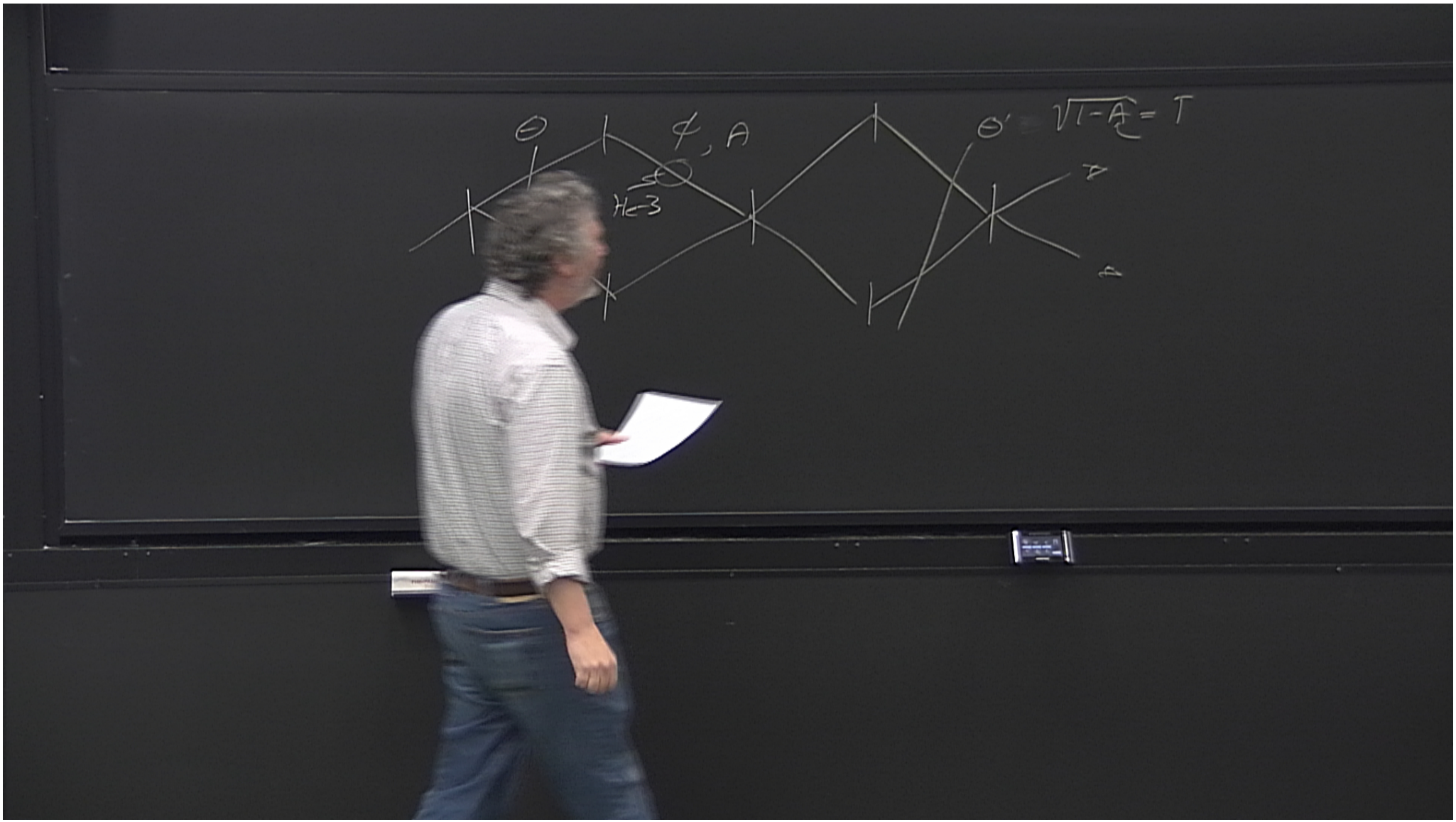
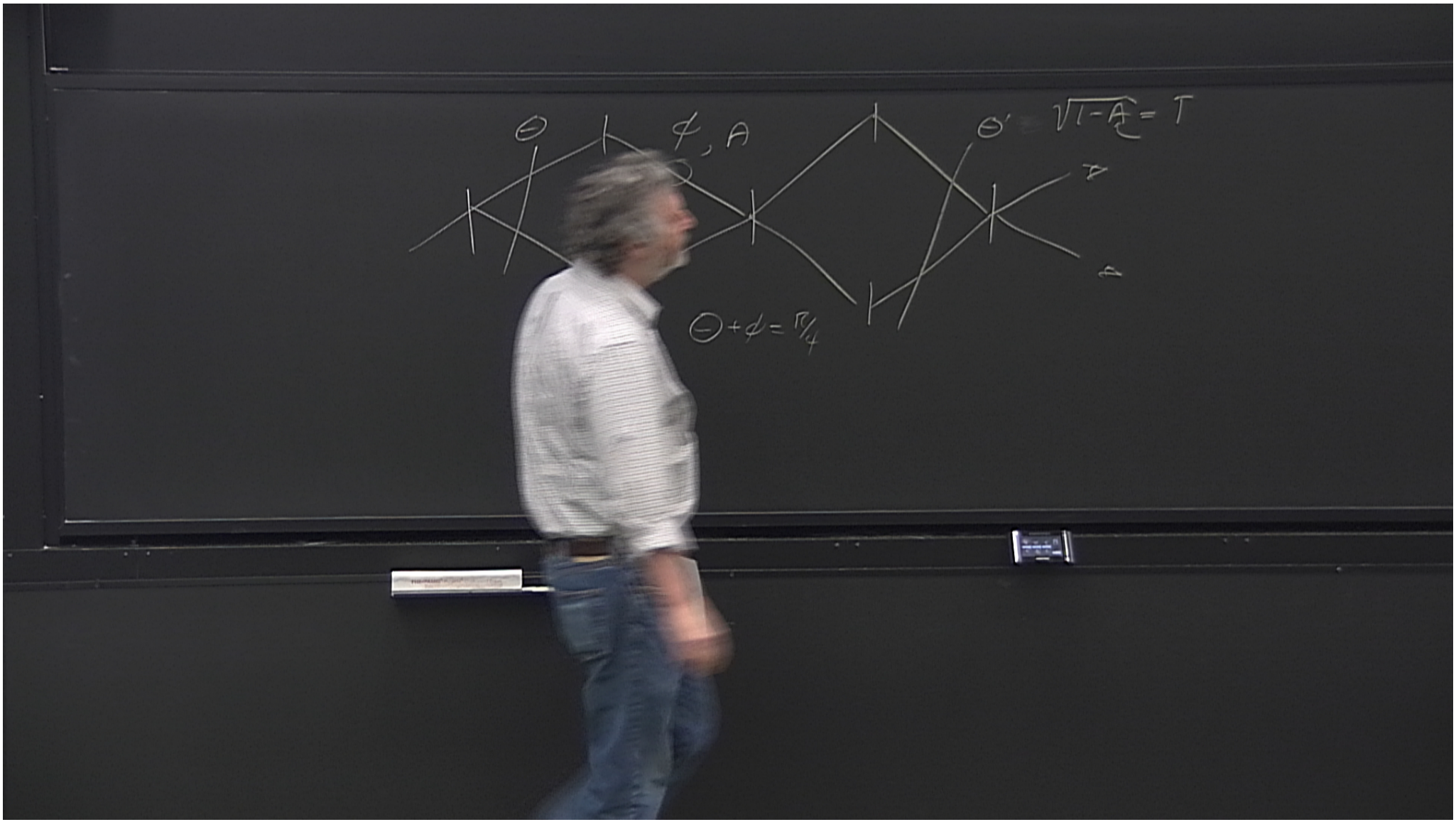
Title: 13/14 PSI - Explorations in Quantum Information - Lecture 3

