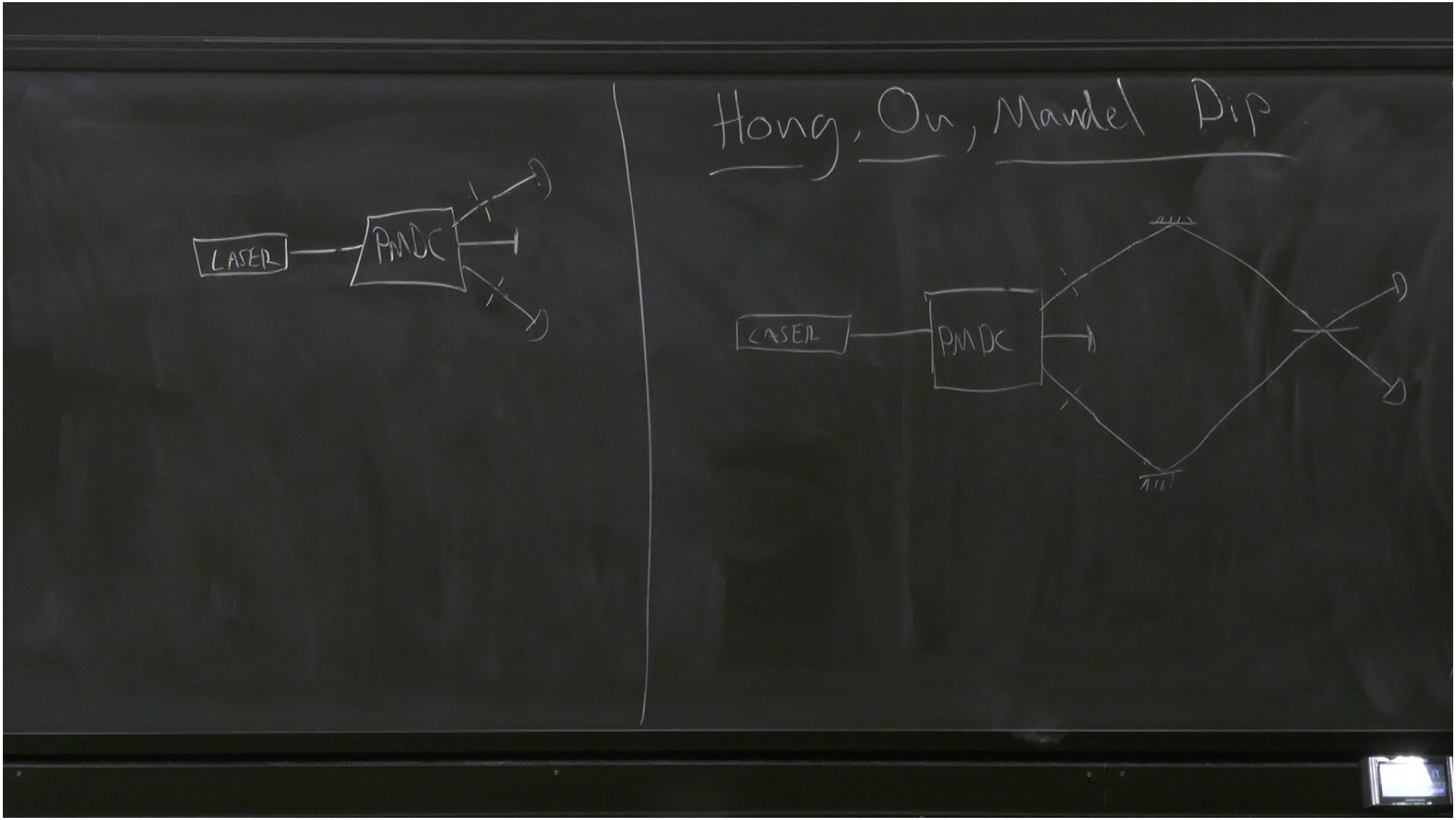
Title: Quantum Foundations Lecture

Speakers: Lucien Hardy

Collection: Quantum Foundations

Date: January 17, 2024 - 10:15 AM

URL: https://pirsa.org/24010063


LASER
PMDC
