

Title: Using online computer games for quantum optimization tasks

Abstract:

In the emerging field of citizen science ordinary citizens have already contributed to research in as diverse fields as astronomy, protein and RNA folding, and neuron mapping by playing online games. In the [www.scienceathome.org](http://www.scienceathome.org) project, we have extended this democratized research to the realm of quantum physics by gamifying a class of challenges related to optimization of gate operations in a quantum computer. The games have been played by more than 150,000 players and perhaps surprisingly we observe [1] that a large fraction of the players outperform state-of-the-art optimization algorithms and yielded new insight into the nature of the so-called quantum speed limit. With a palette of additional games within cognitive science, behavioral economics, and corporate innovation we investigate the general features of individual and collaborative problem solving to shed additional light on the process of human intuition and innovation and potentially develop novel models of artificial intelligence. Finally, we have recently launched our new democratic lab: an easily accessible remote interface for our ultra-cold atoms experiment allowing amateur scientists, students, and research institutions world-wide to perform state-of-the-art quantum experimentation. In first tests nearly a thousand players helped optimize the production of our BEC and discovered novel, efficient strategies.

[1] JJ Sørensen et al, Nature, **532**, 210 (2016)