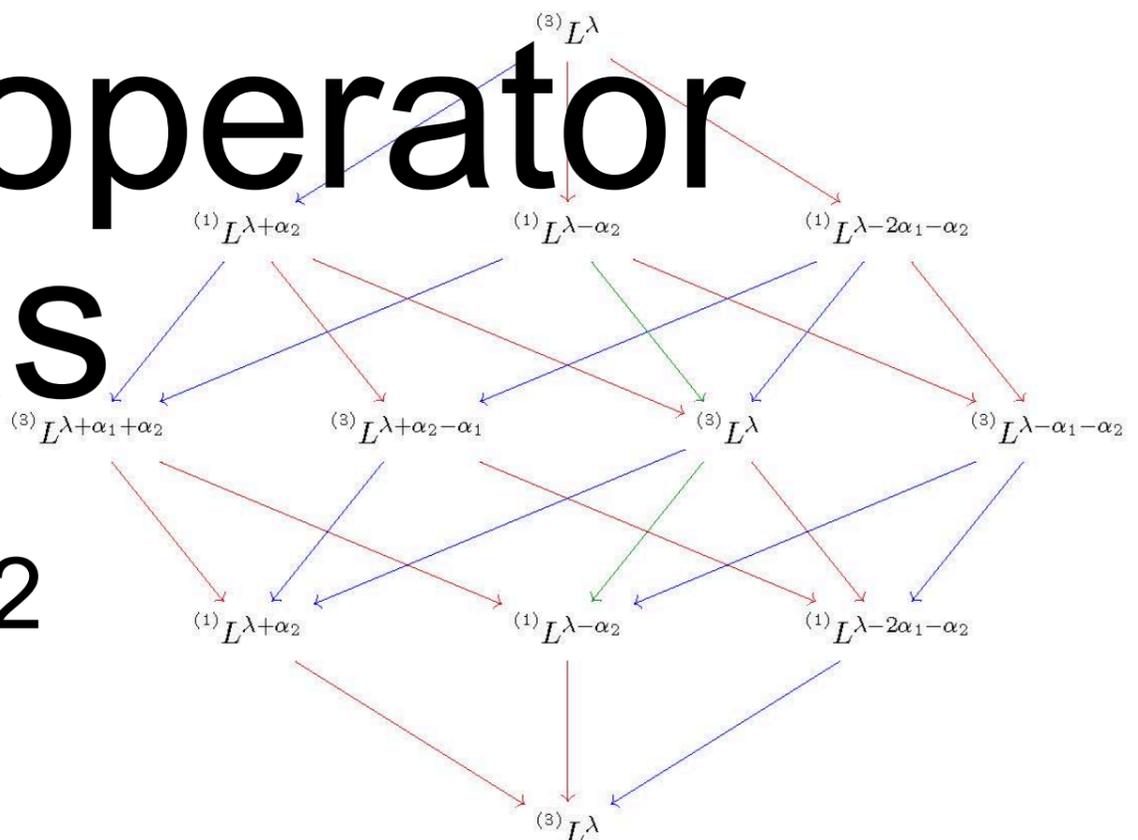


# QM Masterclass

# Vertex operator algebras

1-5 August 2022



by  
**Thomas Creutzig**  
University of Alberta



Vertex operator algebras (VOAs) first appeared in the 1980's as the rigorous notion of chiral algebras (the symmetry algebras) of two dimensional conformal quantum field theories. Since then they have been employed as key ingredients in many modern problems of mathematical physics and pure mathematics, ranging from monstrous moonshine to knot theory and geometry. The older problems have been mostly concerned with the simplest type of VOAs, so-called rational theories.

In the last few years it has been realized that VOAs and their representation theories yield rich invariants of three and four-dimensional supersymmetric quantum field theories. This provides new insights into low-dimensional topology and the quantum geometric Langlands program. Involved VOAs are however not rational (often called logarithmic) and so their representation theory is rich & exciting.

These lectures will be a very modern introduction to the theory of VOAs. We will use techniques from representation theory (especially Lie theory), geometry and topology; no knowledge of VOAs is needed. The lectures will be a mix of general theory and illustrating it with the most important examples, that is free field theories, affine and W-algebras; and the school will end with an exposition of the very recent use and appearance of VOAs in physics, geometry & low-dimensional topology.