Stochastic optimization of a cold atom experiment using a genetic algorithm

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We employ an evolutionary algorithm to automatically optimize different stages of a cold atom experiment without human intervention. This approach closes the loop between computer based experimental control systems and automatic real time analysis and can be applied to a wide range of experimental situations. The genetic algorithm quickly and reliably converges to the most performing parameter set independent of the starting population. Especially in many-dimensional or connected parameter spaces, the automatic optimization outperforms a manual search.

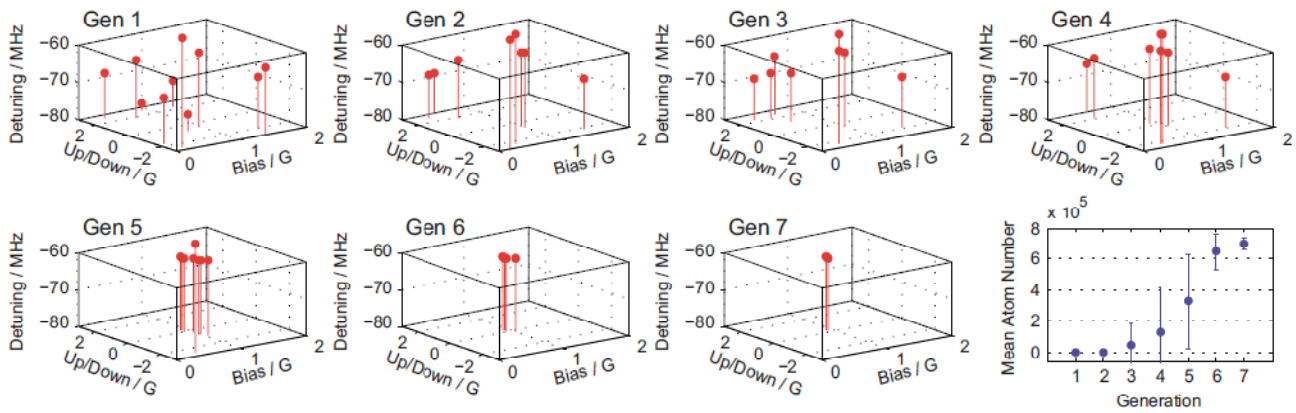

Figure 1. Positions of the individuals in the three-dimensional parameter space through seven generations. Convergence is clearly observed. On the bottom right, the achieved mean atom number for each generation is depicted. The error bars correspond to the standard deviation of the individual's results within each generation.