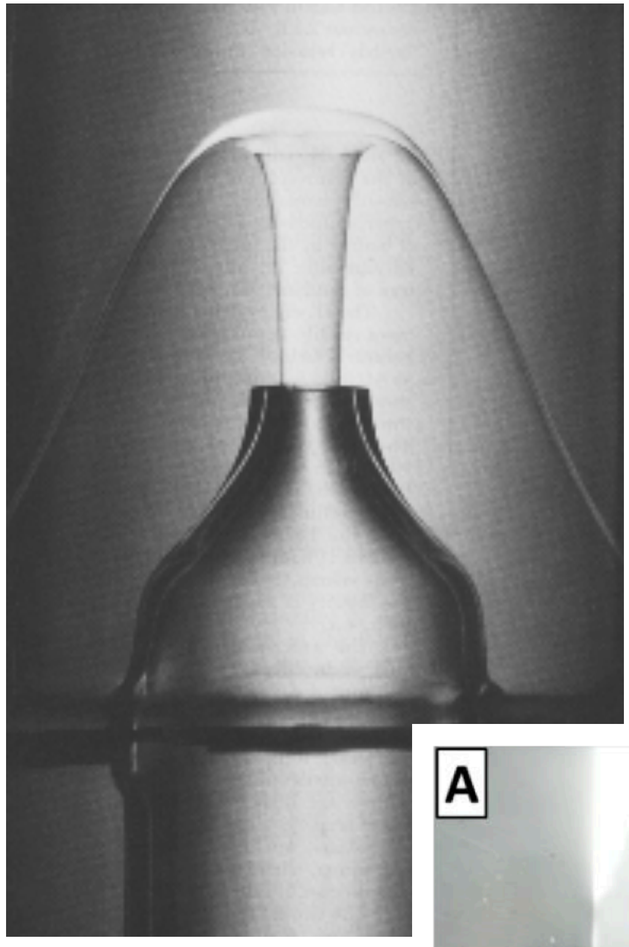
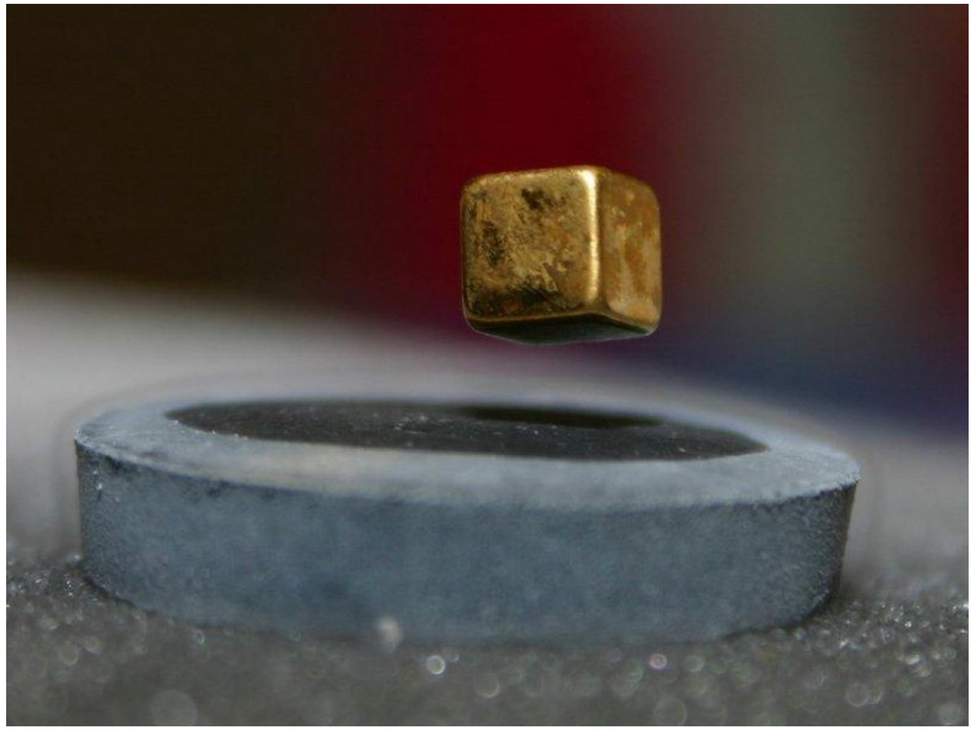
