Mixing a sodium potassium soup – served cold

Lilo Höcker CQD Colloquium Pretalk



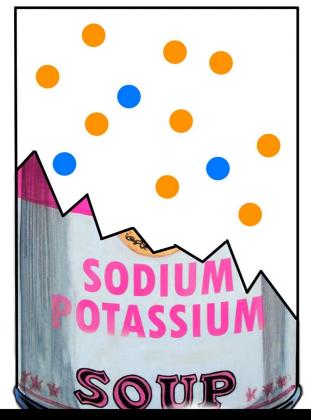




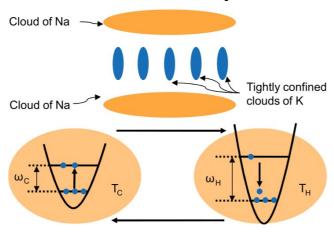




Cold atomic mixtures



Quantum Thermodynamics



Quantized refrigerator for an atomic cloud, Niedenzu et al., Quantum 3, 155 (2019)

Dynamical Gauge Fields

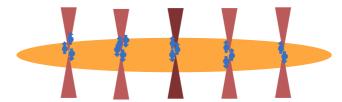




Gauge field

Experimental realization of U(1) gauge invariance in ultracold atomic mixtures, Mil et al., Science 367, 1128 (2020).

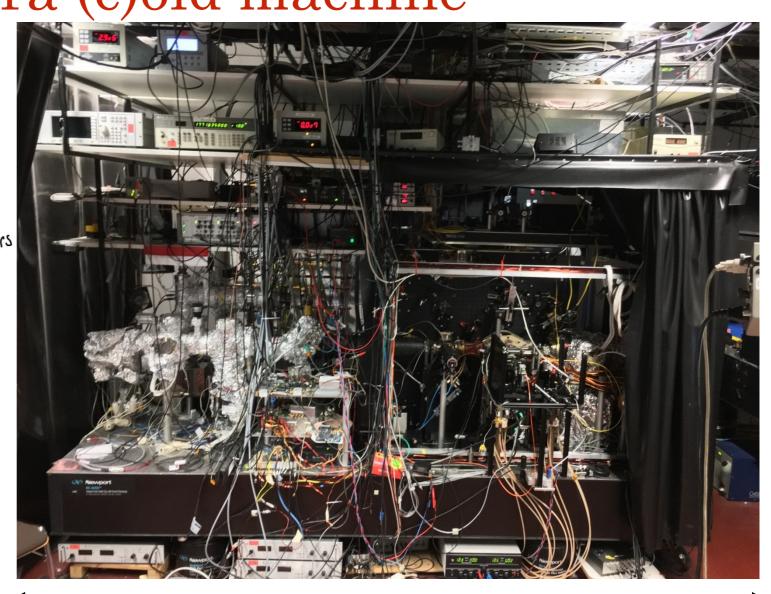
Universal Quantum Computation



Universal quantum computation and quantum error correctionwith ultracold atomic mixtures, Kasper et al., e-Print: arXiv: 2010.15923 (2020)

The ultra (c)old machine

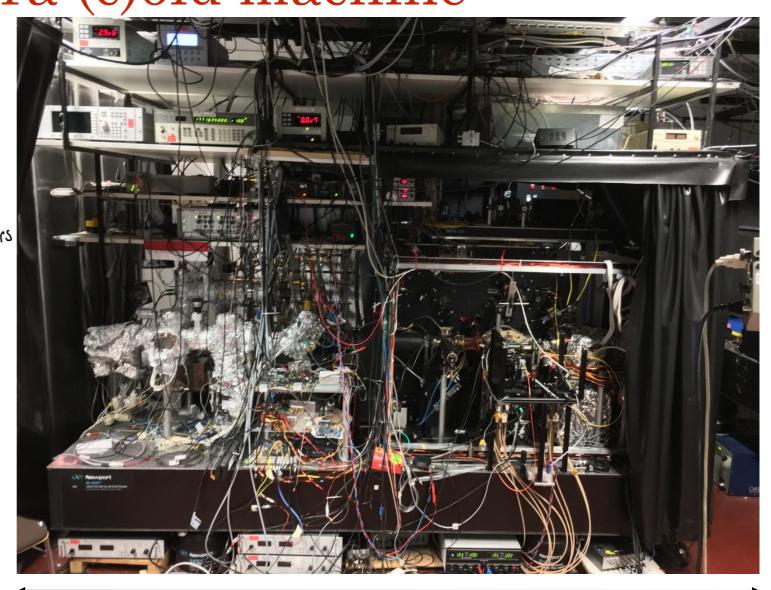
Time spent on machine fight with to theorists de pressed your colleagues talking and getting tweaking parameters filling out forms naitius for state crying finding the Moi alignment figure out where the smell comes from actual ligh tepaly broken things



