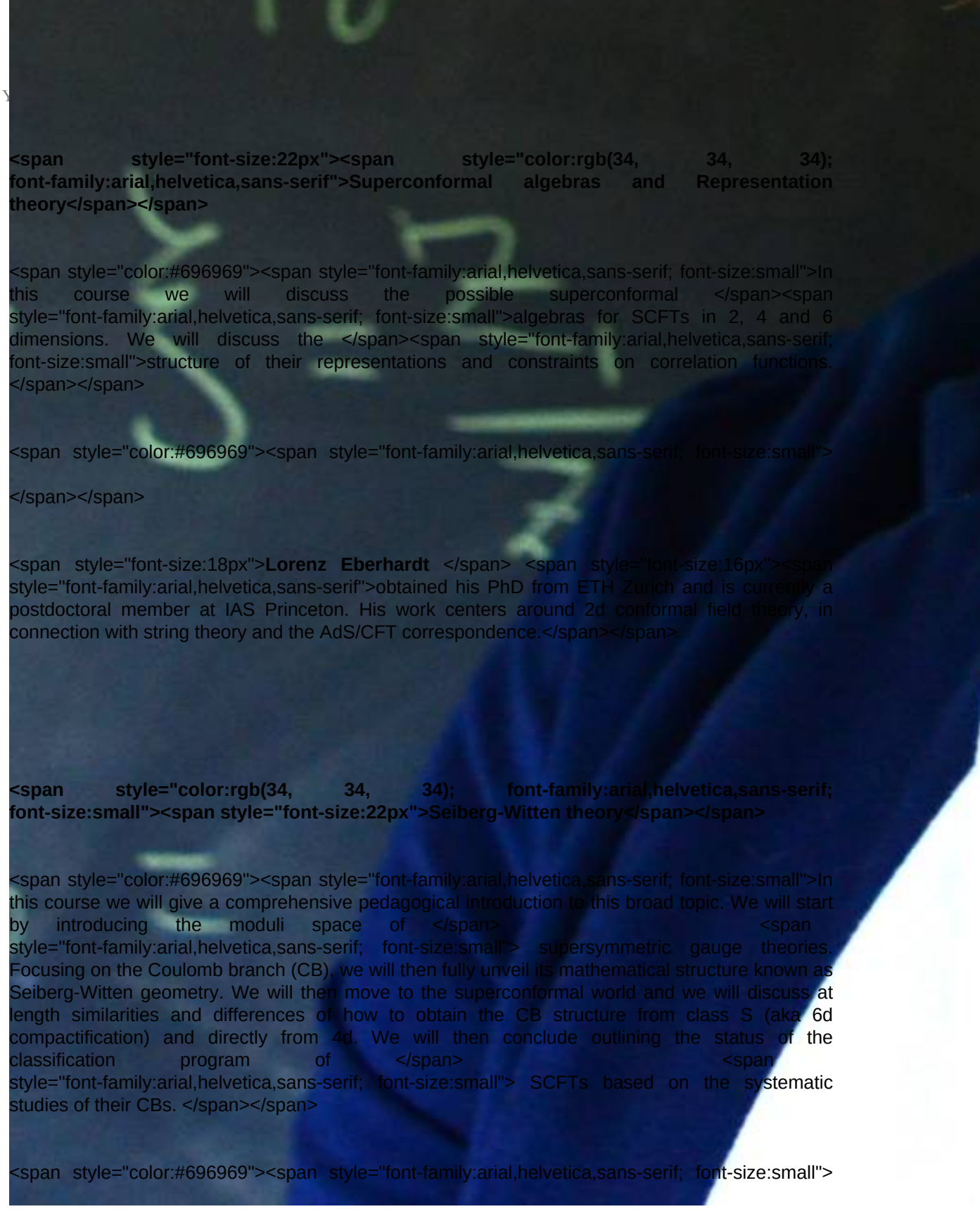
Young Researchers Integrability School 2020

Sunday, 9 February 2020 - Sunday, 16 February 2020

DESY Hamburg

Scientific Programme



Superconformal algebras and Representation theory

In this course we will discuss the possible superconformal algebras for SCFTs in 2, 4 and 6 dimensions. We will discuss the structure of their representations and constraints on correlation functions.

Lorenz Eberhardt obtained his PhD from ETH Zurich and is currently a postdoctoral member at IAS Princeton. His work centers around 2d conformal field theory, in connection with string theory and the AdS/CFT correspondence.

Seiberg-Witten theory

In this course we will give a comprehensive pedagogical introduction to this broad topic. We will start by introducing the moduli space of   supersymmetric gauge theories. Focusing on the Coulomb branch (CB), we will then fully unveil its mathematical structure known as Seiberg-Witten geometry. We will then move to the superconformal world and we will discuss at length similarities and differences of how to obtain the CB structure from class S (aka 6d compactification) and directly from 4d. We will then conclude outlining the status of the classification program of   SCFTs based on the systematic studies of their CBs.

Mario Martone got his PhD from Cornell University in 2014 and is currently a post-doctoral scholar at the University of Texas at Austin. He has a broad range of interests, including Flavory and Higgs physics and Dark Matter. But he is primarily interested in studying formal aspects of superconformal field theories (SCFTs).

