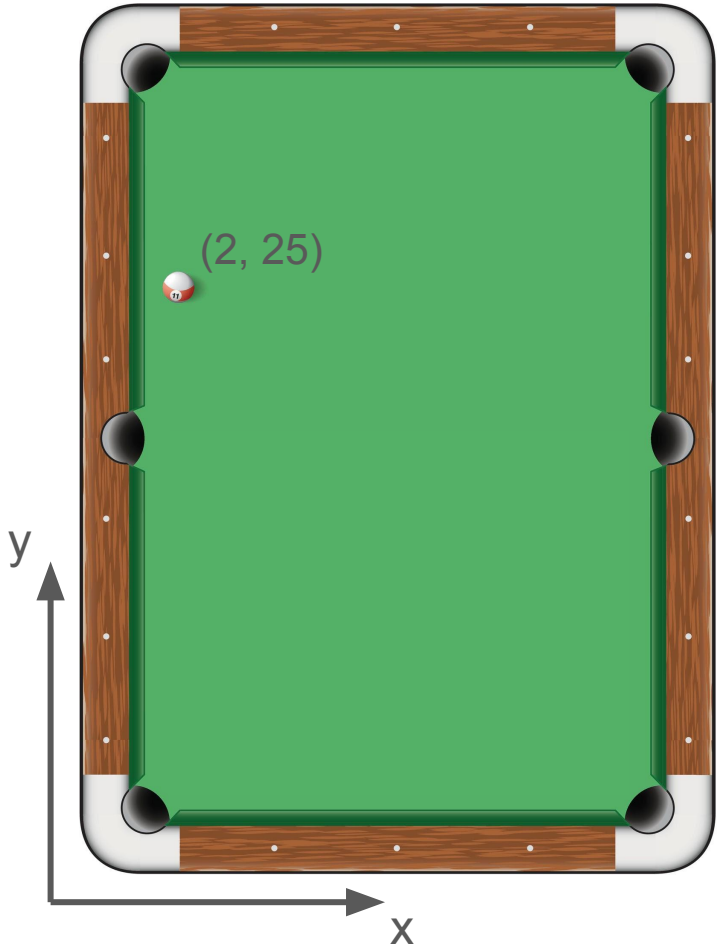
Applications of novel programming languages and compilation techniques to accelerating quantum many-body science