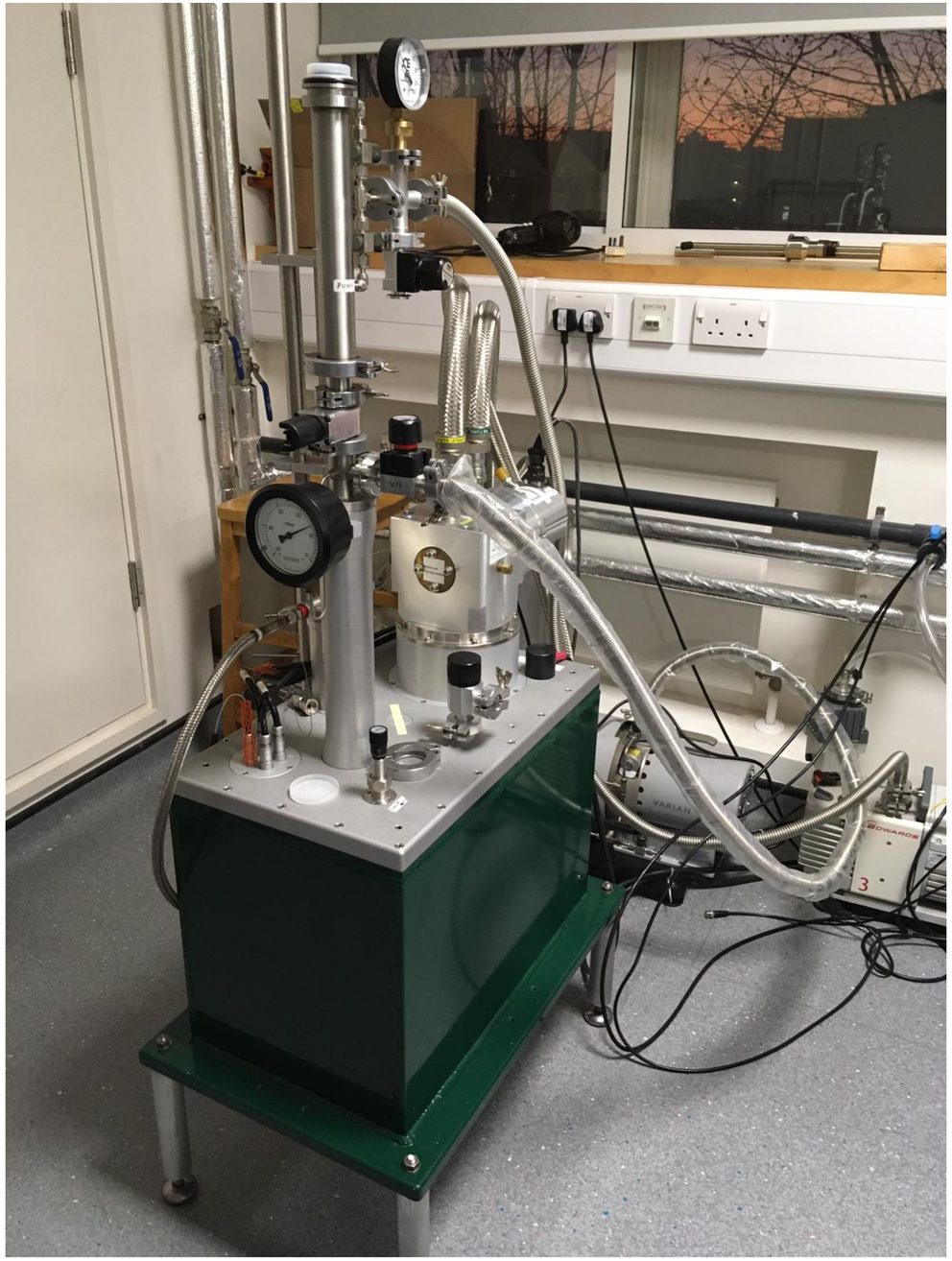
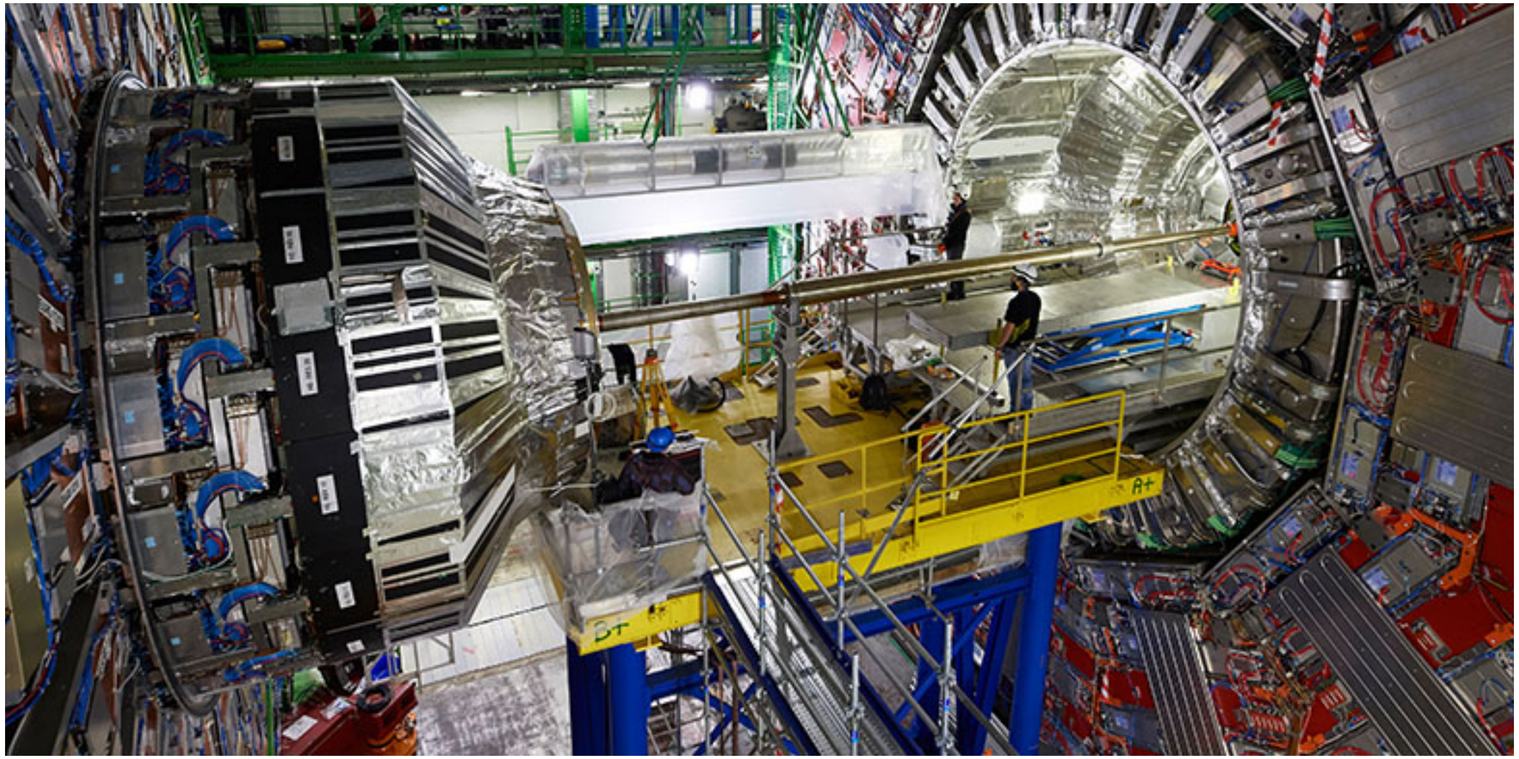