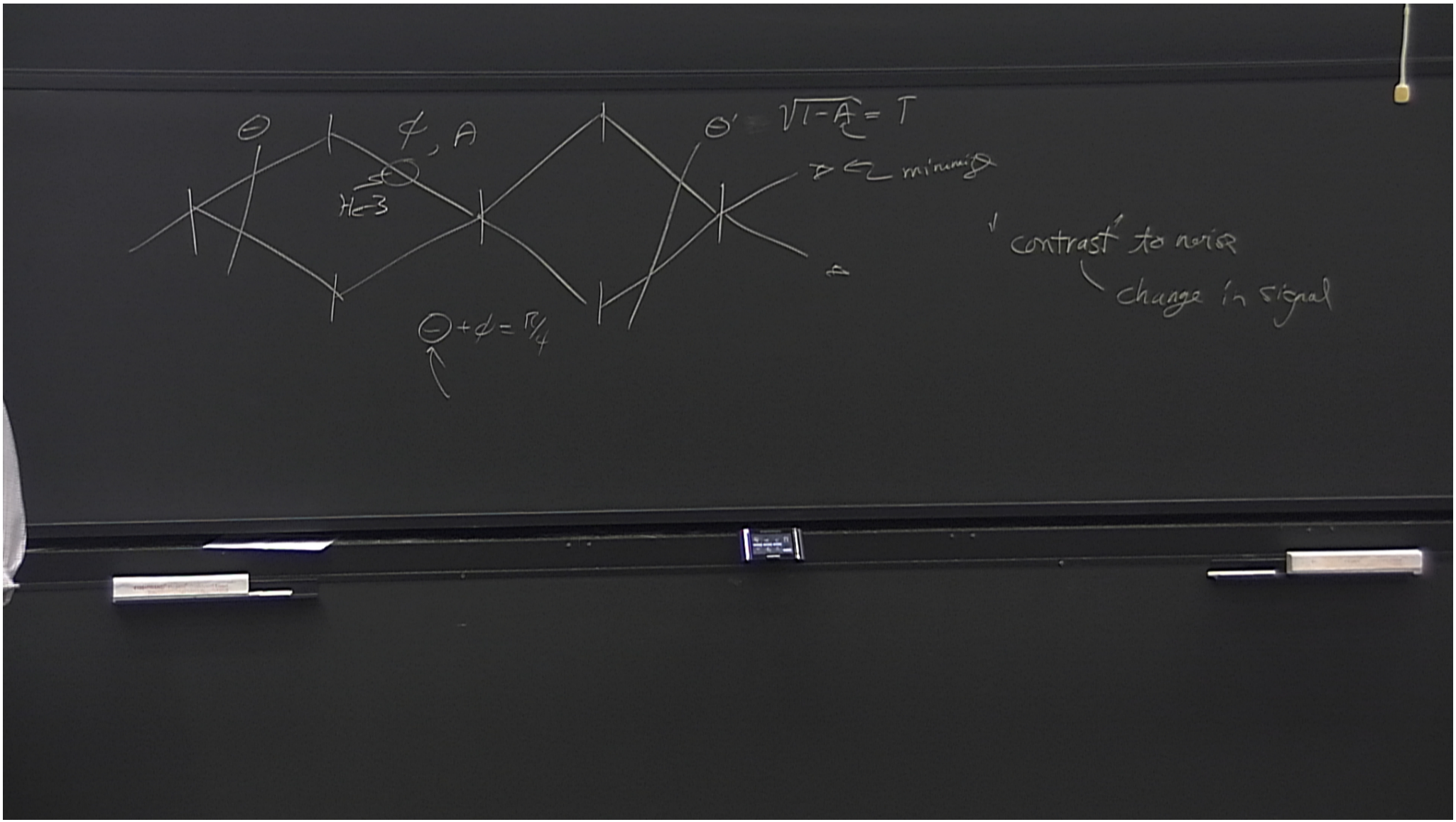
Date: Mar 19, 2014 09:00 AM

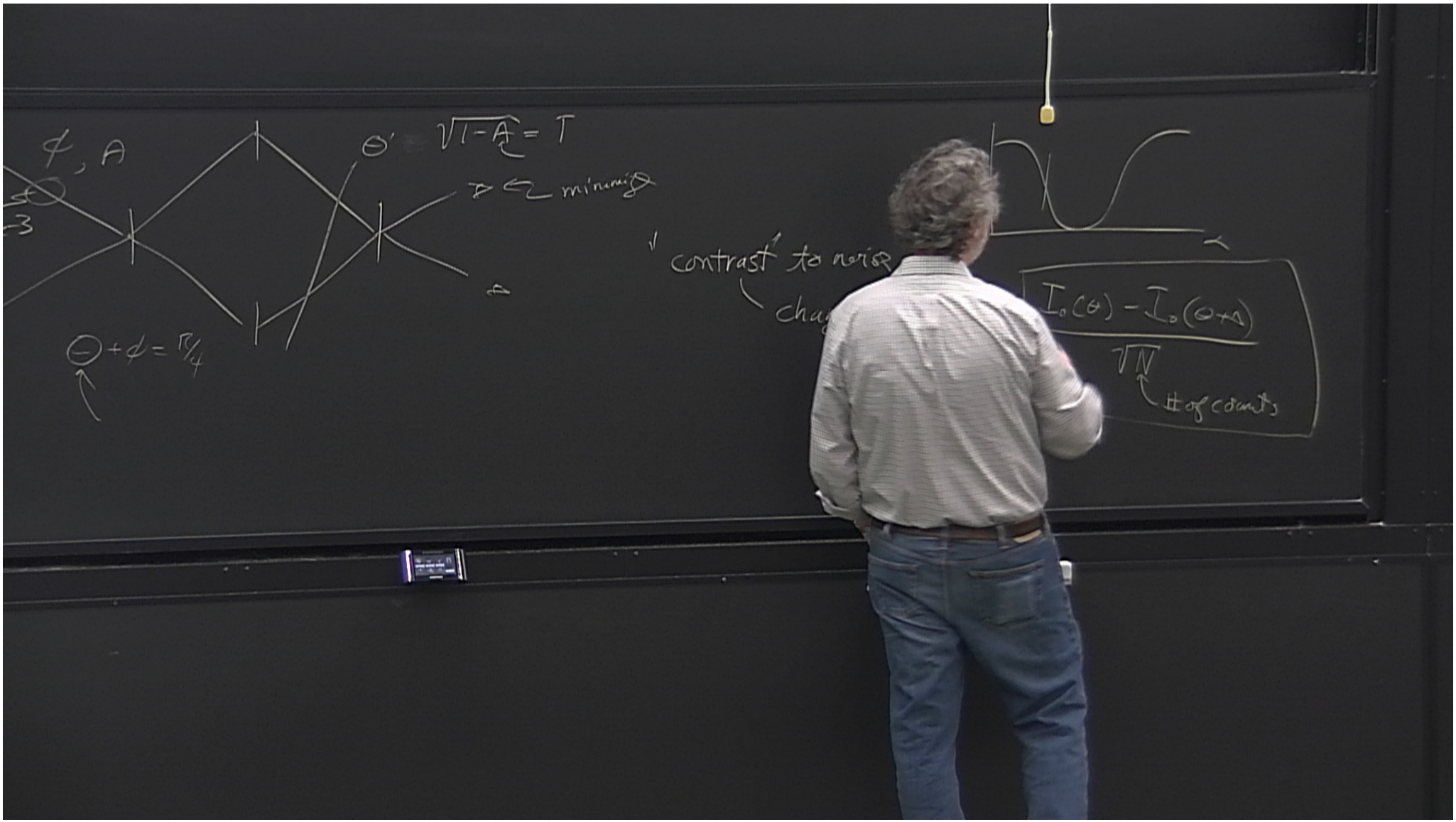