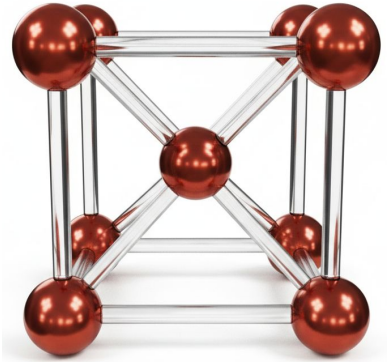
Tom Westerhout

Classical mechanics

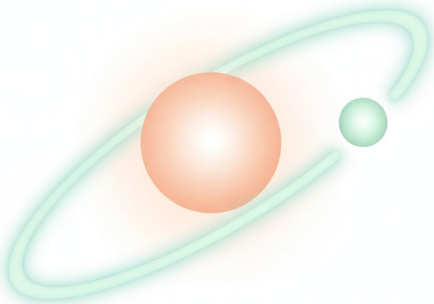


Quantum

Stainless steel pan

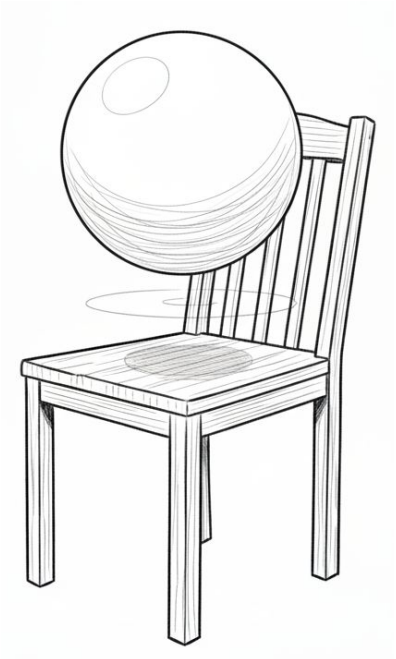


Iron atoms

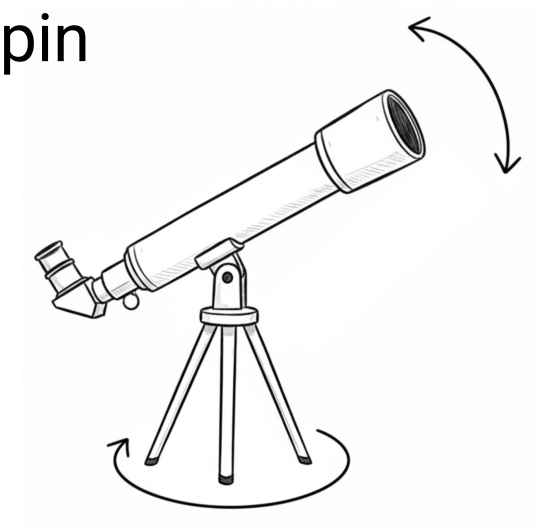


Hydrogen atom

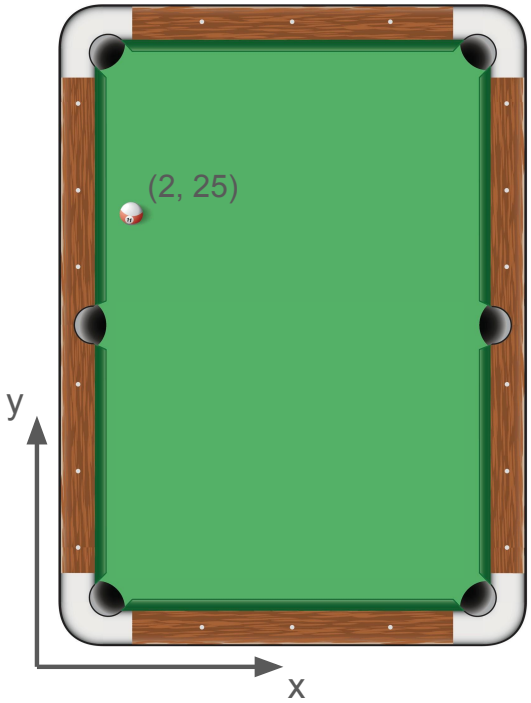
Electron

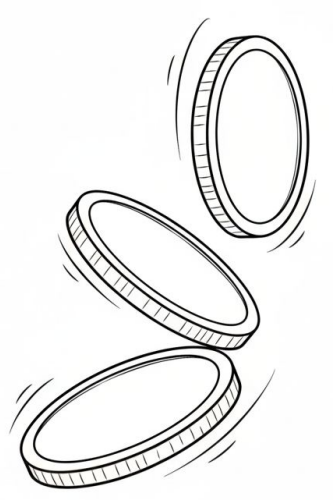


Spin



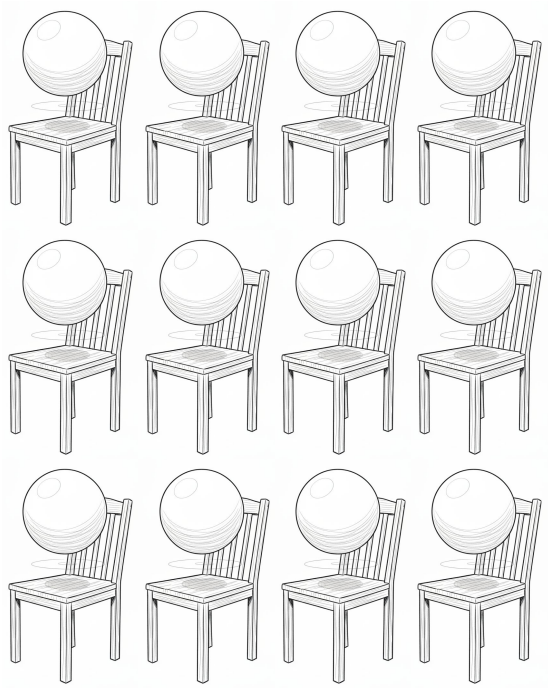
2 angles





Heads or tails

Probability of heads & tails



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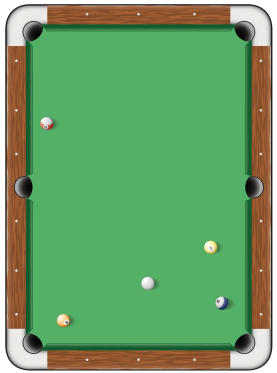
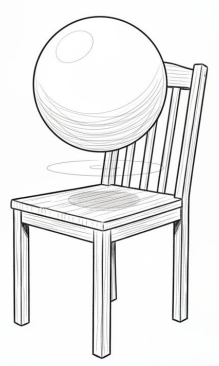
Classical