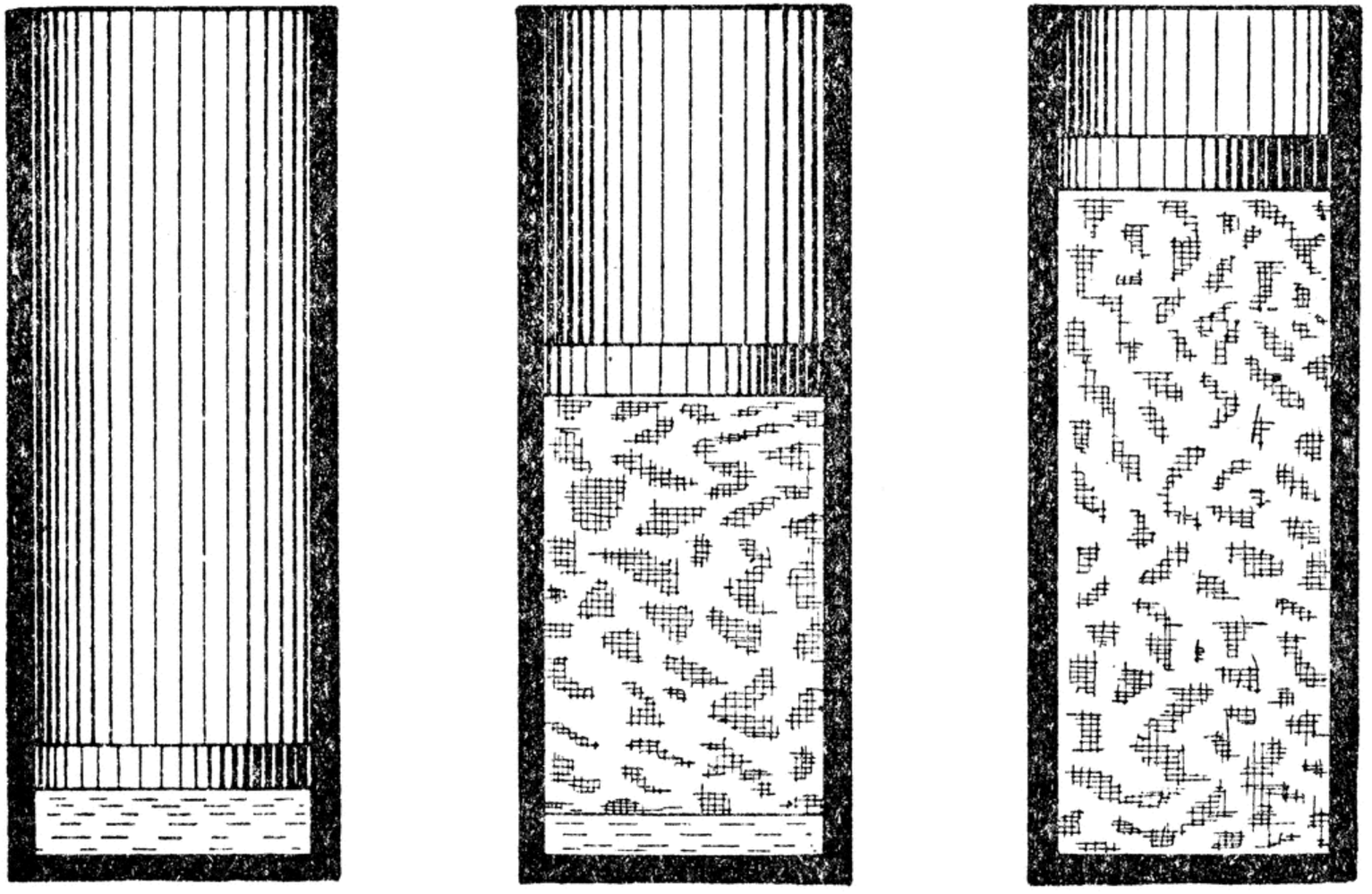


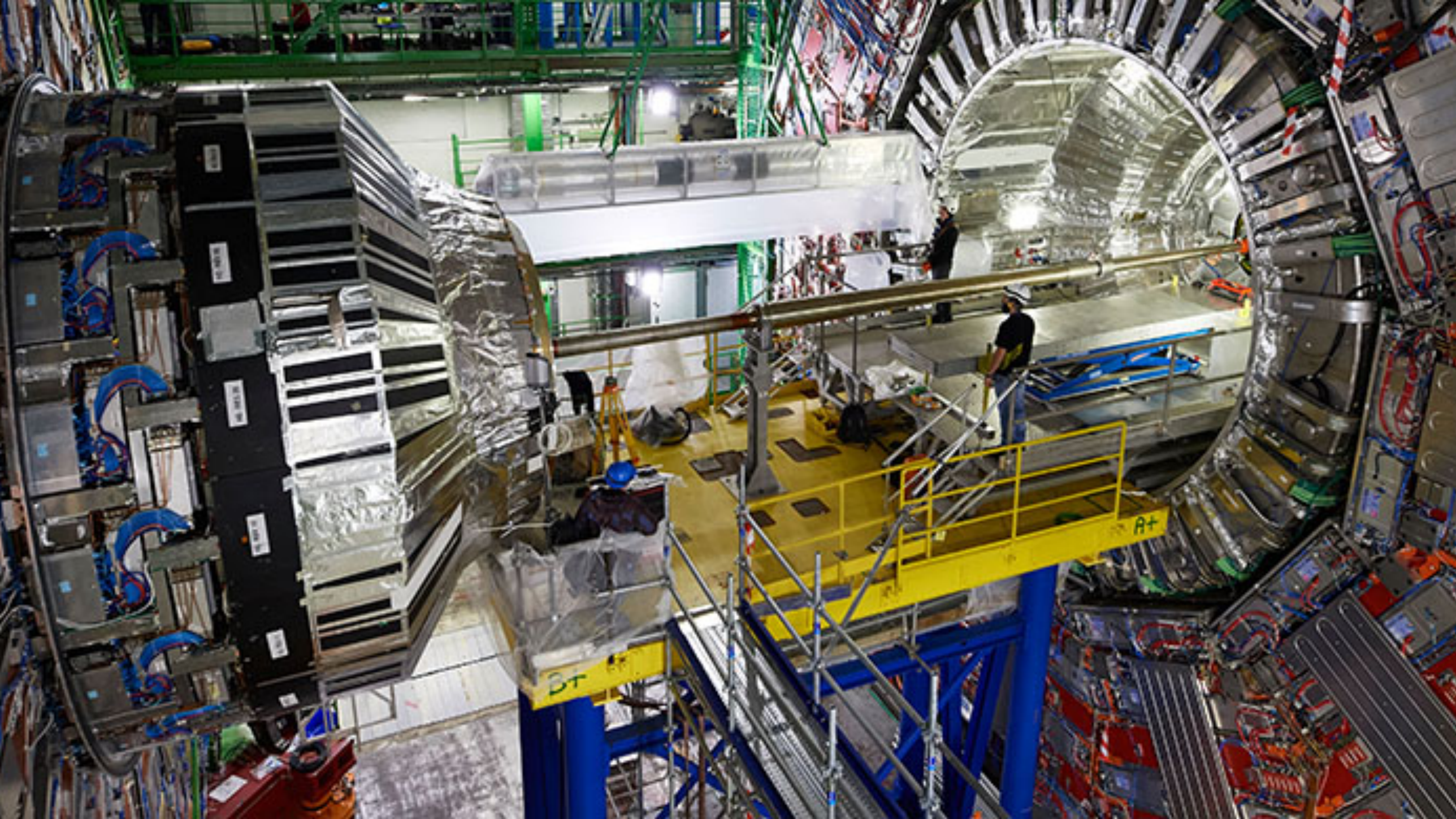
A
$T_c > T_{room}$

B
$T_c < T_{room}$



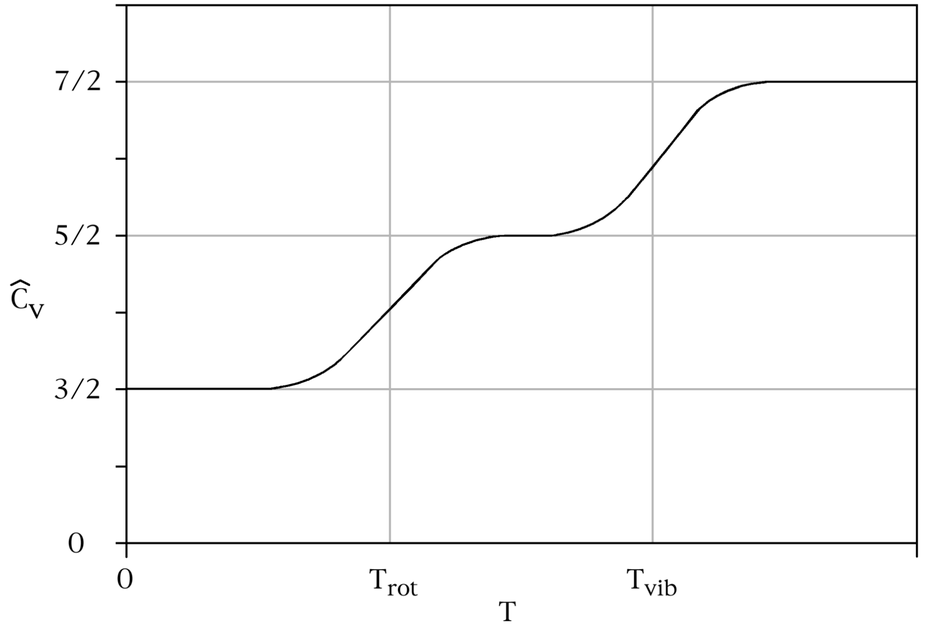

A+
BT


A
B
C


B+
A+

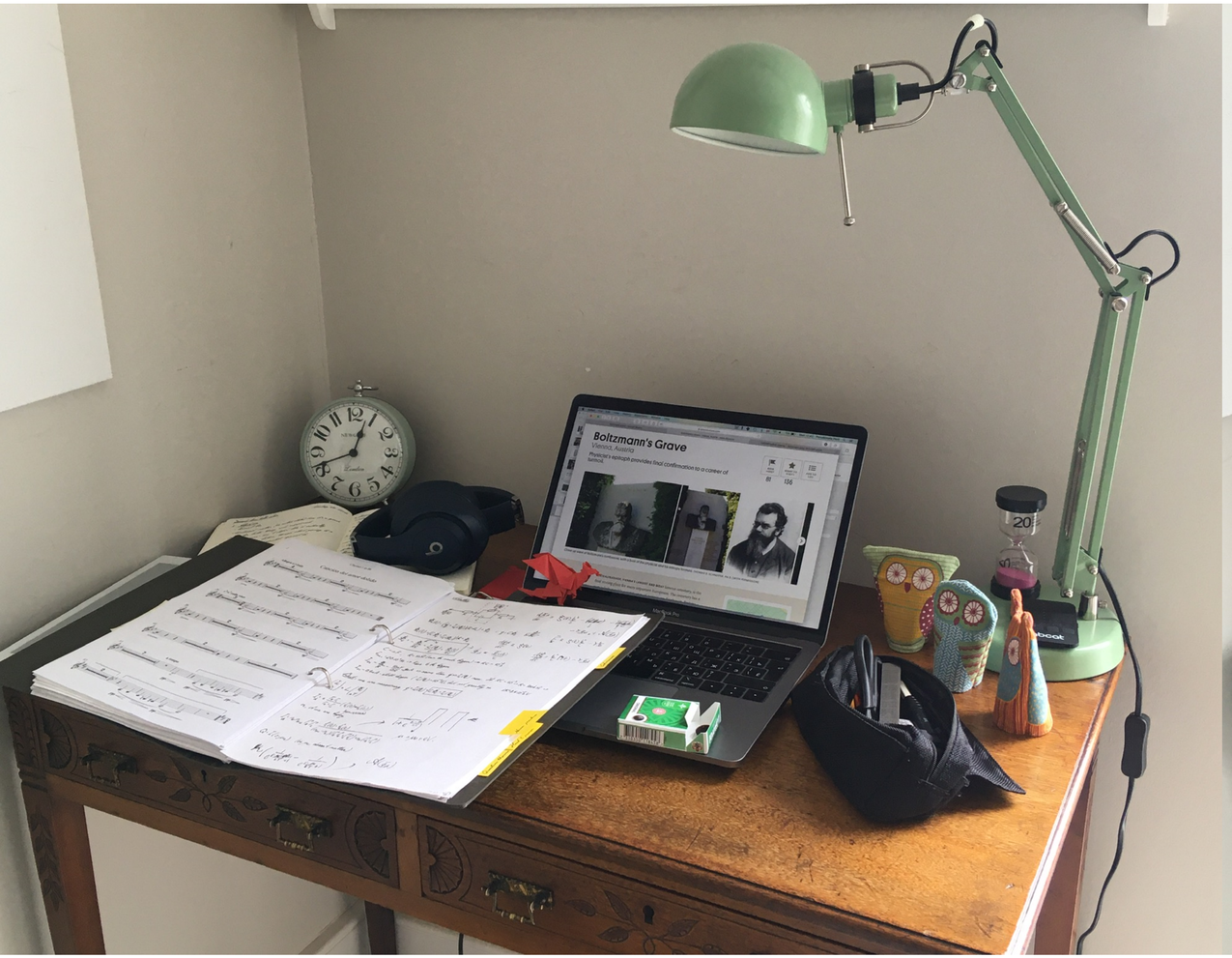
X	Y
solid state or many-body physics	elementary particle physics
chemistry	many-body physics
molecular biology	chemistry
cell biology	molecular biology
•	•
•	•
•	•
psychology	physiology
social sciences	psychology