Hong, Ou, Mandel Dip
LASER
PMDC

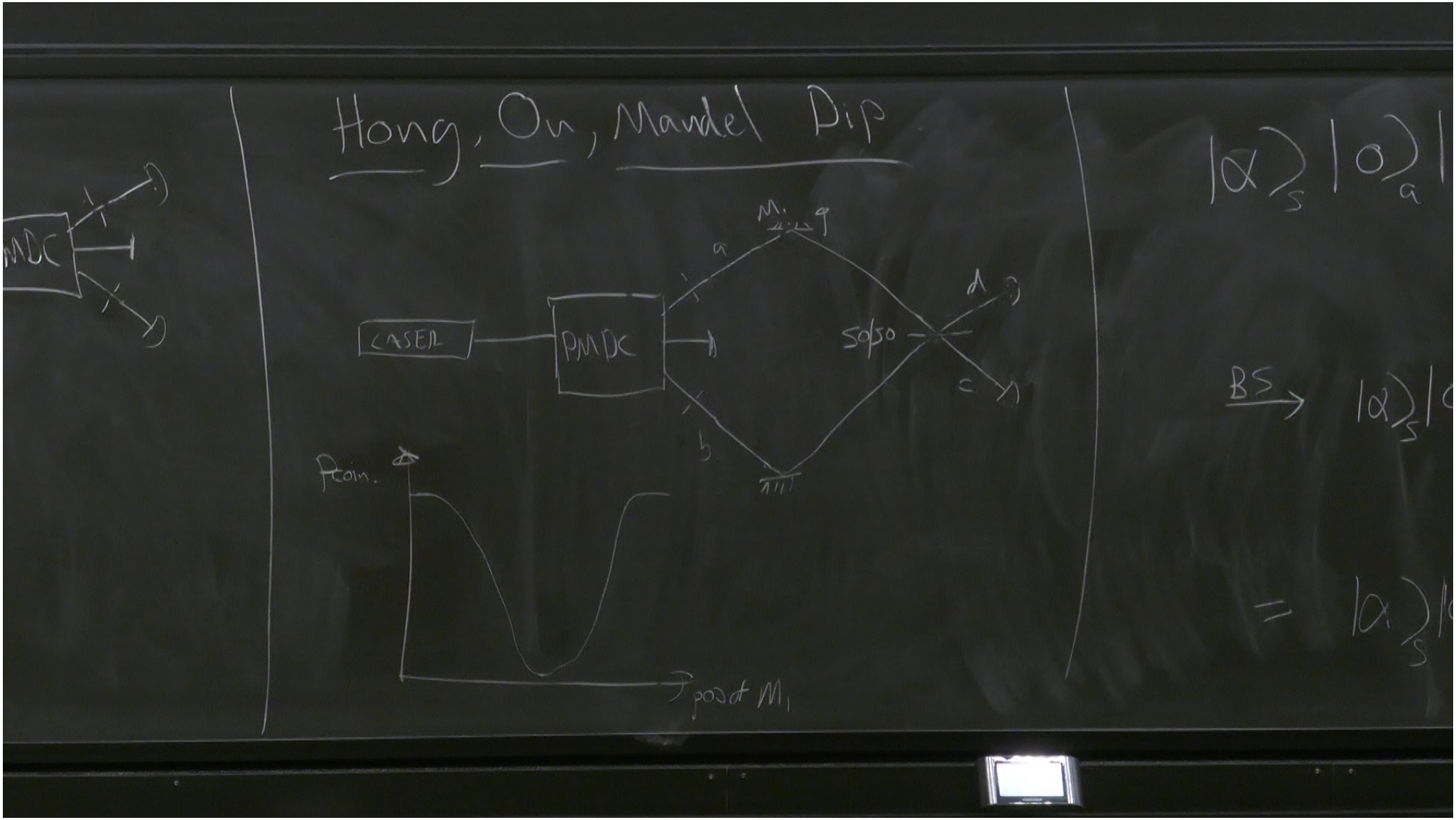
$$|\alpha\rangle_s|0\rangle_a|0\rangle_b \xrightarrow{\text{PNDC}} |\alpha\rangle_s|0\rangle_a|0\rangle_b - c\alpha|\alpha\rangle_s|1\rangle_a|1\rangle_b$$