+2

2, 4, 6, 8, 10, 12, 14, …

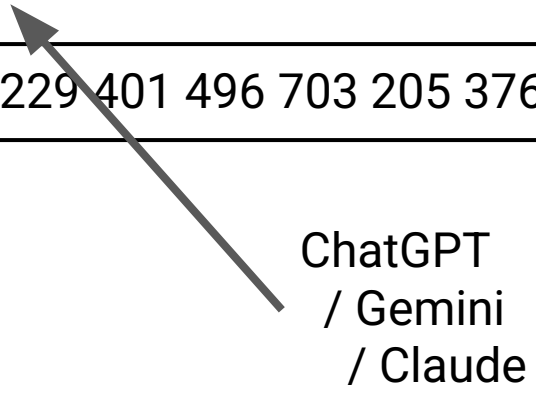
Quantum



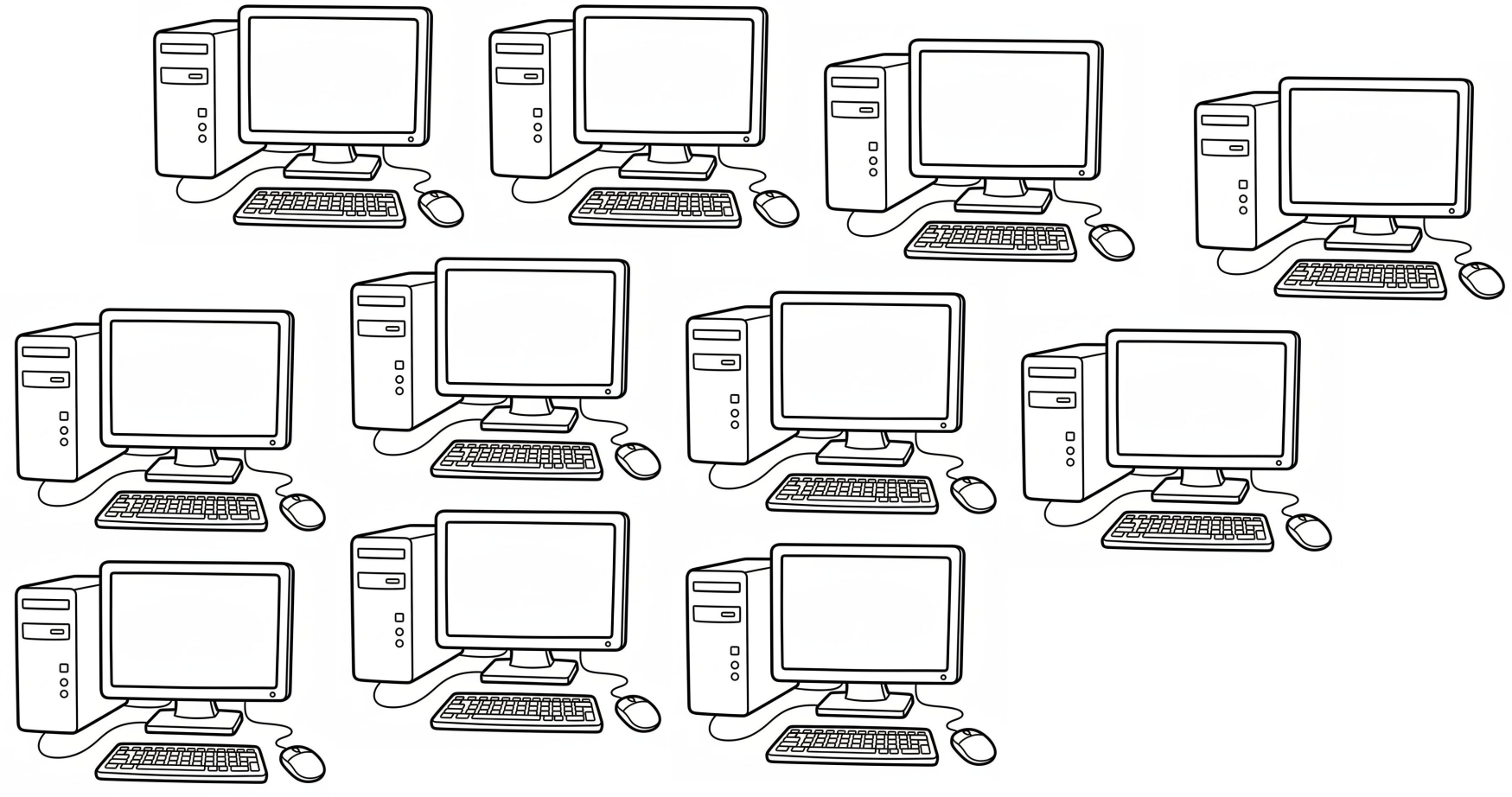
×2

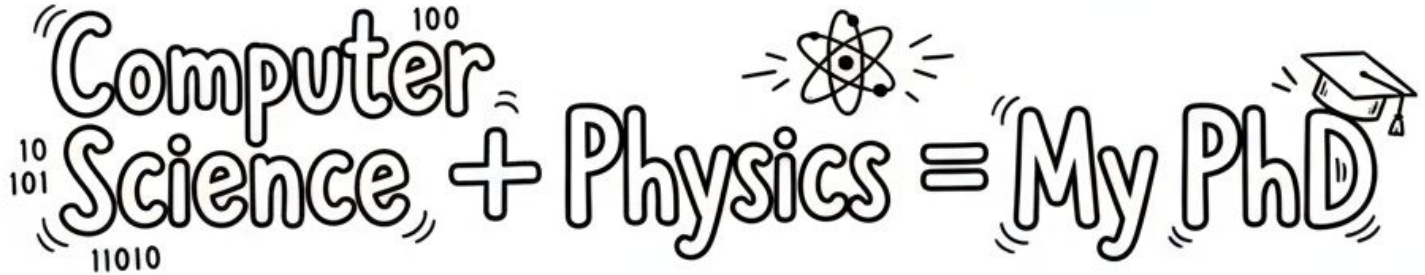
2, 4, 8, 16, 32, 64, 128, …

Pool balls / Spins	Classical	Quantum
1	2	2
5	10	32
20	40	1 048 576
43	86	8 796 093 022 208
100	200	1 267 650 600 228 229 401 496 703 205 376



High performance computing




100
Computer
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101
Science
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Physics
=
My PhD