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The thermodynamics of quantum Yang-Mills theory. Theory and applications. 2nd edition.

(English) [\[Zbl 1343.81004\]](#)

Hackensack, NJ: World Scientific (ISBN 978-981-3100-47-3/hbk; 978-981-3100-48-0/pbk; 978-981-3100-50-3/ebook). xxii, 522 p. (2016).

This is the second edition of a book that appeared back in 2012. For a review of the first edition see [\[Zbl 1242.81003\]](#). This new edition in particular provides a deeper insight into the role of Harrington-Shepard calorons/anticalorons. As has become known in recent years, these are the basic constituents of the thermal ground state. The book now also collects some discussions of the caloron center versus its periphery. The quantum field of the deconfining phase is induced by a classical Euclidean field. The role of the thermal ground state in $U(1)$ propagation and the photonic particle-wave duality are discussed. Finally, the last chapter now investigates the redshift-temperature theory of the cosmic microwave background which is based on the $SU(2)$ Yang-Mills theory. The temperature-redshift relation of the cosmic wave background is derived and a re-ionization of the early universe is explained. Addressed at the end is a possible mechanism of mass generation for cosmic neutrinos. This monograph is written with high rigor and will win the attention of graduate students.

Reviewer: [Gert Roepstorff \(Aachen\)](#)

MSC:

- 81-02 Research monographs (quantum theory)
- 81T13 Yang-Mills and other gauge theories
- 81T28 Thermal quantum field theory
- 82B30 Statistical thermodynamics
- 81V80 Applications of quantum theory to quantum optics
- 85A25 Radiative transfer (astronomy and astrophysics)

Keywords:

Yang-Mills theory; gauge invariance; non-abelian gauge group; thermodynamics; nonperturbative methods; astrophysical applications; low-temperature photon physics