*P.W. Anderson, "More is different", Science, **177**, 4047, (1971)*


7/2
5/2
3/2
0
$\widehat{C}_V$
0
T_{rot}
T_{vib}
T

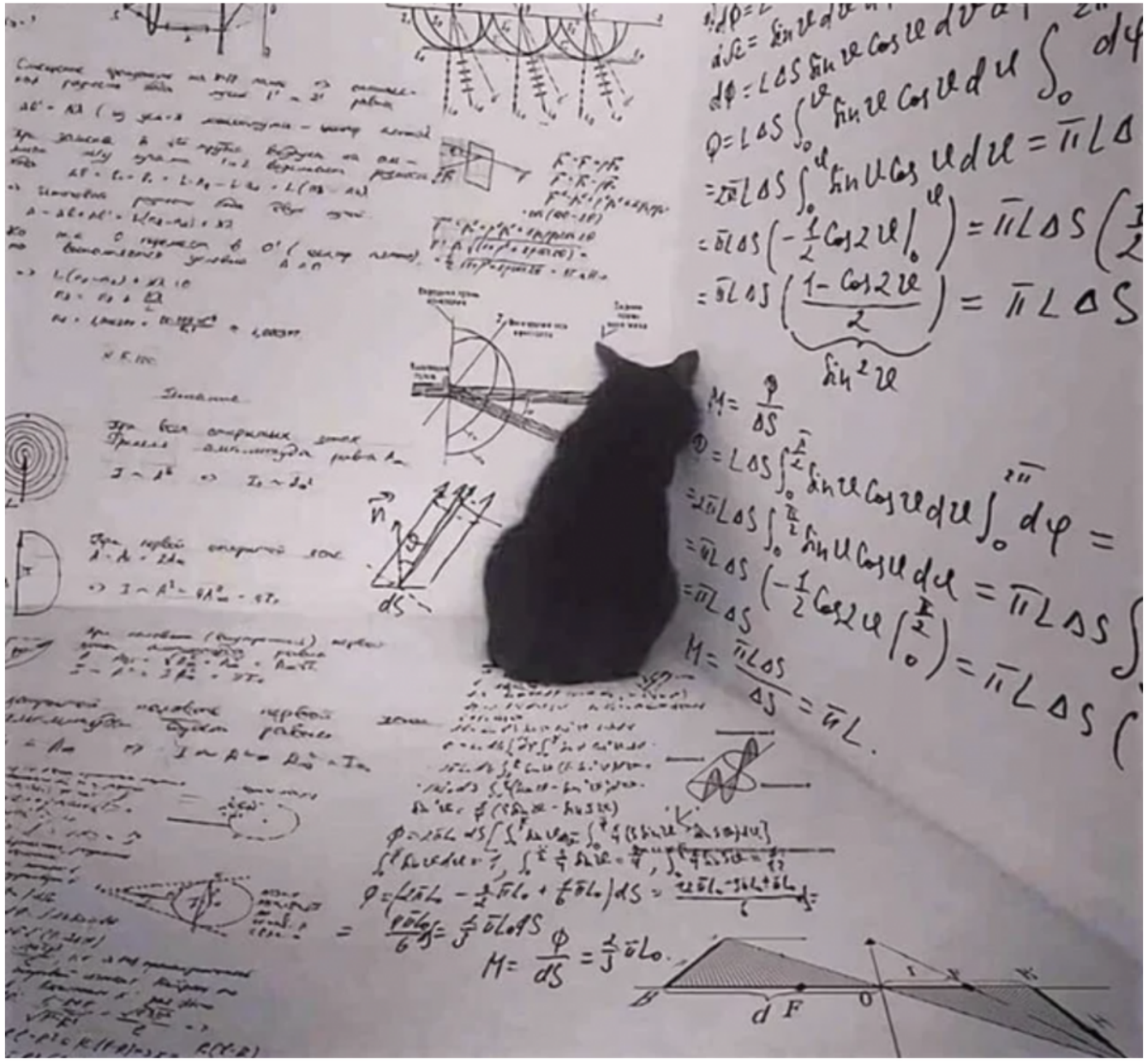
$\Delta S > 0$

S = k. log W
LVDWIG
BOLTZMANN
1844 – 1906
HENRIETTE
BOLTZMANN
EB. EDLE von AIGENTLER
1854 – 1938
DR PHIL.PAULA
BOLTZMANN
GEB. CHIARI
1891 – 1977
ARTHUR
BOLTZMANN
DIPL.ING. DR PHIL. HOFRAT
1881 – 1932
LVDWIG
BOLTZMANN
1923 – 1943
ZTER MÄNNLICHER NACHKOMME.
GEFALLEN BEI SMOLENSK