2.5 m

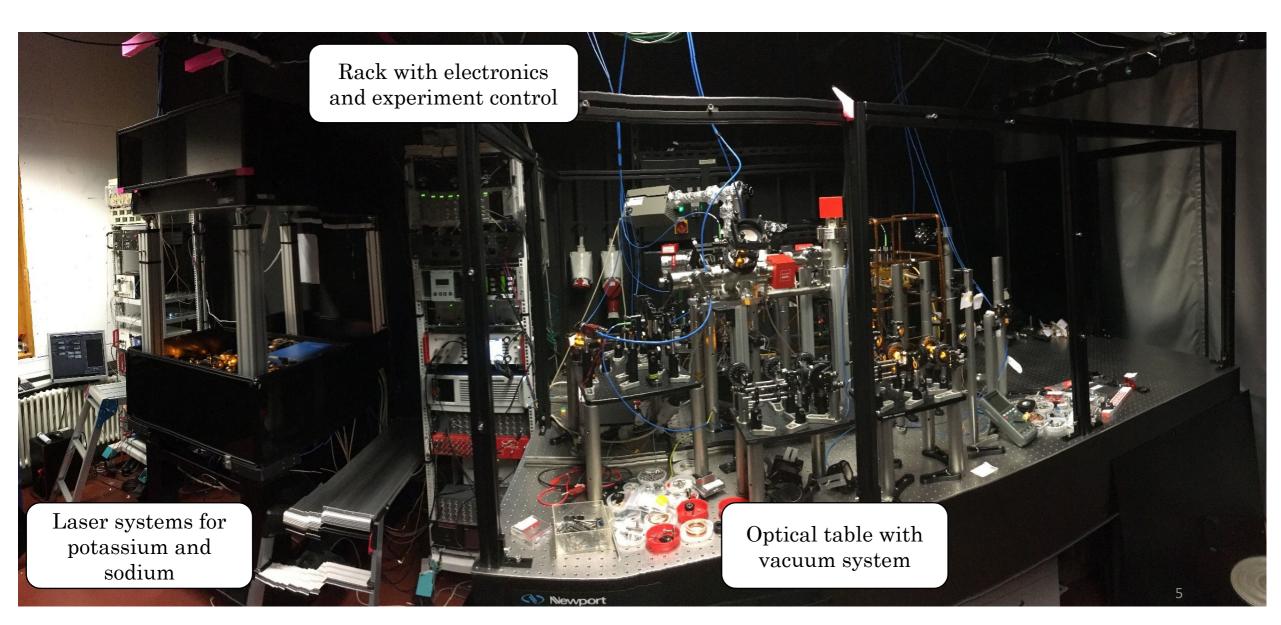
The ultra (c)old machine

Time spent on machine fight with to theorists depressed your colleagues talking and getting tweaking parameters order found mattial for surt taking data crying finding the Moi alignment figure out where the smell comes from of old boxes tepaly broken things

