

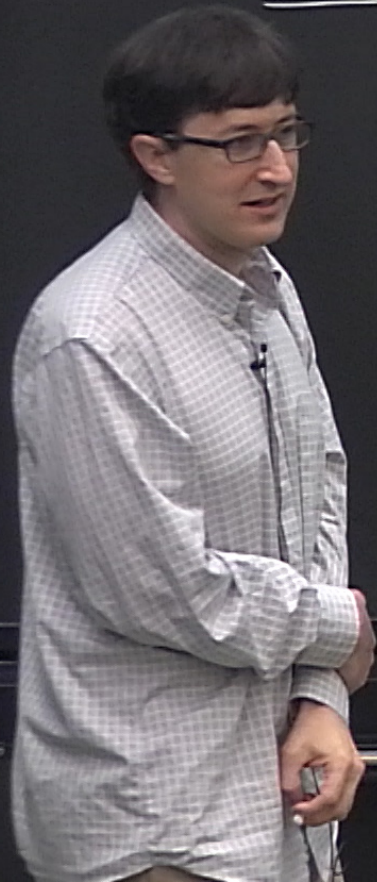
Title: CPT symmetric universe

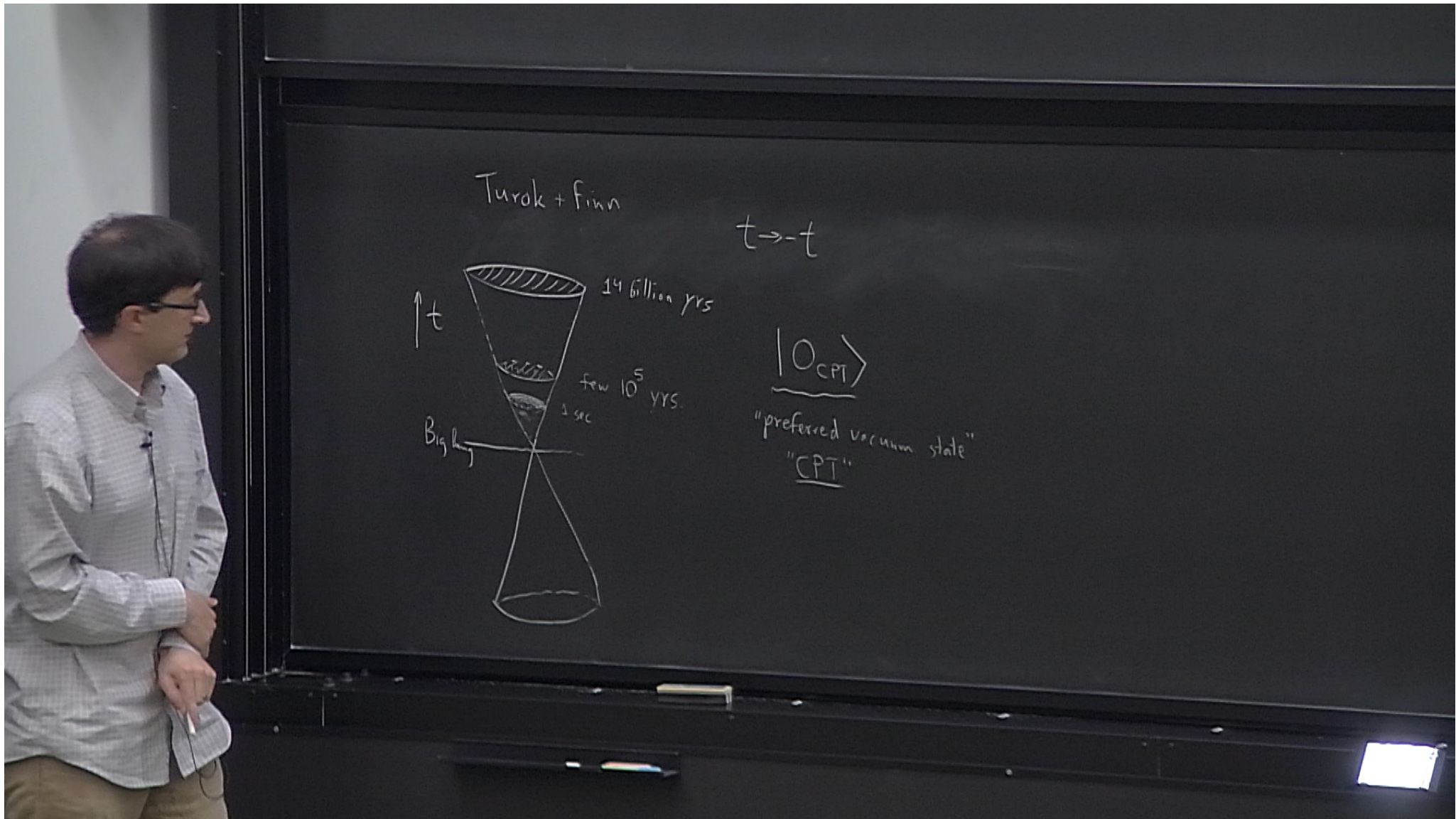
Date: Jul 23, 2018 10:30 AM

URL: <http://pirsa.org/18070059>

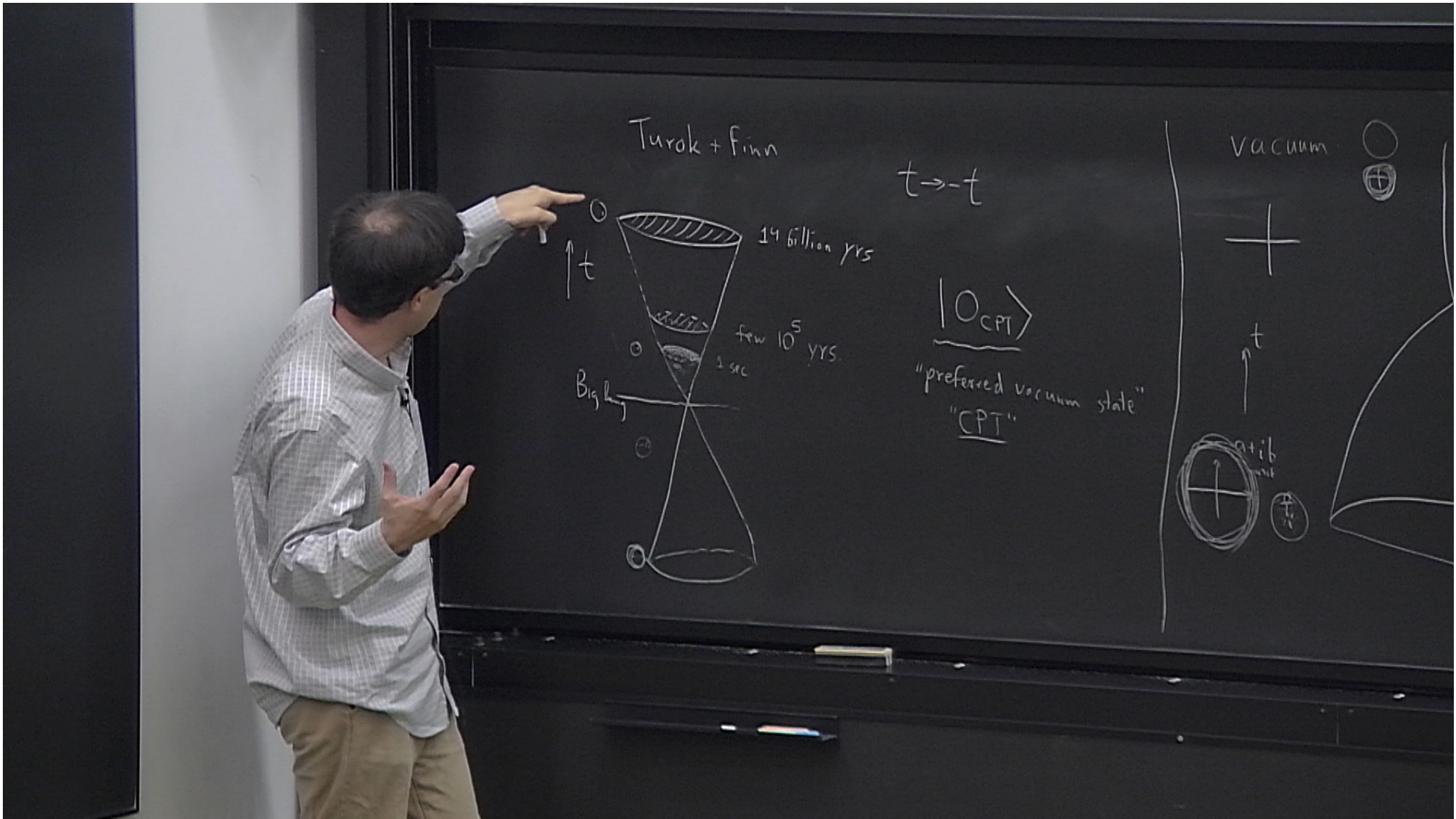
Abstract: **Abstract:** From astronomical observations, we know that the state of the early universe (just after the Big Bang) was extremely simple. This is surely an important clue about how the universe began, but what exactly is it trying to tell us? I will explain our new answer to this question: we think it is telling us that the universe before the bang is a kind of mirror image of the universe after the bang (they are related by "CPT symmetry"). (Based on recent work with Kieran Finn and Neil Turok: <https://arxiv.org/pdf/1803.08928.pdf>)