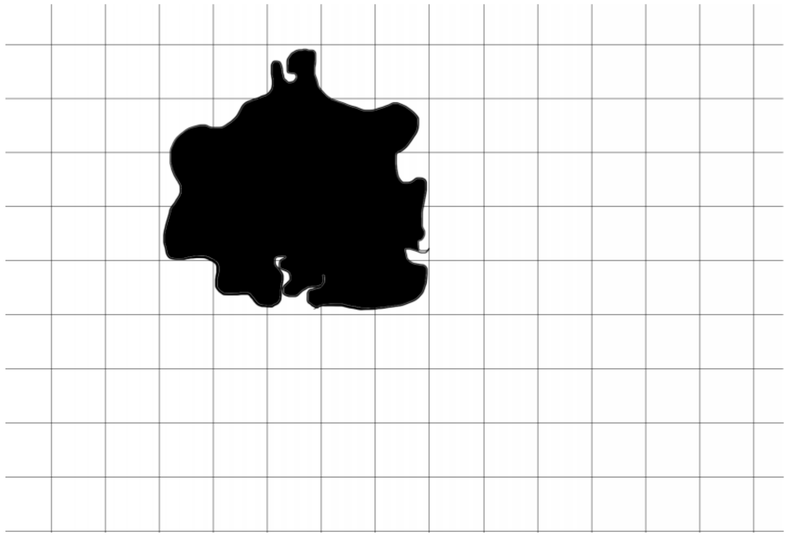

Boltzmann's Grave
Vienna, Austria

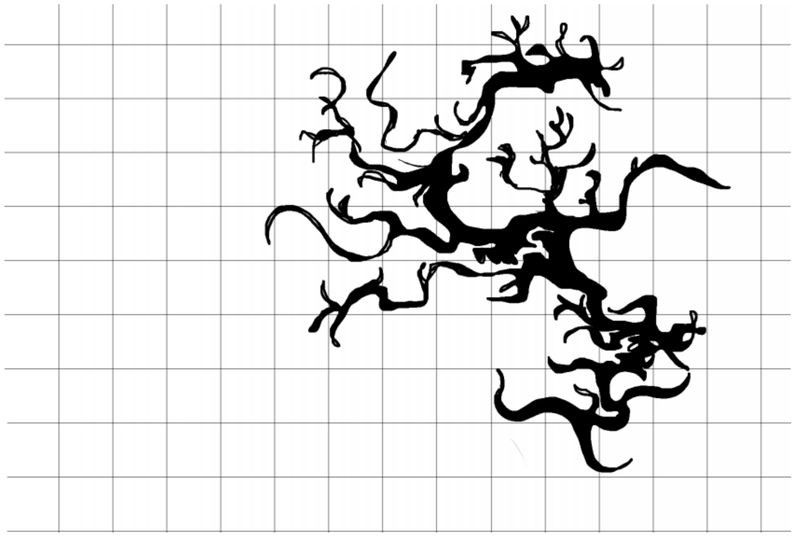
SICK!
science

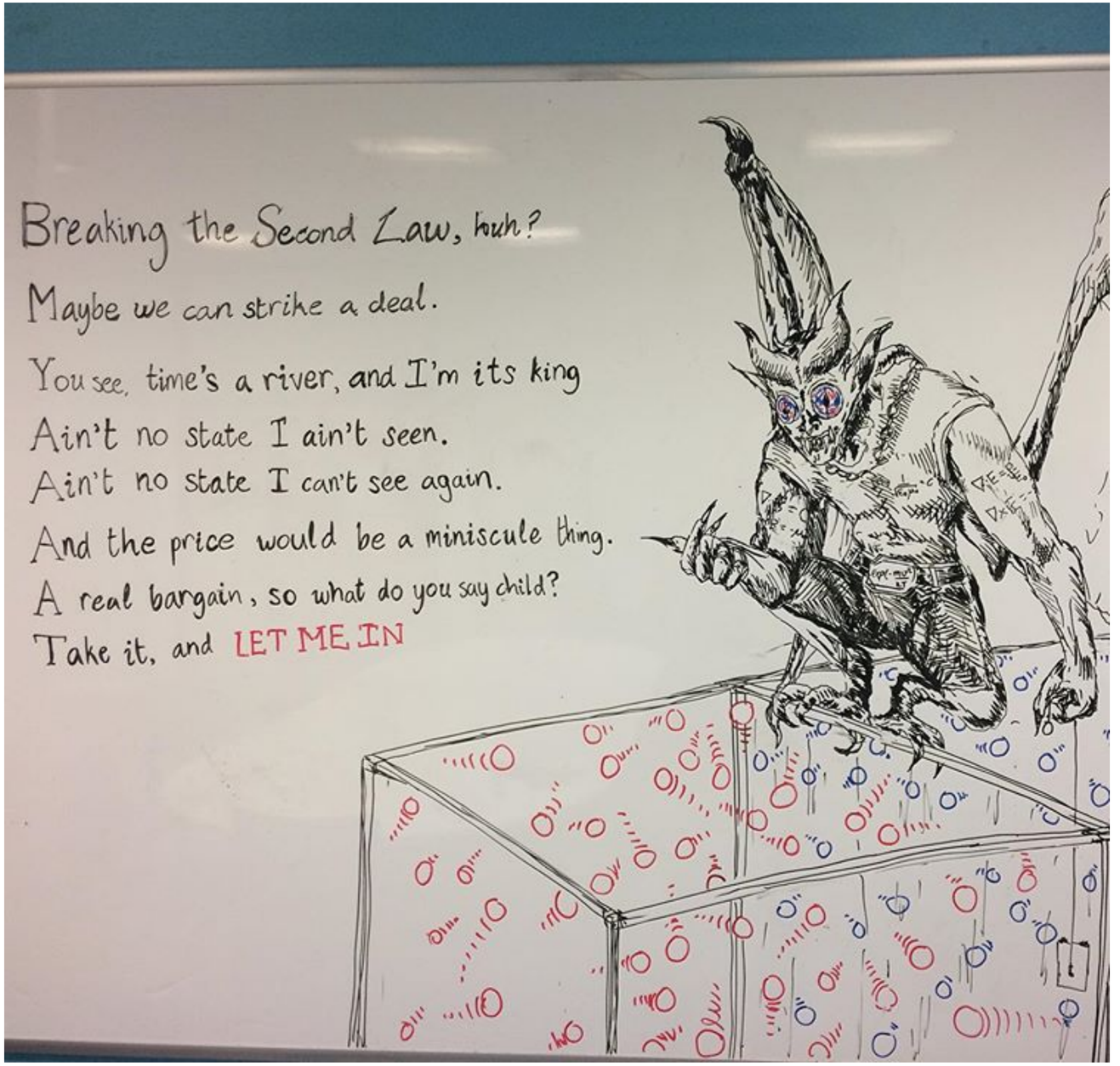
Remarkably, Boltzmann himself offered the hypothesis that "the universe, considered as a mechanical system — or at least a very large part of it which surrounds us — started from a very improbable state, and is still in a very improbable state" to explain the asymmetry in the second law. This view has subsequently been echoed by Gold, Feynman, Lebowitz and co-workers, Peierls, Penrose, and others, albeit with various degrees of emphasis and detail.