URL: http://pirsa.org/14030031

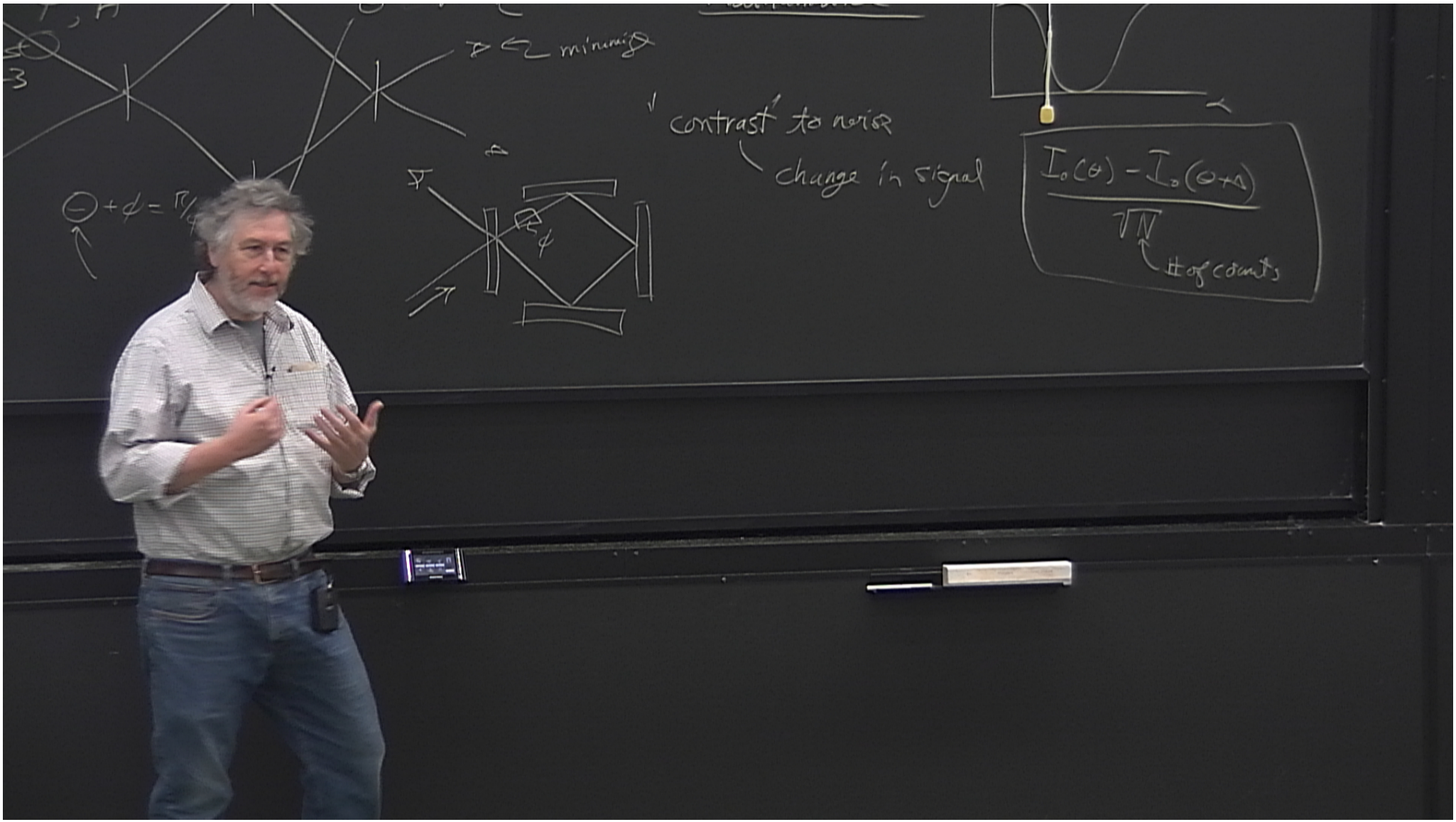
Abstract:

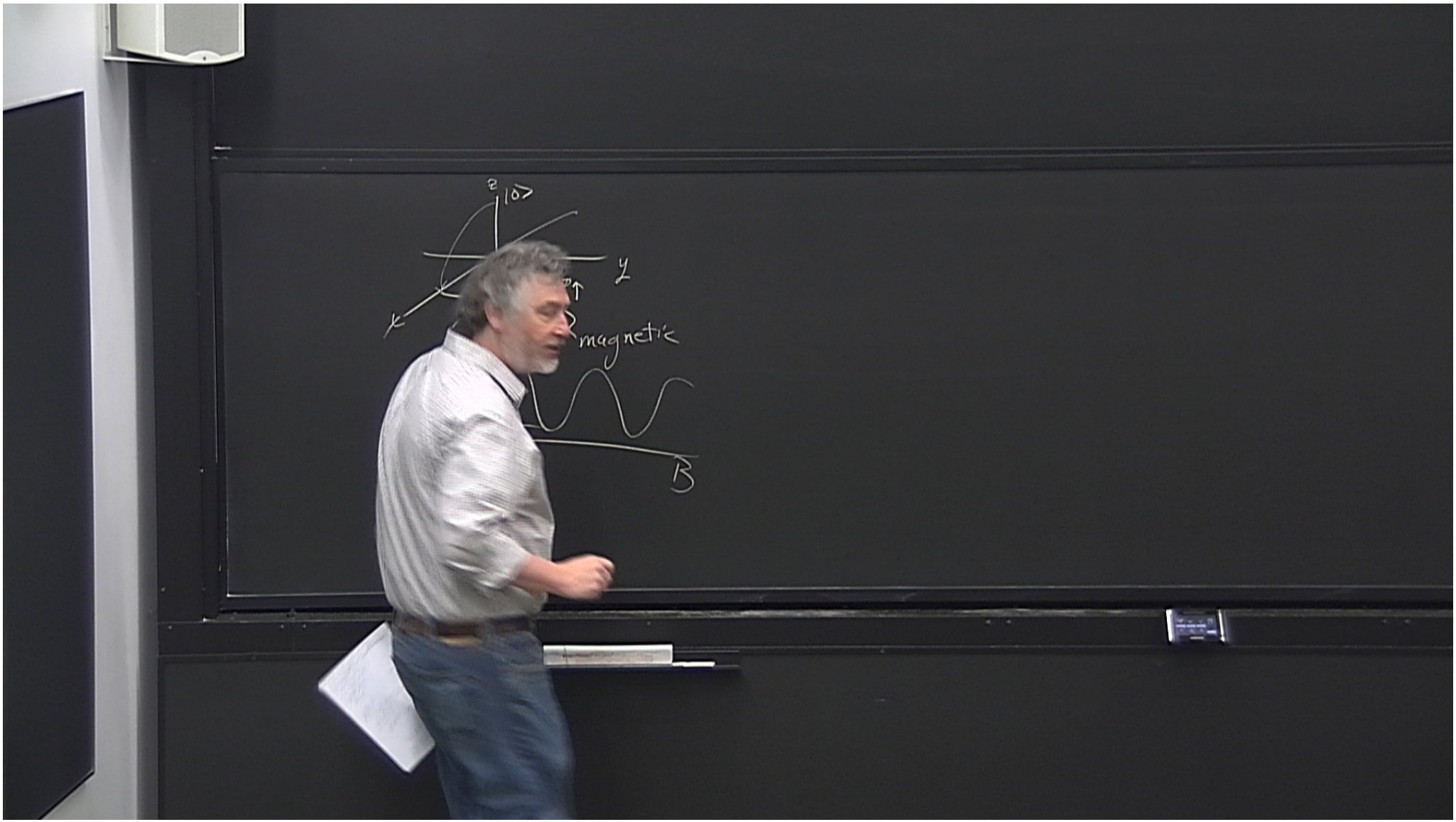

Θ
φ, A
Θ'
√1−A² = T

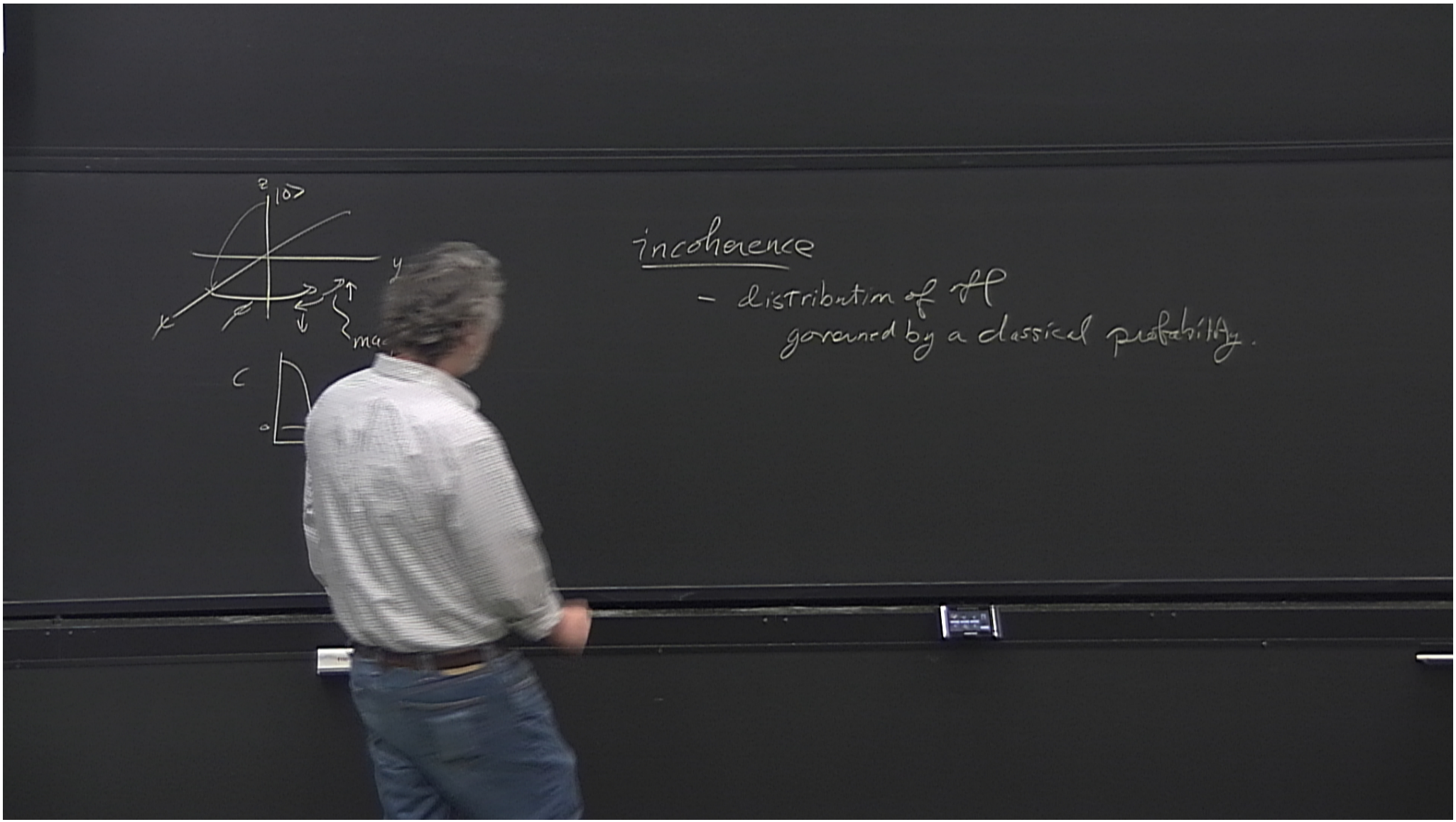

θ
φ, A
θ'
√(1−A²) = T