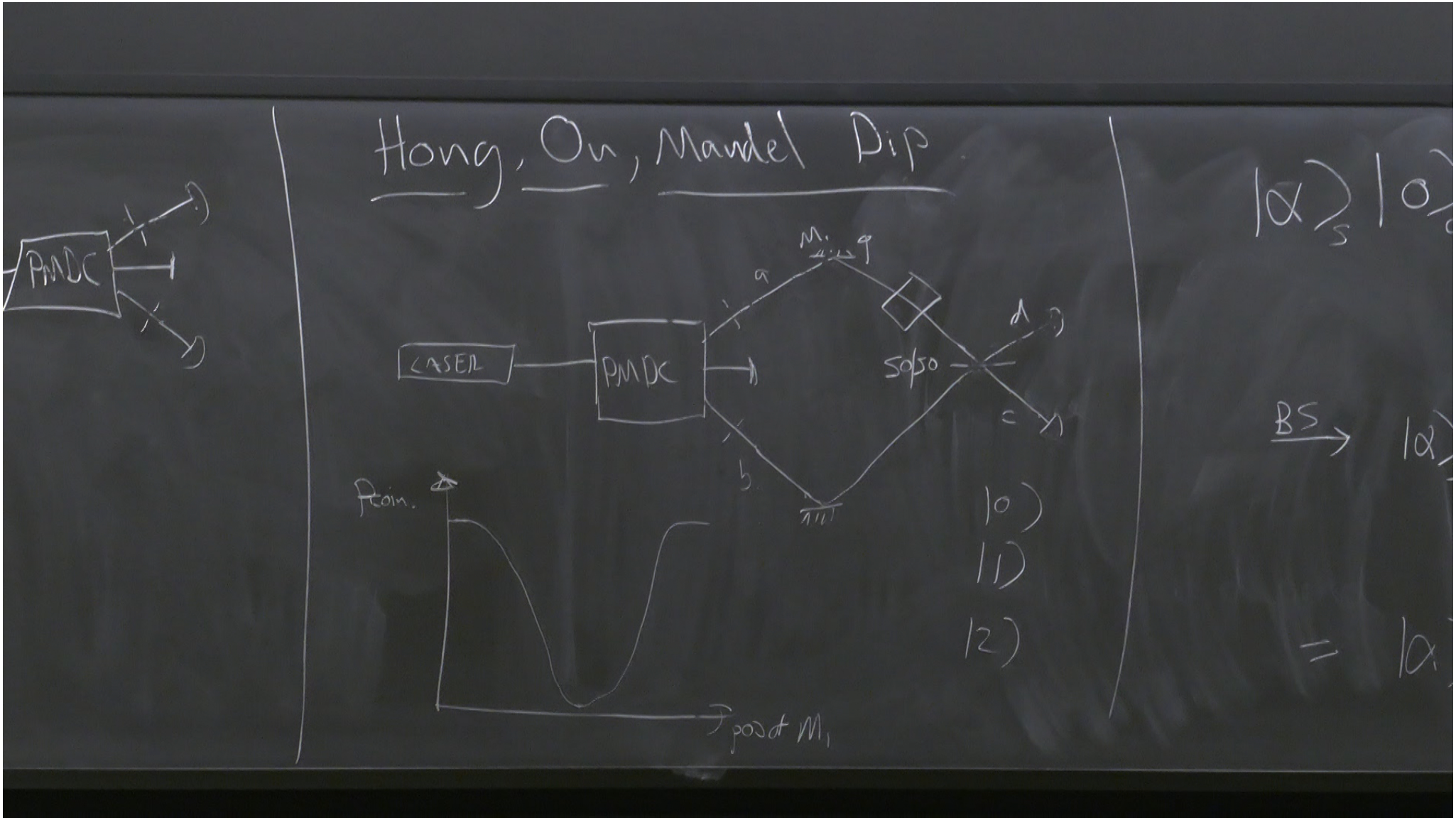
$$= |\alpha\rangle_s|0\rangle_a|0\rangle_b - c\alpha\hat{a}^\dagger\hat{b}^\dagger|\alpha\rangle_s|0\rangle_a|0\rangle_b$$