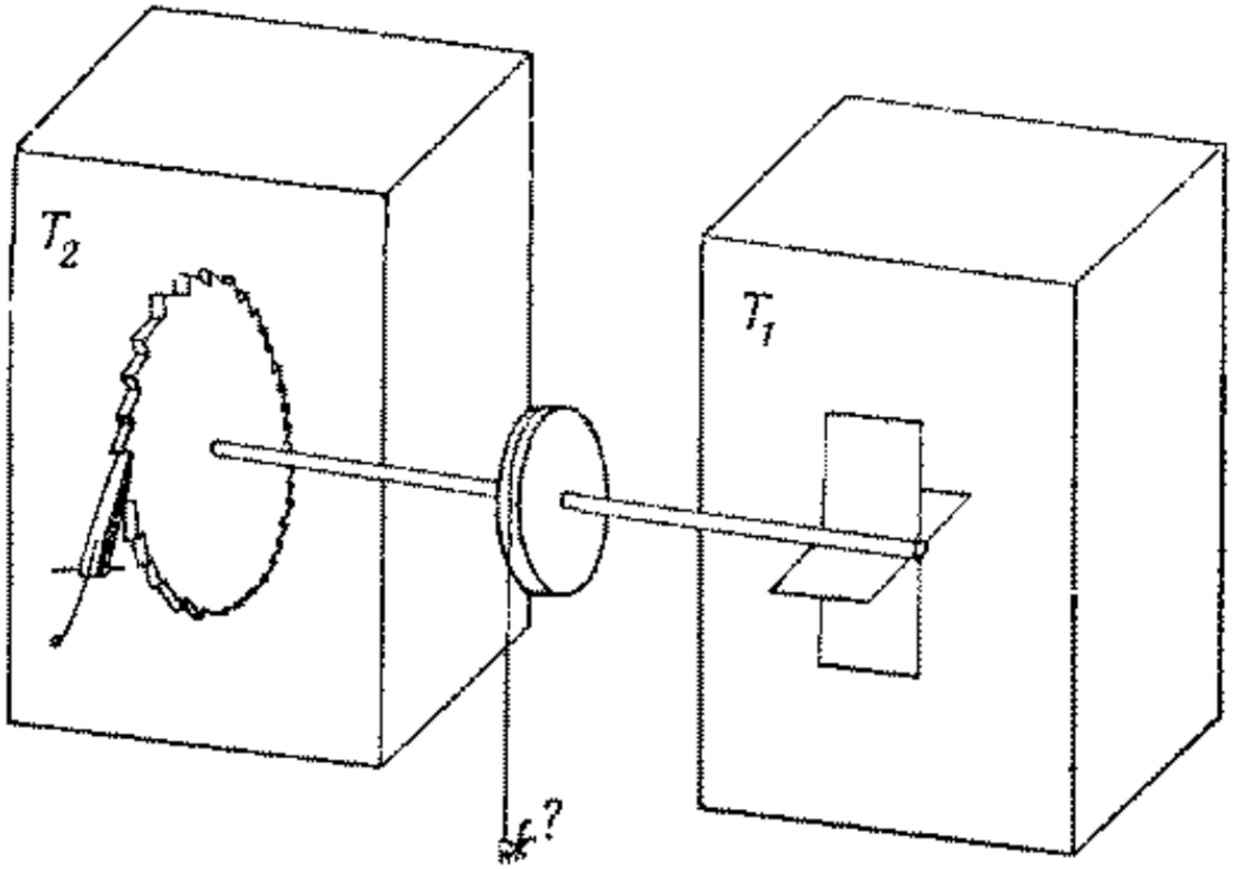


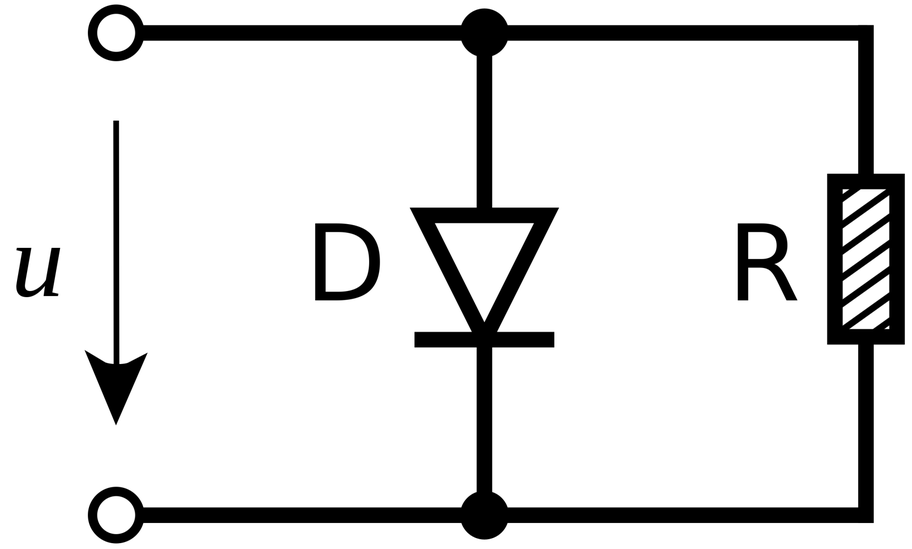
Meanwhile, inside the box, the cat is planning its revenge…

