

## Day 1 (Poster A)

Marian R. Lingsch Rosenfeld, LMU Munich

Title: Towards a Quantum Game of Life

Abstract:

We apply quantum annealing to the game of life originally proposed by John Conway in two different ways:

(i) We extend the game of life by using quantum hardware to directly represent the grid for the game of life. The evolution is executed by adjusting the weights between the grid cells, resulting in a probabilistic variant of the game of life. We analyze the behavior of the system and if periodic structures are generated.

(ii) We encode time series of game of life grids as variables of a QUBO instance and encode the rules of the game of life as an optimization problem between any two consecutive grids. Afterwards a selector in the form of a cost function can be used to choose states fulfilling a given requirement. In this case, we analyze which initial states produce periodic structures. Based on these two studies, we discuss possible use cases for quantum annealing devices in artificial life and complex system simulation in general.

This work was done in collaboration with Thomas Gabor.