θ+φ = π/4

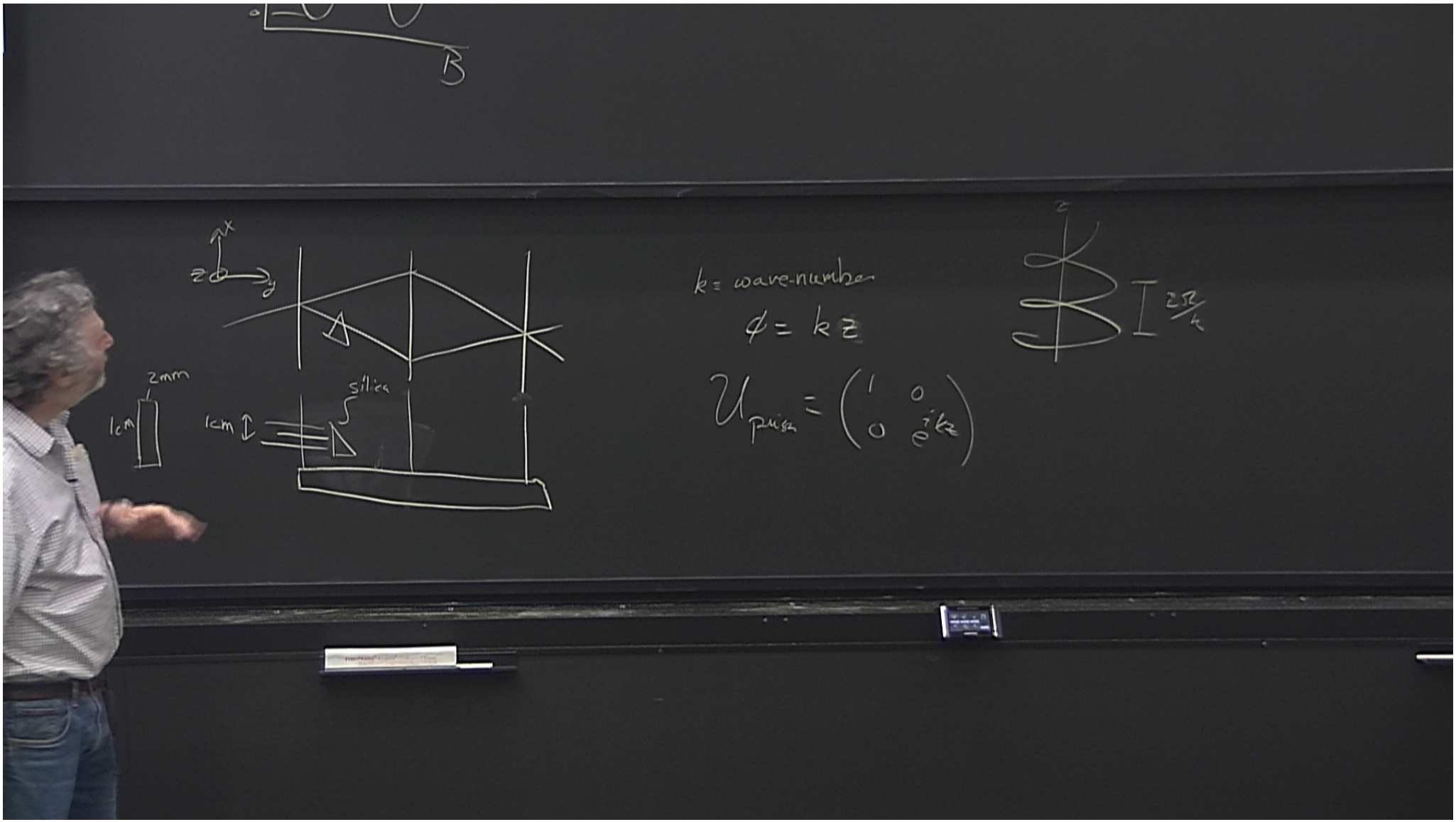

θ
φ, A
H=-3
θ'
√(1-A²) = T
minimize
contrast to noise
change in signal
θ + φ = π/4

