



THE UNIVERSITY
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SPECIAL RESEARCH
CENTRE FOR THE
SUBATOMIC
STRUCTURE OF MATTER



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Visualization of Quantum Chromodynamics (QCD)

At this extreme scale (just a few Femto-Meters), the box is big enough for just a few protons. QCD theory is an important part of the Standard Model of the Universe concerning the strong interaction between quarks and gluons, the fundamental particles that make up composite hadrons such as the proton, neutron and pion. QCD is a type of quantum field theory where the QCD analogue of electric charge is a property called colour. Gluons are the force carrier of the theory, like photons are for the electromagnetic force in quantum electrodynamics. [[Wikipedia](#)].

In this image, the vortex structure of the gluon field is illustrated by rendering the vortex lines that run along the centres of the colour-field vortices. Their correlation with the key aspect of QCD that generates the mass of the proton is examined by volume-rendering the topological charge density.

Courtesy of Prof. Derek B. Leinweber, in collaboration with James Biddle, Waseem Kamleh and Daniel Trewartha, Centre for the Subatomic Structure of Matter (CSSM), Department of Physics, University of Adelaide, Australia. This work was presented at LATTICE 2018, 36th International Symposium on Lattice Field Theory. July 22nd to July 28th 2018 in Michigan State University (<https://indico.fnal.gov/event/15949/session/10/contribution/95>)