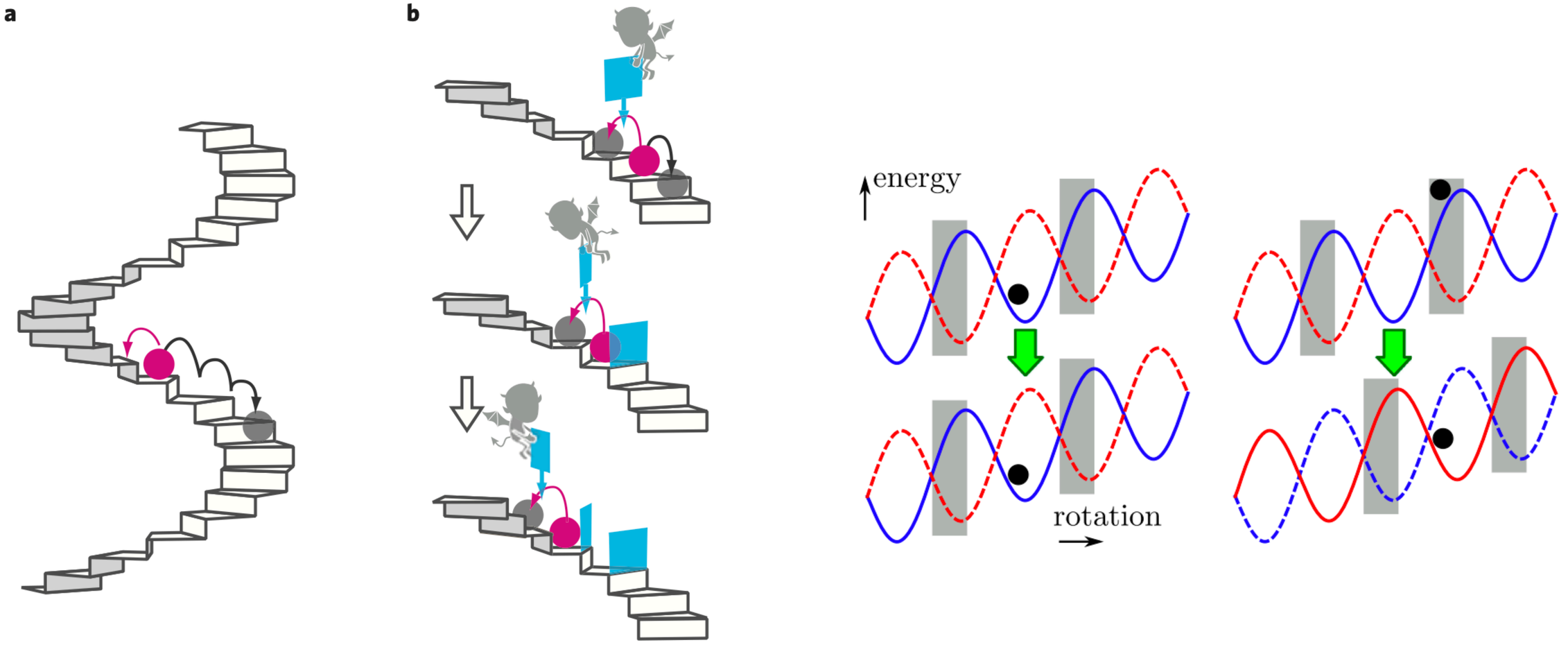




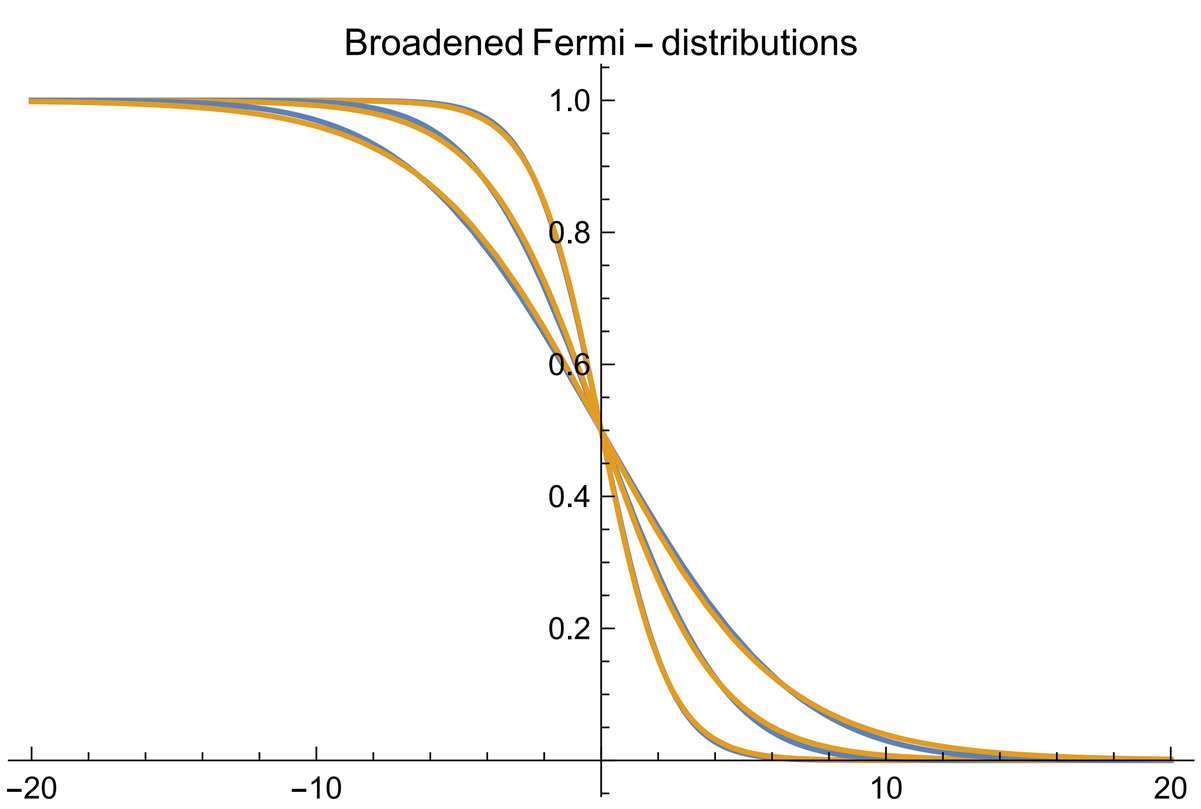

Breaking the Second Law, huh?
Maybe we can strike a deal.
You see, time's a river, and I'm its king
Ain't no state I ain't seen.
Ain't no state I can't see again.
And the price would be a miniscule thing.
A real bargain, so what do you say child?
Take it, and LET ME IN

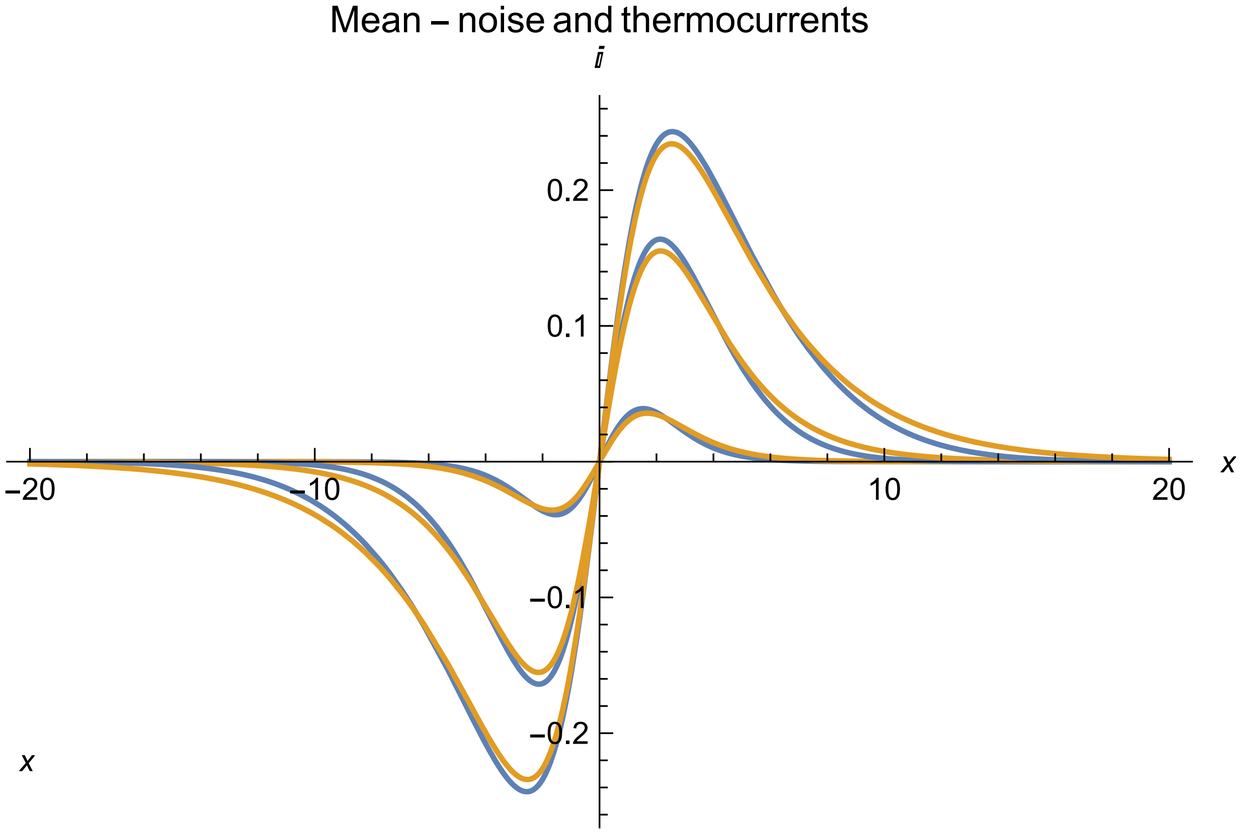

T_2
T_1
?