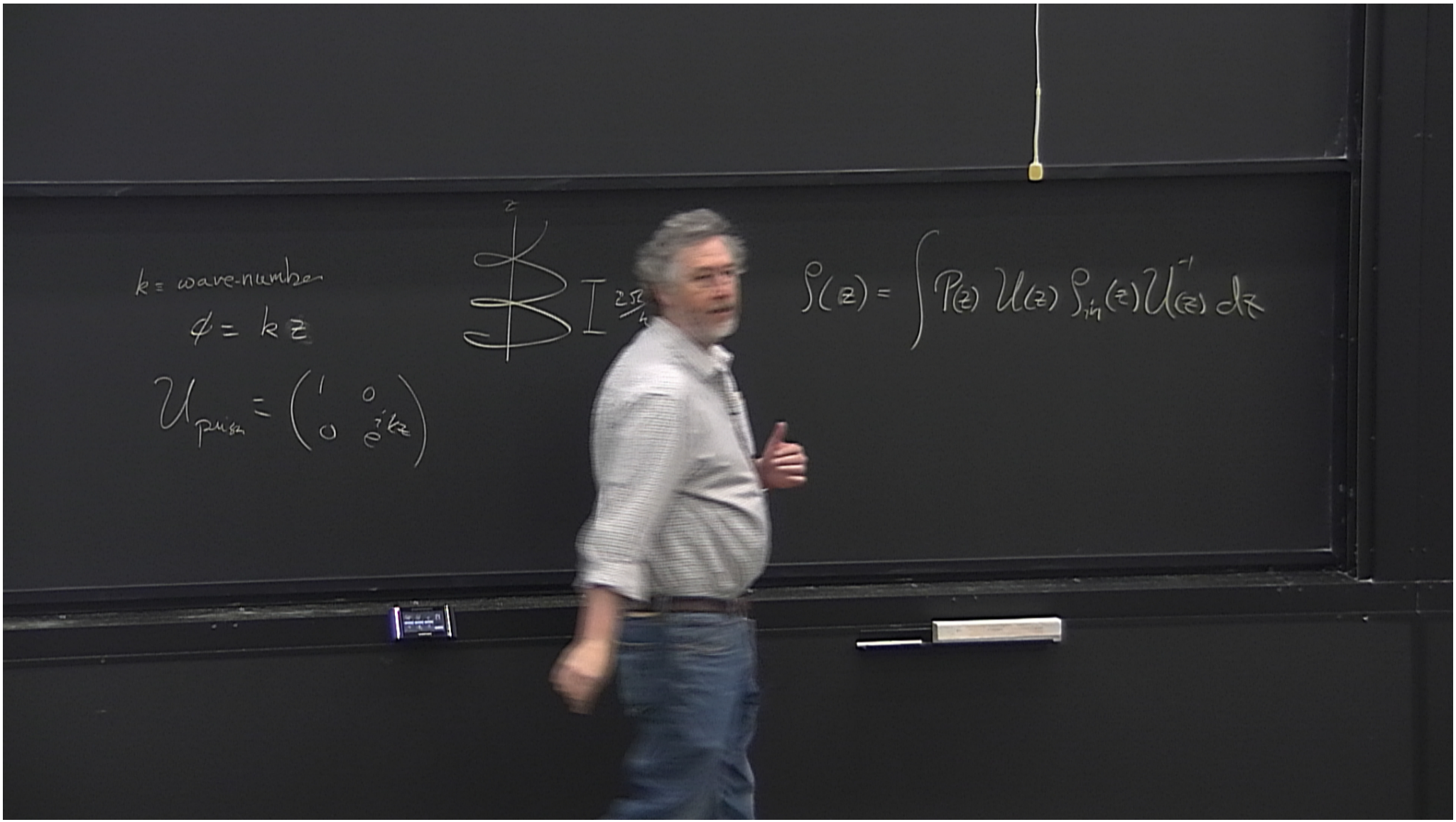

$\sqrt{1-A} = T$
minimize
contrast to noise
$\frac{I_0(\theta) - I_0(\theta+\Delta)}{\sqrt{N}}$
# of counts