Einstein, Penrose, Dyson, Conway, Noether, Alvarez





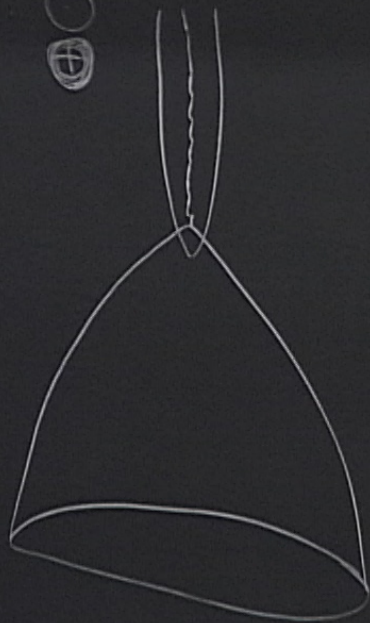
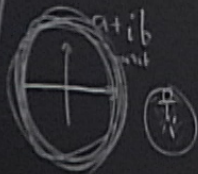




Vacuum



t



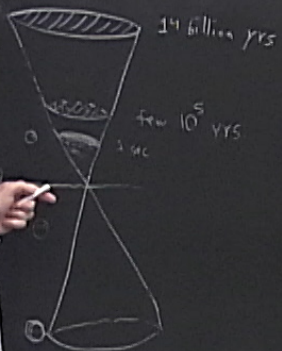
C = charge conjugation

P = parity

T = time reversal



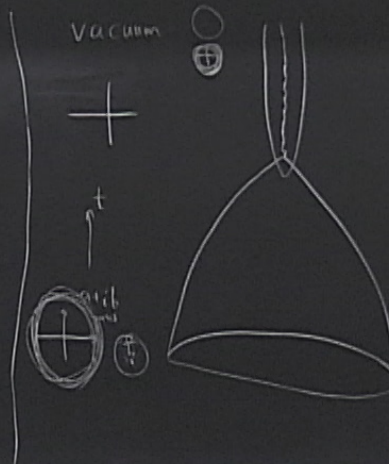
Turok + Finn



$$t \rightarrow -t$$

$$|0_{CPT}\rangle$$

"preferred vacuum state"  
"CPT"



