

# Zero density heavy quark SU(2) gauge theory and the Stefan-Boltzmann limit

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Abstract: SU(2) lattice gauge theory is investigated where the trace of the Wilson lines at any lattice point and along each direction is constrained to zero. Hence, each of the lattice configurations possesses a vanishing density of heavy (anti-) quarks. The results are compared with those of pure SU(2) gauge theory which can be interpreted as the grand canonical realization of the heavy quark theory where only the ensemble average of the heavy quark density vanishes.

The static quark anti-quark potential of the constrained theory is obtained from (spatially smeared) Wilson loops at zero temperature. We find that the potential coincides with that of pure SU(2) gauge theory (without constraints). Hence, the familiar "running" of the lattice spacing with  $\beta$  is recovered.

We find evidence that the constrained theory undergoes a deconfinement transition at finite temperature (despite the constraints). Both, quark and gluon deconfinement, sets in at roughly the critical temperature  $T_c$  known from pure SU(2) gauge theory. While the percolation properties of the confining vortices are studied to explore quark deconfinement, the vacuum energy density  $\epsilon$  and the pressure  $p$  is calculated to see the onset of the black body radiation of gluons. It turns that  $(\epsilon + p)/T^4$  strongly peaks at the critical temperature. With increasing temperature, the constrained system seems to approach the Stefan-Boltzmann limit of free gluons from above.