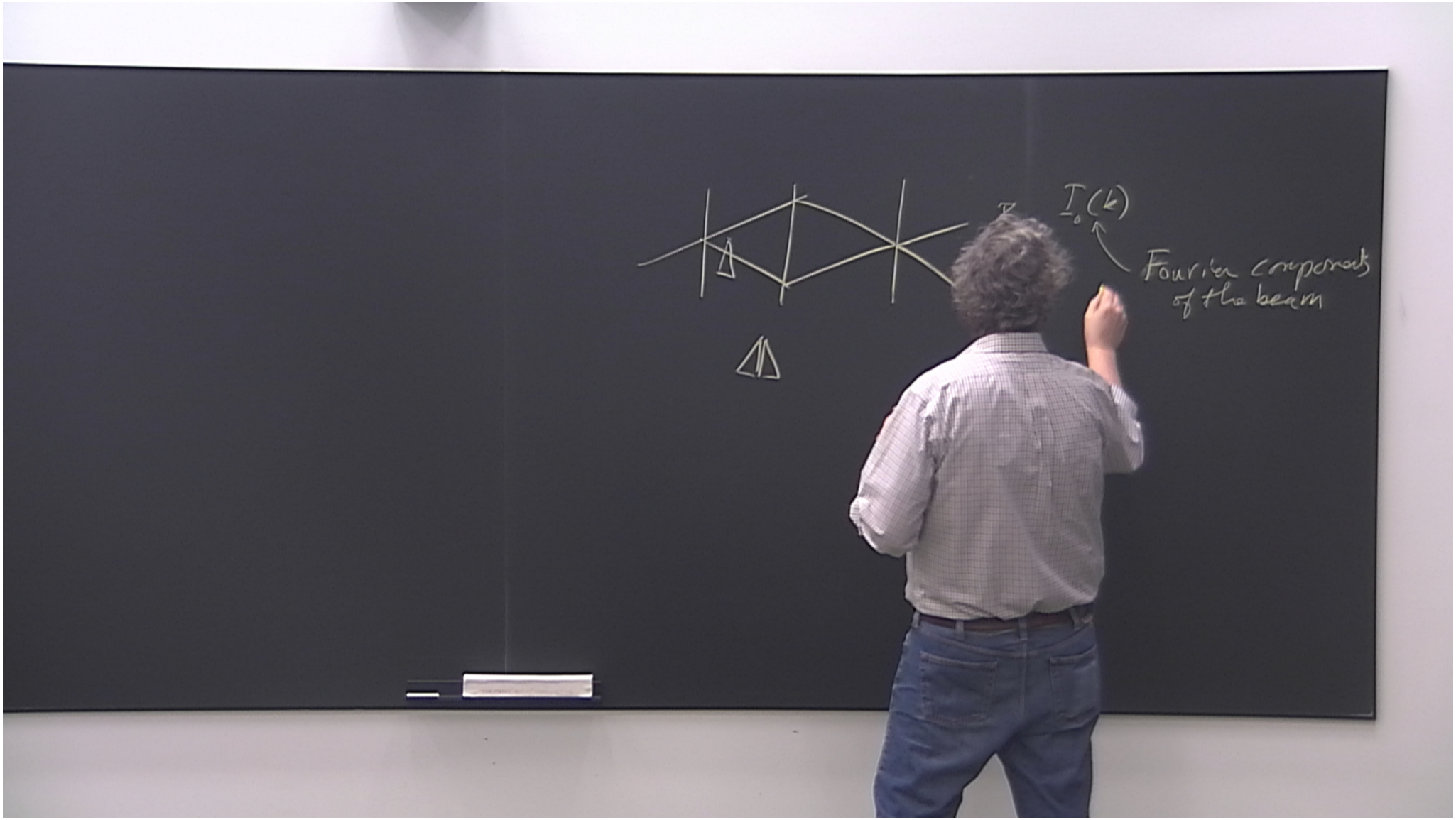

minimum
contrast to noise
change in signal
$\frac{I_0(\theta) - I_0(\theta+\Delta)}{\sqrt{N}}$
# of counts


z
|0>
y
x
magnetic
B


|0>
y
x
C
incoherence
- distribution of ρ
governed by a classical probability.


B
x
z
y
2mm
1cm
1cm
silica
k = wave-number
$\phi = kz$
$U_{prism} = \begin{pmatrix} 1 & 0 \\ 0 & e^{ikz} \end{pmatrix}$
z
$2\pi/k$


k = wave-number
$\phi = kz$
$U_{prism} = \begin{pmatrix} 1 & 0 \\ 0 & e^{ikz} \end{pmatrix}$
$\rho(z) = \int P(z)\, U(z)\, \rho_{in}(z)\, U^{-1}(z)\, dz$


$I_0(k)$
Fourier components of the beam

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QE Lec 3.cdf

element of the distribution remains pure.

We will take the *z*-distribution of the neutron beam to have support over ±5 mm, with uniform probability over this range. We can describe the distribution via a "top-hat" function. The measured intensity is then integrated over this distribution.

```
M6O[q_,  a_] := Integrate[Tr[Ezp . res6[q,z,a]],{z,-0.5,0.5}]
```

- **Problem 19:**

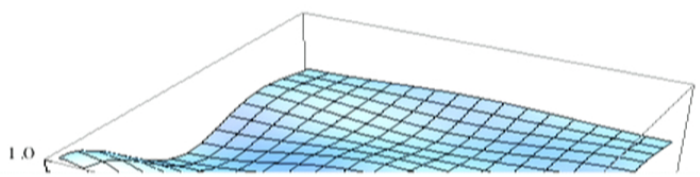
Define a density matrix for fixed *q* and averaged over *z*. What is the purity of this density matrix?

```
M6O[q, a]
```

$$0.5 + \frac{-\mathrm{Sin}[a - 0.5\,q] + \mathrm{Sin}[a + 0.5\,q]}{2\,q}$$

Note that the *q* dependence is a sinc function (the Fourier transform of a top-hat function).

```
Plot3D[M6O[q, a], {a, 0, 2 π}, {q, 0, 20},
 {AxesLabel → { "phase (Radians)", "q", "O-beam intensity"}, PlotRange → {0, 1}}]
```



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QE Lec 3.cdf

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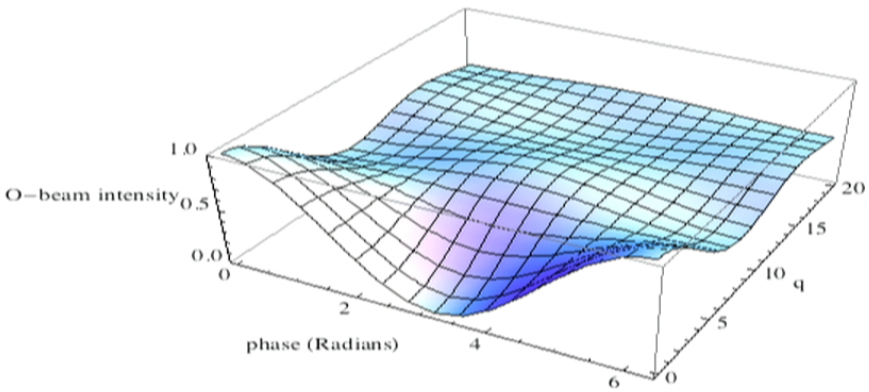
```




```
M6H[q_,  a_] := Integrate[Tr[Ezm . res6[q,z,a]],{z,-0.5,0.5}]
```

```
M6H[q, a]
```

$$0.5\,q + 0.5\,\mathrm{Sin}[a - 0.5\,q] - 0.5\,\mathrm{Sin}[a + 0.5\,q]$$

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