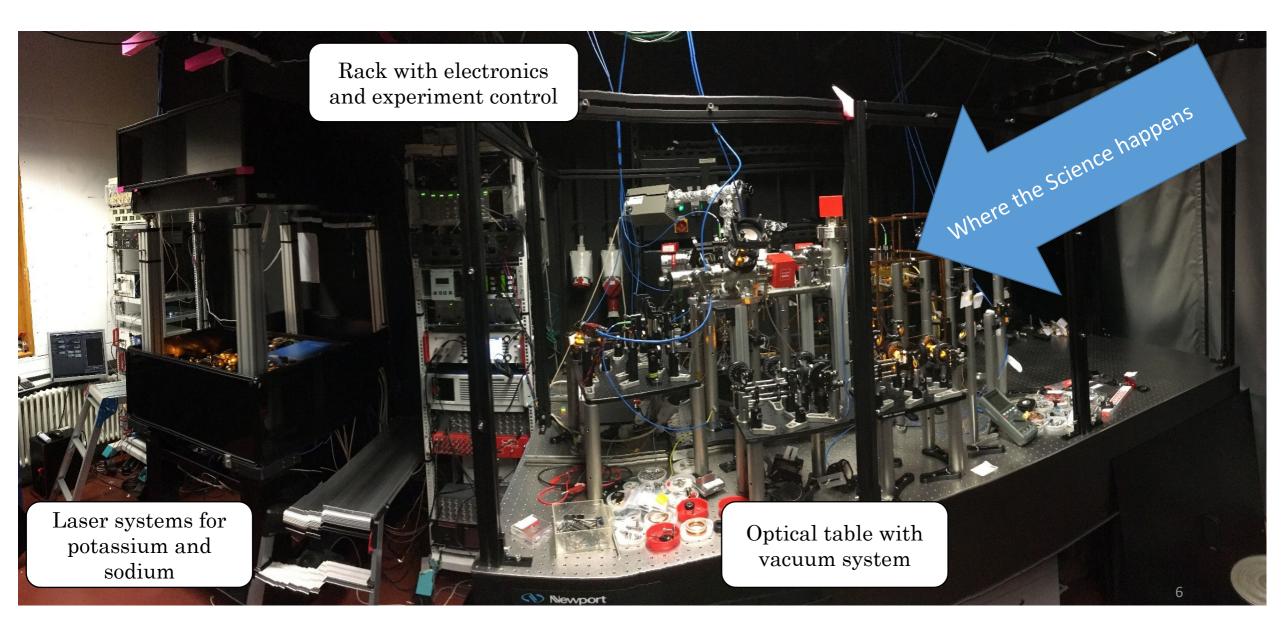


2.5 m

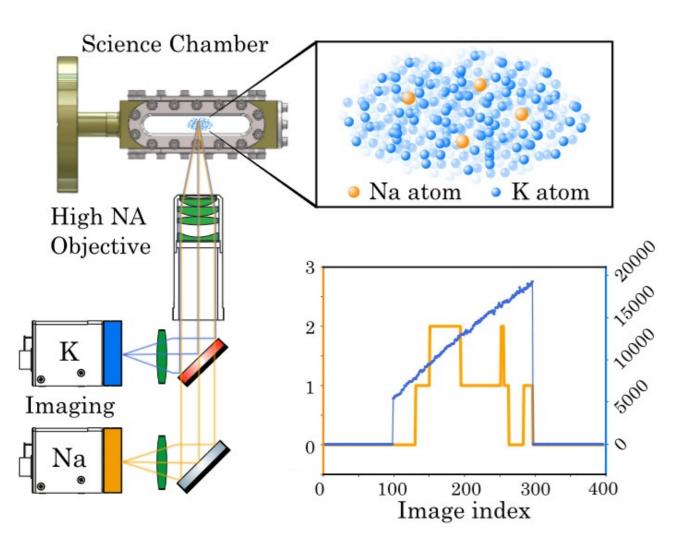
SoPa: Another cool machine

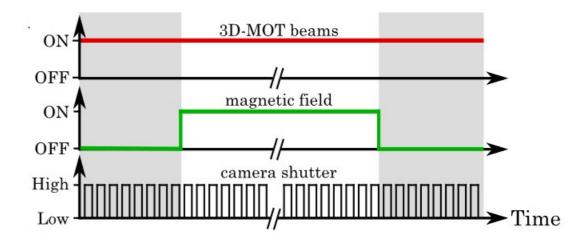


SoPa: Another cool machine

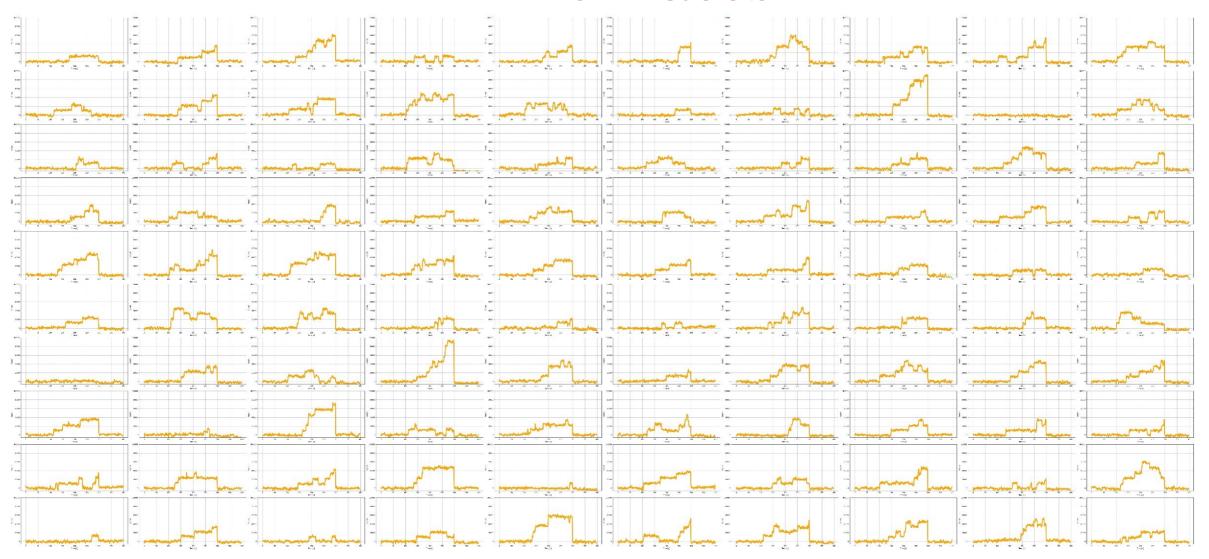


Single atom counting

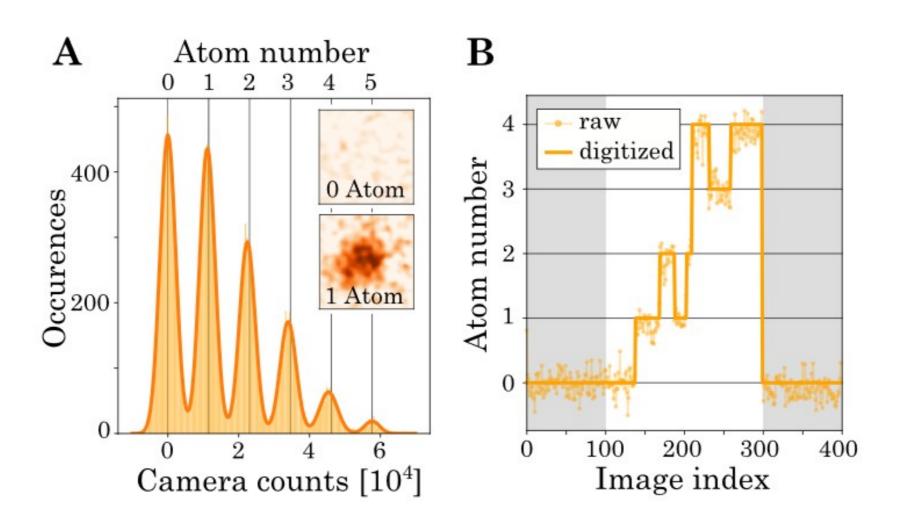




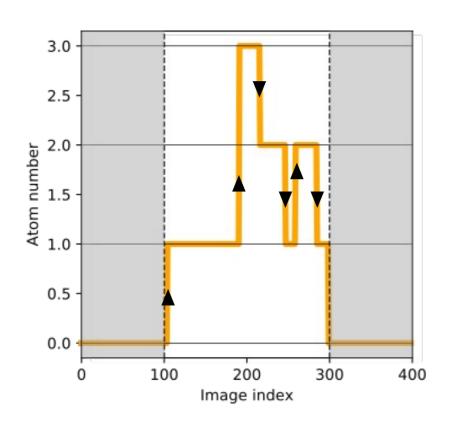
Time traces

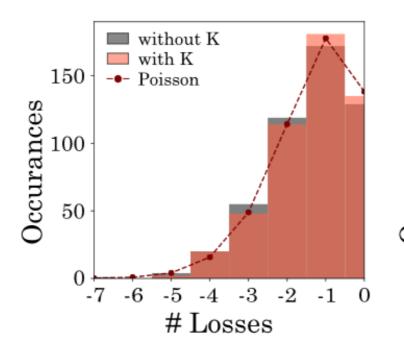


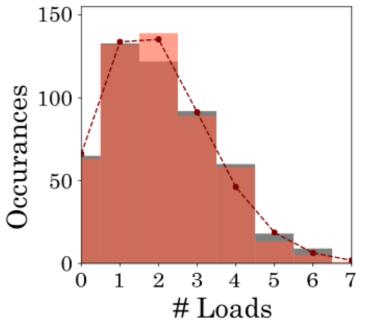
Single atom counting & digitization



MOT dynamics







Loss Process