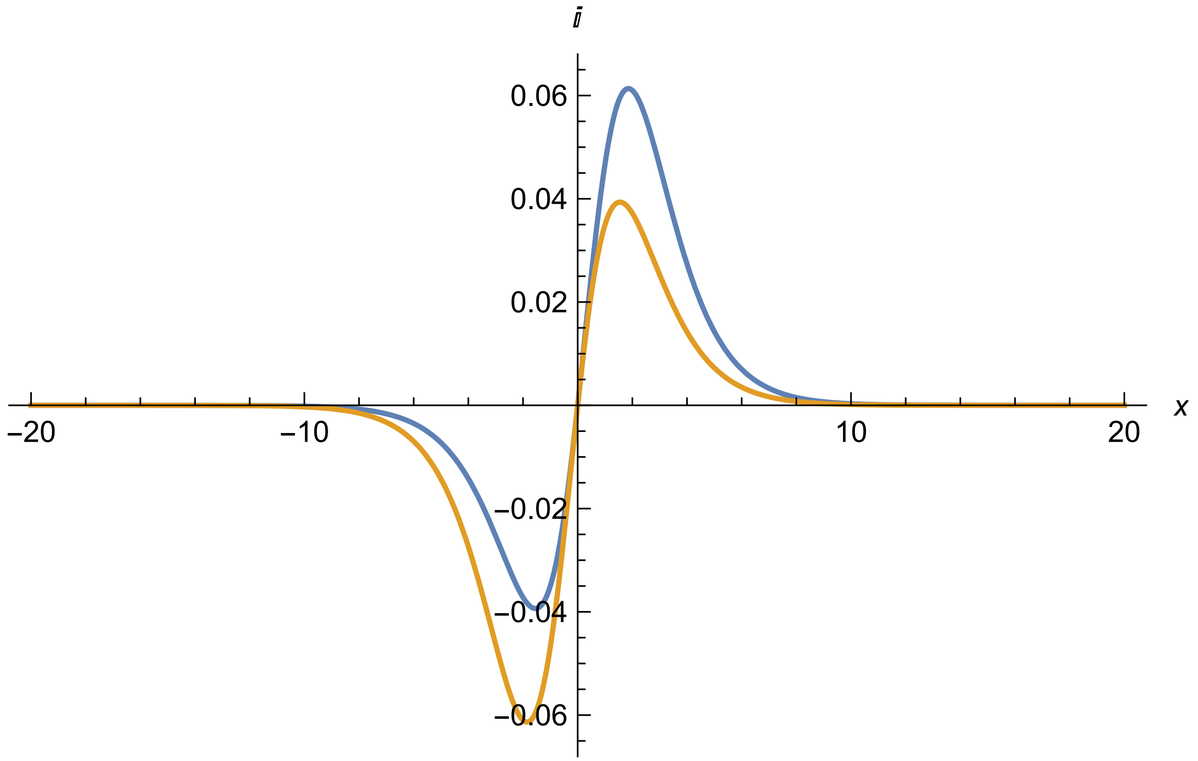

u
D
R

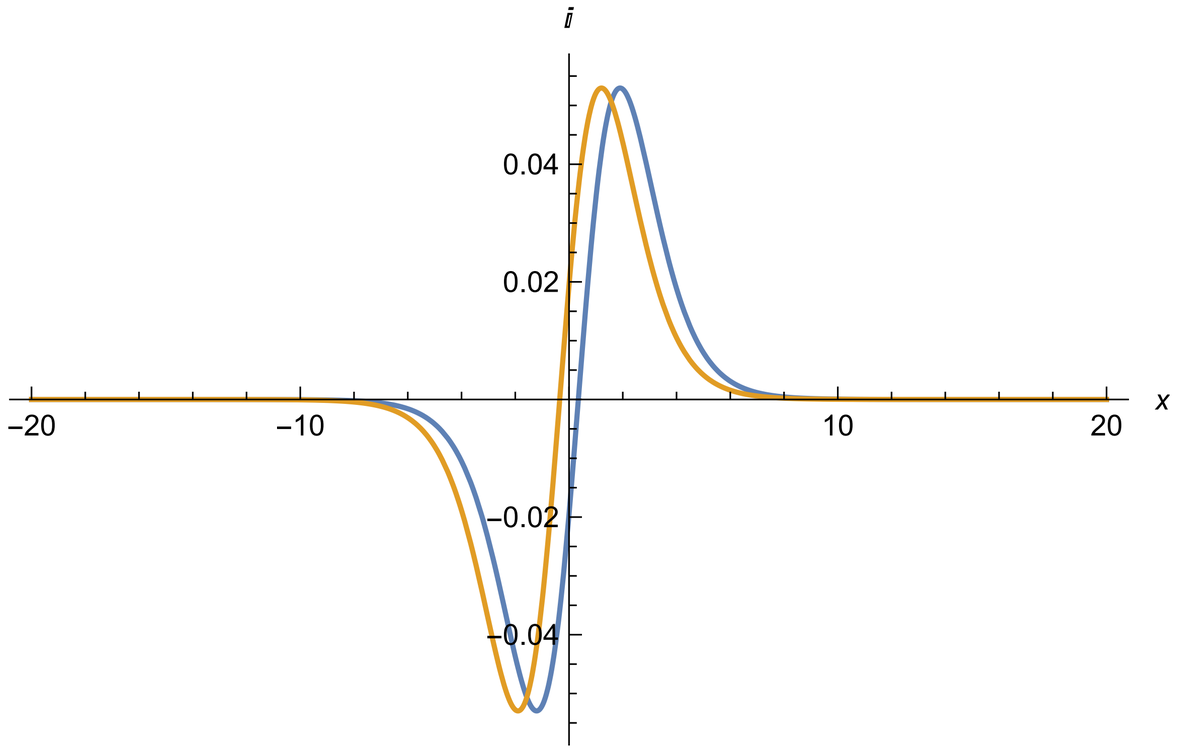


Toyabe, S., Sagawa, T., Ueda, M. *et al.* Experimental demonstration of information-to-energy conversion and validation of the generalized Jarzynski equality. *Nature Phys* **6,** 988–992 (2010)


Broadened Fermi – distributions
1.0
0.8
0.6
0.4
0.2
−20
−10
10
20
x


Mean – noise and thermocurrents
ī
0.2
0.1
−0.1
−0.2
−20
−10
10
20
x


i
0.06
0.04
0.02
−0.02
−0.04
−0.06
x
−20
−10
10
20


i
0.04
0.02
−0.02
−0.04
x
−20
−10
10
20