

Selected topics in nuclear and particle physics:

Content and bibliography

Spring semester 2024

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EPFL

<https://moodle.epfl.ch/course/view.php?id=2861>

Content of the course

PART I

- Neutrino physics: (≈ 6 weeks)
 - historical introduction
 - neutrino mass measurements
 - neutrino mass generation in the SM
 - astrophysical neutrinos
 - neutrino oscillations
 - phenomenology (MNS matrix)
 - oscillation experiments

PART II

- Dark matter: (≈ 3 weeks)
 - short introduction on cosmology
 - evidence for dark matter:
 - from astrophysics
 - from cosmology
 - dark matter candidates:
 - (astrophysical objects)
 - elementary particles
 - experimental searches for dark matter

PART III

- Quark-Gluon Plasma (≈ 4 weeks)
 - principles
 - creation of QGP
 - properties of QGP
 - experiments
 - identification and signature of QGP
 - selection of experimental results

Bibliography

I.Neutrino physics:

- “Fundamentals of Neutrino Physics and Astrophysics”
C. Giunti and C.W. Kim
Oxford University Press, 2007
- “Neutrino masses, mixing, and oscillations”, in the Review of Particle Physics, 2020
<https://pdg.lbl.gov/2020/reviews/rpp2020-rev-neutrino-mixing.pdf>
- “Neutrino mass models”
A. de Gouvêa
Annu. Rev. Nucl. Part. Sci. 66 (2016) 197
- “Measurement of ϑ_{13} ”
S.-B. Kim and K.-B. Luk
Annu. Rev. Nucl. Part. Sci. 65 (2015) 329
- “The LSND and MiniBooNE oscillation searches at high Δm^2 ”
J.M. Conrad, W.C. Louis, M.H. Shaevitz
Annu. Rev. Nucl. Part. Sci. 63 (2013) 45
- Many useful links on “Neutrino Unbound”
(web page maintained by C Giunti)
<http://www.nu.to.infn.it/>

II.Dark Matter:

- “Dark matter candidates from particle physics and methods of detection”
J.L. Feng
[arXiv:1003.0904](https://arxiv.org/abs/1003.0904)

III.Quark Gluon Plasma:

- “The quark-gluon plasma”
H. Satz
[arXiv:1101.3937](https://arxiv.org/abs/1101.3937)
- “Advances in Quark Gluon Plasma”
G. Martinez
[arXiv:1304.1452](https://arxiv.org/abs/1304.1452)
- “Heavy-ion collisions at the LHC: a review of the results from Run 1”
A. Armesto and E. Scomparin
[arXiv:1511.02151](https://arxiv.org/abs/1511.02151)
- “Heavy-ion physics at the LHC: review of Run 1 results”
R. Bala, I. Bautista and A. Ortiz
[arXiv:1605.03939](https://arxiv.org/abs/1605.03939)