$$p_{\rm loss} = \frac{N_{\rm loss}}{\sum_{i} N_i}$$

Loading Process

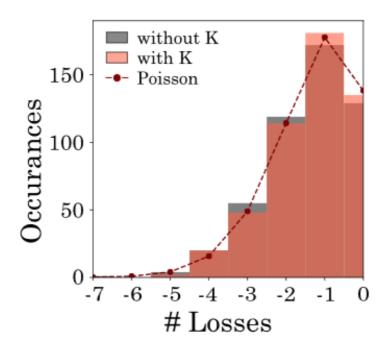
$$p_{\text{load}} = \frac{N_{\text{load}}}{N_{\text{img}}}$$

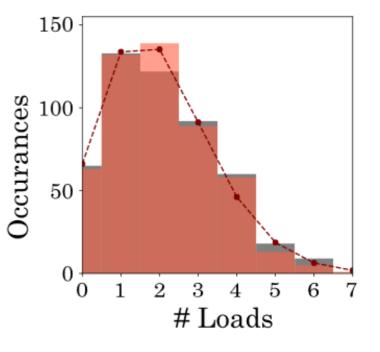
MOT dynamics

Influence of K atoms

	$p_{ m load} \ [\%]$	p_{loss} [%]
Without K	1.06(3)	2.76(23)
With K	1.02(3)	2.47(24)

Stochastic dynamics of a few sodium atoms in a cold potassium cloud, Rohit Prasad Bhatt, Jan Kilinc, Lilo Höcker, Fred Jendrzejewski (2021). arXiv:2101.01135.





