

Spring 2022 Colloquium

Department of Physics & Astronomy, A&M-Commerce

Mar 31, Thursday, 4-5 PM

Live Zoom Meeting

<https://tamuc.zoom.us/j/93600001218>

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Nuclear Physics

A data-driven approach to quantifying the shear viscosity of nature's most ideal fluid

Dr. Steffen Bass

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Steffen A. Bass is the Arts & Sciences Distinguished Professor of Physics at Duke University and currently serves as Chair of the Department of Physics. Prof. Bass received his Ph.D. in Theoretical Physics in 1997 from the J.W. Goethe University in Frankfurt, Germany, and subsequently held postdoctoral appointments at Duke University and Michigan State University (as Visiting Assistant Professor). He joined the faculty of Duke University in 2000. He was named a Distinguished Chair in 2020. From 2000 to 2005 he also held a position as RIKEN-BNL Research Center Fellow. Prof. Bass does research at the intersection of theoretical nuclear and particle physics, in particular relativistic heavy-ion collisions, with which one aims to create a primordial state of matter at extremely high temperatures and densities (the Quark-Gluon-Plasma) that resembles the composition of the early Universe shortly after the Big Bang. More information can be found at

<https://scholars.duke.edu/person/bass>

Abstract

About a microsecond after the Big Bang, the universe was in a state called the Quark Gluon Plasma (QGP), in which quarks and gluons, the basic constituents of the strong nuclear force, roamed freely. Due to its large expansion, this plasma went through a phase transition to form hadrons - most importantly nucleons - which constitute the building blocks of matter as we know it today. Determining the properties of the QGP would not only teach us about the dynamics of the early universe but also teach us about the properties of its underlying quantum field theory (Quantum Chromo-Dynamics) at high temperatures and densities - domains of the theory that are currently not accessible in first-principles calculations. Only in the last two decades have accelerators been able to create the conditions of temperature and density in the laboratory that are favorable for the QGP to exist. The Relativistic Heavy-Ion Collider (RHIC) at Brookhaven National Laboratory was built specifically to observe and study this phase of matter and the Large Hadron Collider (LHC) at CERN has devoted a significant research program to this purpose as well. One of the most surprising discoveries to come out of QGP research is that it behaves like a liquid with the smallest specific viscosity ever observed in nature. This lecture will elucidate how an interdisciplinary collaboration of experimental and theoretical physicists together with computer scientists and statisticians has been able to tease out the remarkable properties of this extreme liquid and how scientific advances in Bayesian statistics and grid computing have come to bear to advance one of the most dynamic areas of Nuclear Physics.