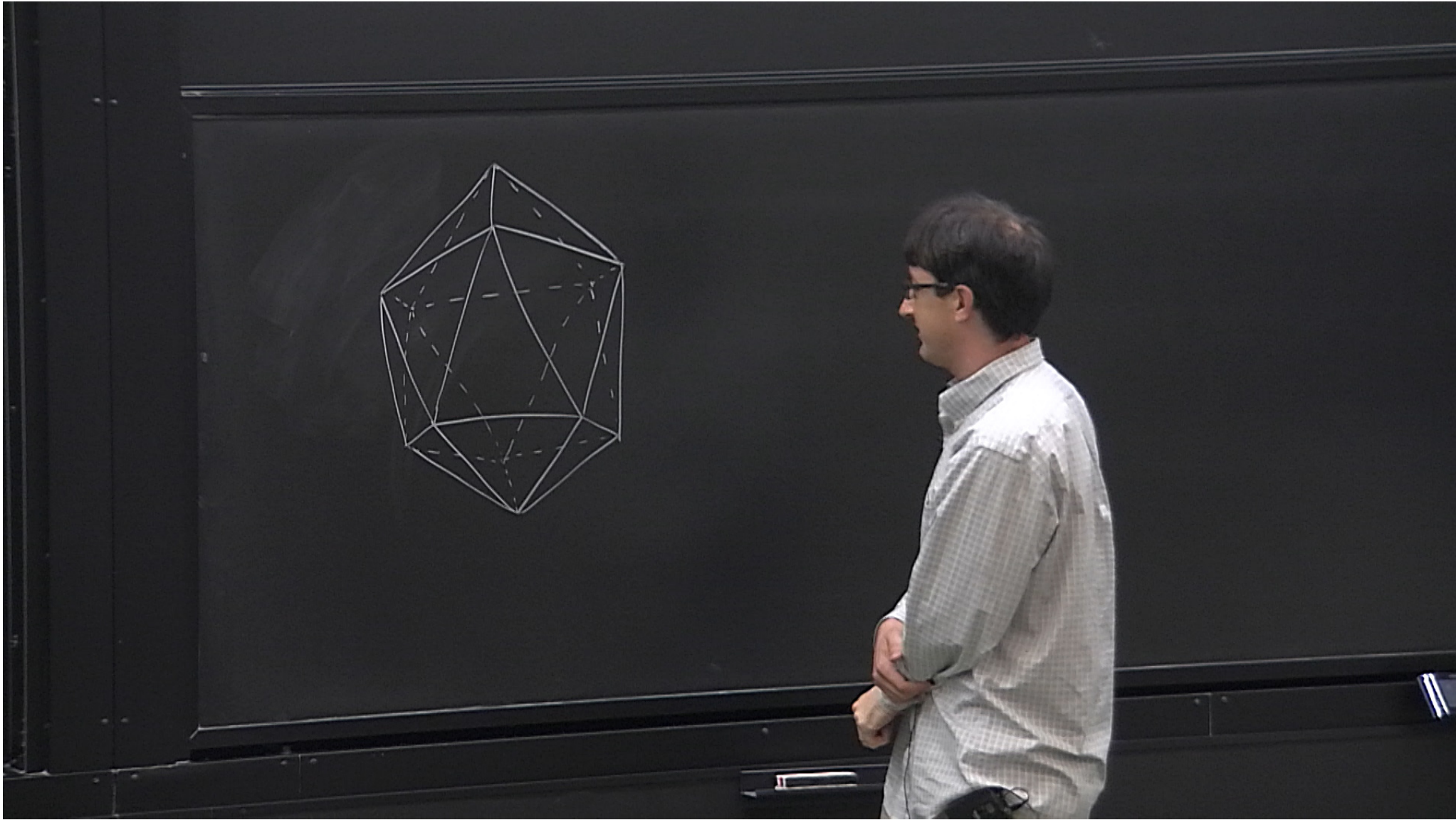
→ C = charge conjugation

→ P = parity

→ T = time reversal

CPT

"spontaneously broken"





conjugation

reversal

"spontaneously broken"

	SU(3)	SU(2)	U(1)
$q_L^i$	3	2	$1/6$
$u_R$	3	1	$2/3$
$d_R$	3	1	$-1/3$
$l_L^i$	1	2	$-1/2$
$\nu_R^i$	1	1	0
$e_R^i$	1	1	-1

"gauge bosons"  
spin 2

$$q_L = \begin{pmatrix} u_L \\ d_L \end{pmatrix}$$

$l_L$