1988) 2484
<http://dx.doi.org/10.1103/PhysRevD.37.2484>