$$\xrightarrow{\text{BS}} |\alpha\rangle_s|0\rangle_a|0\rangle_b - c\alpha\frac{1}{2}\underbrace{(\hat{c}^\dagger + i\hat{d}^\dagger)(i\hat{c}^\dagger + \hat{d}^\dagger)}|\alpha\rangle_s|0\rangle_c|0\rangle_d$$

$$i\hat{c}^\dagger\hat{c}^\dagger + i\hat{d}^\dagger\hat{d}^\dagger + (\hat{c}^\dagger\hat{d}^\dagger - \hat{d}^\dagger\hat{c}^\dagger) \quad [\hat{c}^\dagger, \hat{d}^\dagger] = 0$$

$$= |\alpha\rangle_s|0\rangle_a|0\rangle_b - \frac{i\sqrt{2}c\alpha}{2}|\alpha\rangle_s|2\rangle_c|0\rangle_d - \frac{\sqrt{2}c\alpha}{2}|\alpha\rangle_s|0\rangle_c|2\rangle_d$$


Hong, Ou, Mandel Dip
PMDC
LASER
PMDC
50/50
M1
a
b
c
d
Rcoin.
pos at M1
|α⟩s |0⟩a
BS
|α⟩s |0
= |α⟩s


PMDC
Hong, Ou, Mandel Dip
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R coin.
pos at M1
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10)
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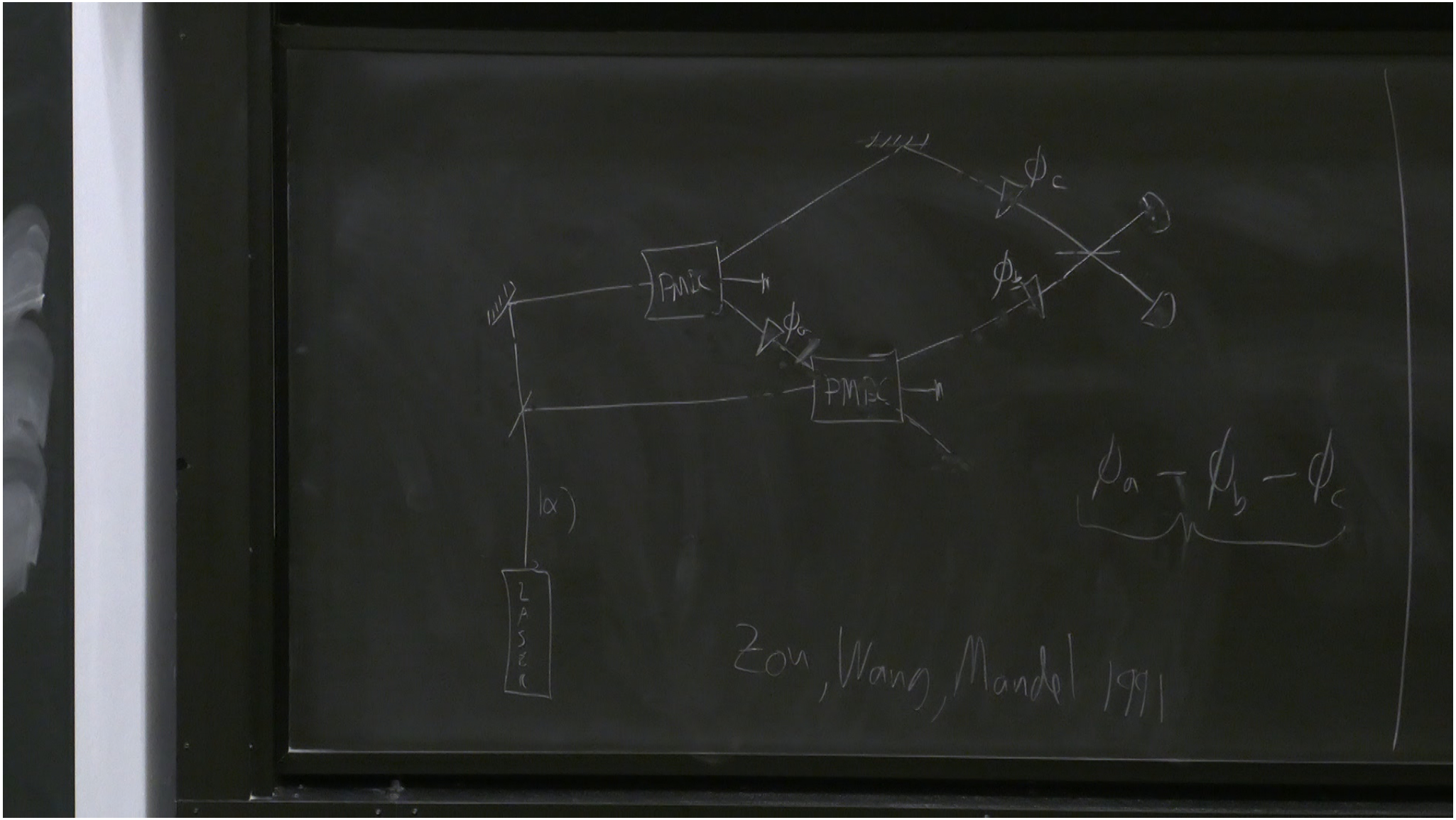
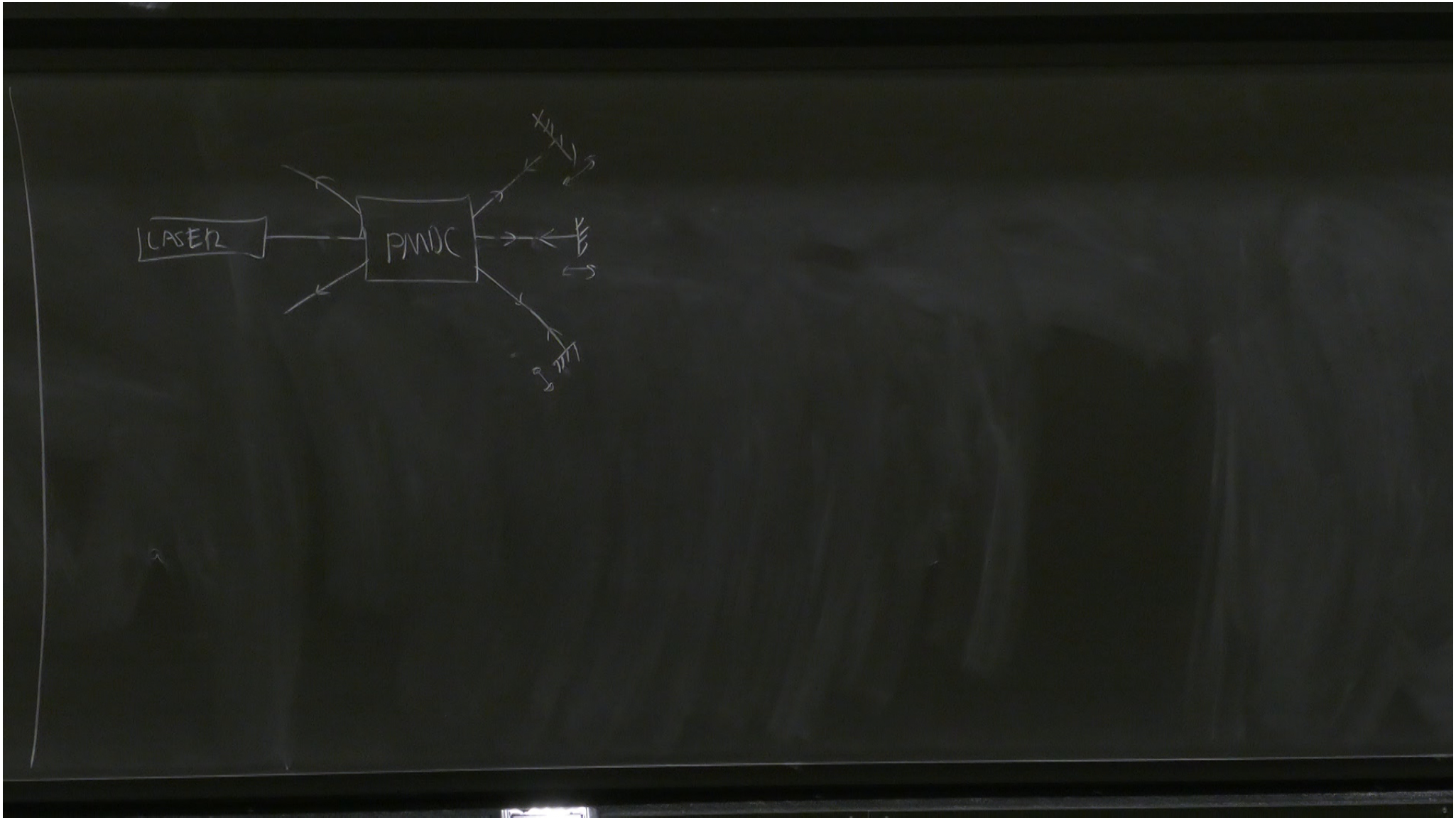
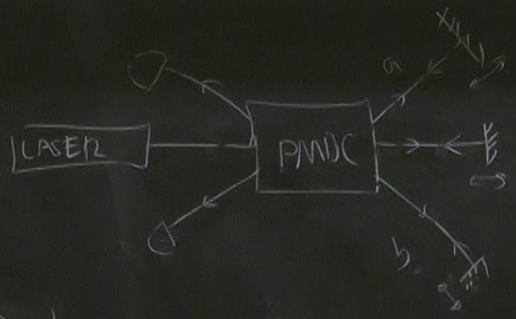