Loss Process

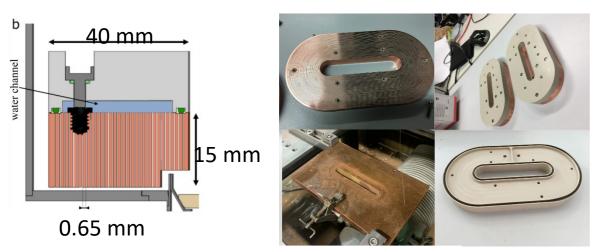
$$p_{\rm loss} = \frac{N_{\rm loss}}{\sum_{i} N_{i}}$$

Loading Process

$$p_{\text{load}} = \frac{N_{\text{load}}}{N_{\text{img}}}$$

Current status

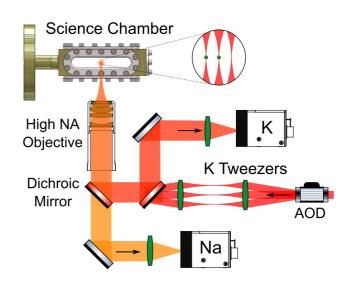
New Coils



Compact bulk-machined electromagnets for quantum gas experiments, Roux and B. Cilenti and V. Helson and H. Konishi and J. P. Brantut SciPost Phys. 6,4 2019

Magnetic Trap 100 200 300 400 500 600 0 100 200 300 400 500

Optical Tweezer



Dipole trap