**Superconformal index **

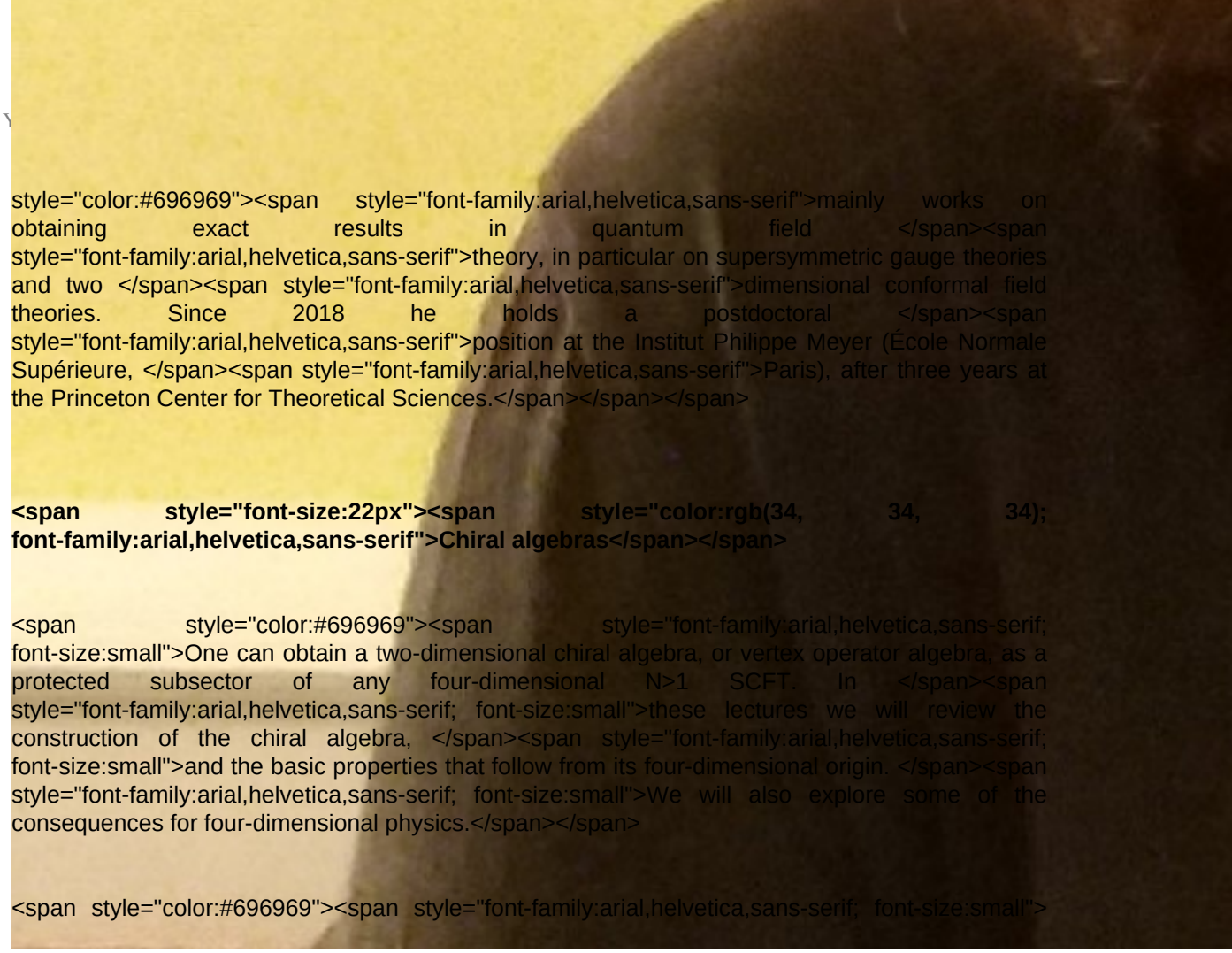
In this course we will introduce the superconformal index in four dimensions. We will discuss how it allow us to perform different nontrivial checks of varius conjectured dualities and describe its relation with two dimensional topological theories on Riemann surfaces.

Abhijit Gadde got his PhD from Stony Brook University in 2011 and after two postdocs at Caltech and IAS, he is currently a faculty member at TFIR. He had been working on different aspects of strongly coupled quantum field theories and string theory. Most recently, he has been interested in analytic results in conformal as well as superconformal field theories.

The AGT correspondence

This course will describe the AGT correspondence, which relates many non-perturbative aspects of four-dimensional N=2 supersymmetric gauge theories to certain two-dimensional conformal field theories. After a primer on 4d N=2 gauge theories and S-duality, I will explain how observables such as the four-sphere partition function are reproduced by two-dimensional correlators. The correspondence is enriched by various extended operators of the 4d theory (Wilson loops, 't Hooft loops, surface operators, domain walls), all of which have counterparts in 2d. I will discuss the correspondence between supersymmetric indices and 2d topological quantum field theory, as well as the 3d-3d correspondence relating 3d N=2 theories and Chern-Simons theories.

Bruno Le Floch <span



style="color:#696969">mainly works on obtaining exact results in quantum field theory, in particular on supersymmetric gauge theories and two dimensional conformal field theories. Since 2018 he holds a postdoctoral position at the Institut Philippe Meyer (École Normale Supérieure, Paris), after three years at the Princeton Center for Theoretical Sciences.

Chiral algebras

One can obtain a two-dimensional chiral algebra, or vertex operator algebra, as a protected subsector of any four-dimensional N>1 SCFT. In these lectures we will review the construction of the chiral algebra, and the basic properties that follow from its four-dimensional origin. We will also explore some of the consequences for four-dimensional physics.

Madalena Lemos got her PhD from Stony Brook University in 2015, followed by a postdoc at DESY. She is currently a postdoctoral fellow at CERN, working on non-perturbative aspects of (super)conformal field theories.