PMDC
PMDC
LASER
Zou, Wang, Mandel 1991


LASER
PMDC



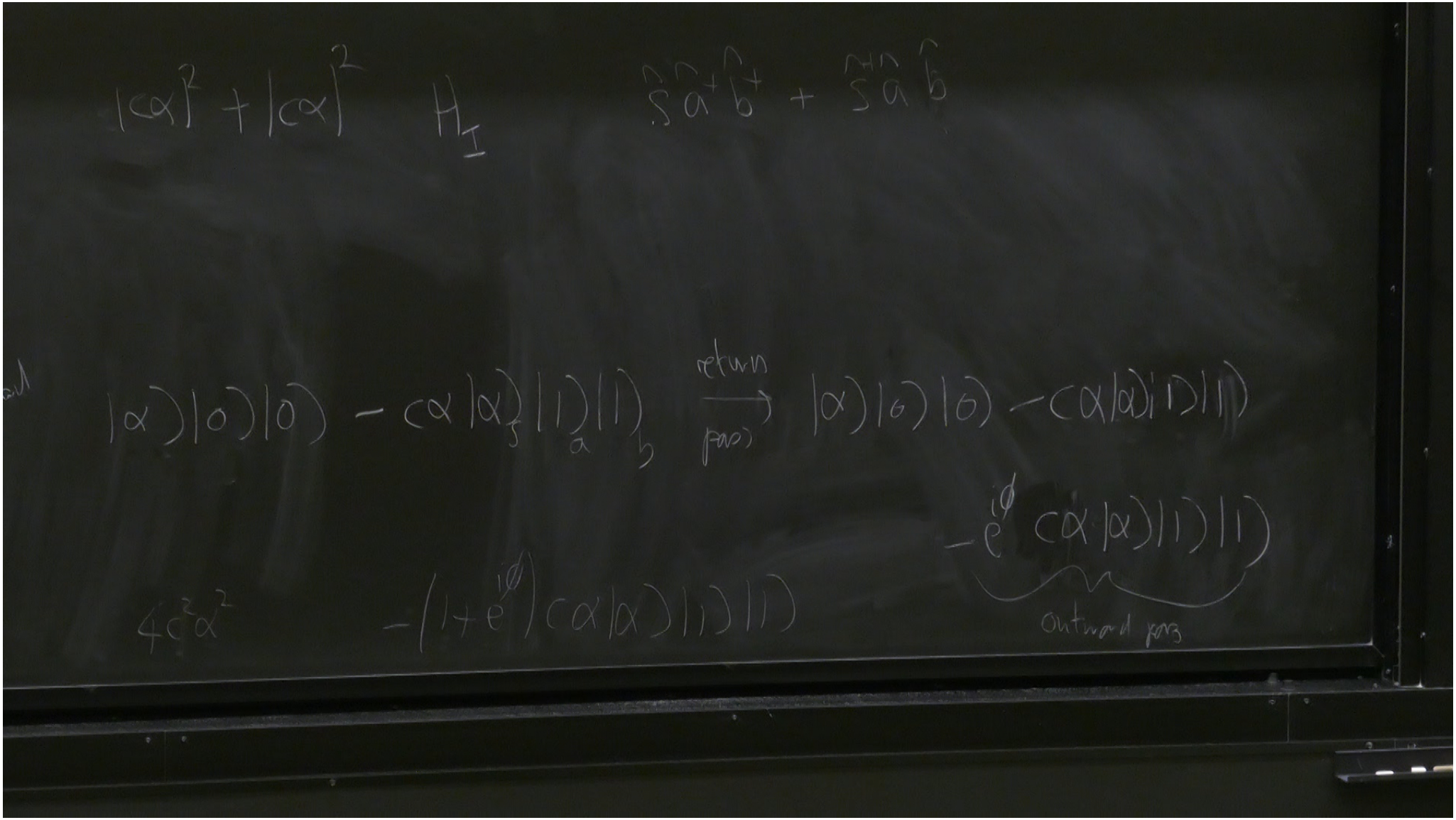
Zeilinger's group

$|\alpha|^2 + |\alpha|^2$ H_I $\hat{s}\hat{a}^\dagger\hat{b}^\dagger + \hat{s}\hat{a}\hat{b}$

$|\alpha\rangle|0\rangle_a|0\rangle_b \xrightarrow{\text{outward pass}} |\alpha\rangle|0\rangle|0\rangle - c\alpha|\alpha\rangle_s|1\rangle_a|1\rangle_b \xrightarrow{\text{return pass}} |\alpha\rangle|0\rangle|0\rangle - c\alpha|\alpha\rangle|1\rangle|1\rangle$

$-e^{i\phi}c\alpha|\alpha\rangle|1\rangle|1\rangle$

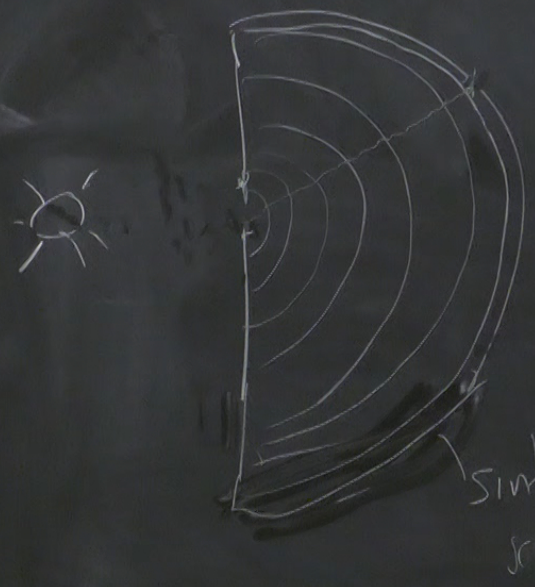
$4c^2\alpha^2$ $-(1+e^{i\phi})c\alpha|\alpha\rangle|1\rangle|1\rangle$

