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Are strategies in physics discrete? A remote controlled investigation ROBERT HECK, JACOB F. SHERSON, Department of Physics and Astronomy, Aarhus University, WWW.SCIENCEATHOME.ORG TEAM AND PLAYERS TEAM — In science, strategies are formulated based on observations, calculations, or physical insight. For any given physical process, often several distinct strategies are identified. Are these truly distinct or simply low dimensional representations of a high dimensional continuum of solutions? Our online citizen science platform www.scienceathome.org used by more than 150,000 people recently enabled finding solutions to fast, 1D single atom transport [Nature2016]. Surprisingly, player trajectories bunched into discrete solution strategies (clans) yielding clear, distinct physical insight. Introducing the multi-dimensional vector in the direction of other local maxima we locate narrow, high-yield “bridges” connecting the clans. This demonstrates for this problem that a continuum of solutions with no clear physical interpretation does in fact exist. Next, four distinct strategies for creating Bose-Einstein condensates were investigated experimentally: hybrid and crossed dipole trap configurations in combination with either large volume or dimple loading from a magnetic trap. We find that although each conventional strategy appears locally optimal, “bridges” can be identified. In a novel approach, the problem was gamified allowing 750 citizen scientists to contribute to the experimental optimization yielding nearly a factor two improvement in atom number.

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