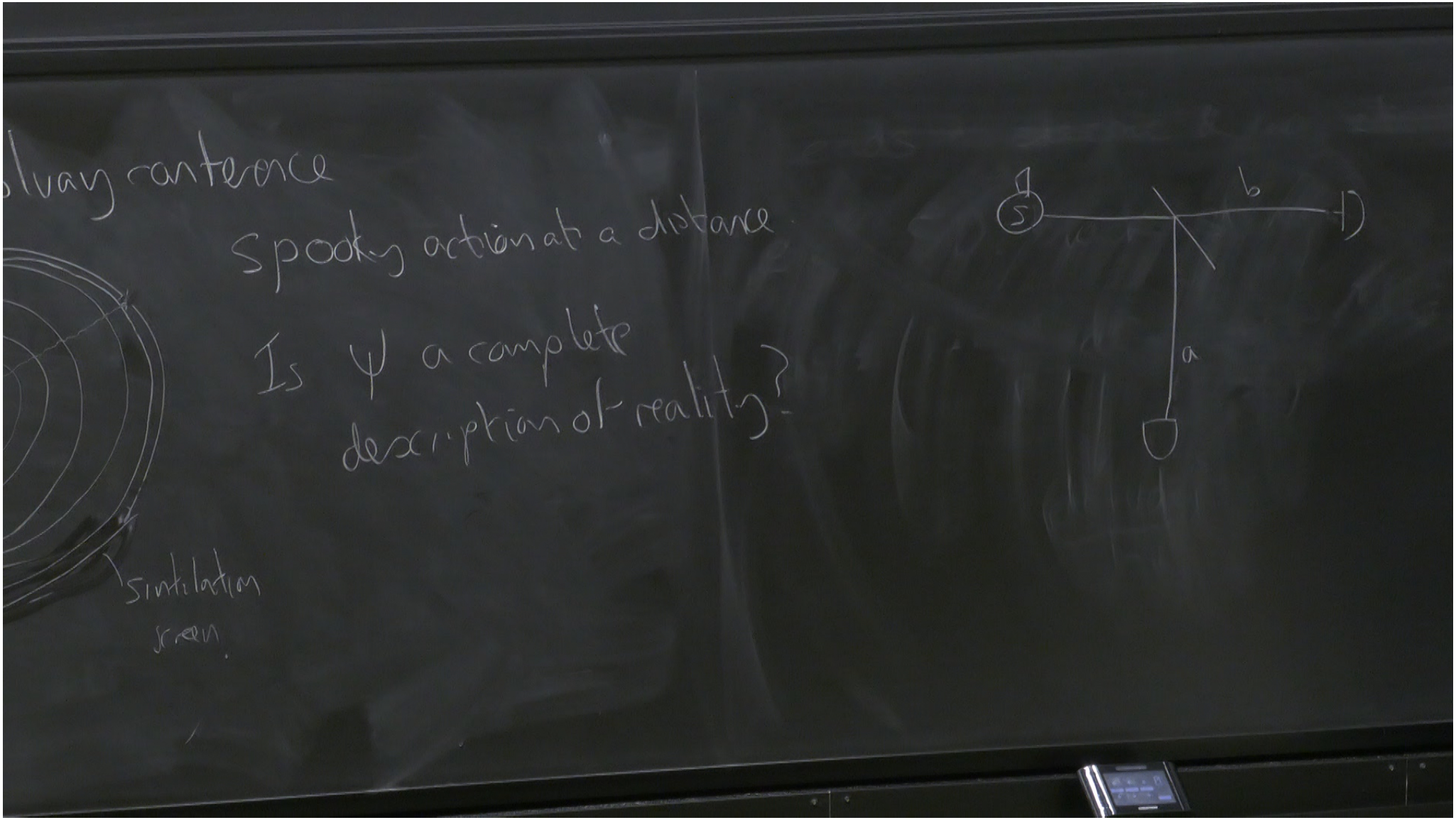

$|\alpha|^2 + |\alpha|^2$
H_I
$\hat{s}\hat{a}^\dagger\hat{b}^\dagger + \hat{s}^*\hat{a}\hat{b}$
$|\alpha\rangle|0\rangle|0\rangle - c\alpha|\alpha\rangle_s|1\rangle_a|1\rangle_b$
return
pass
$|\alpha\rangle|0\rangle|0\rangle - c\alpha|\alpha\rangle|1\rangle|1\rangle$
$-e^{i\phi}c\alpha|\alpha\rangle|1\rangle|1\rangle$
outward pass
$4c^2\alpha^2$
$-(1+e^{i\phi})c\alpha|\alpha\rangle|1\rangle|1\rangle$

1927 Solvay conference

spooky action at a distance

Is ψ a complete description of reality?




lway conference
Spooky action at a distance
Is ψ a complete
description of reality?
Scintillation
screen
S
b
a