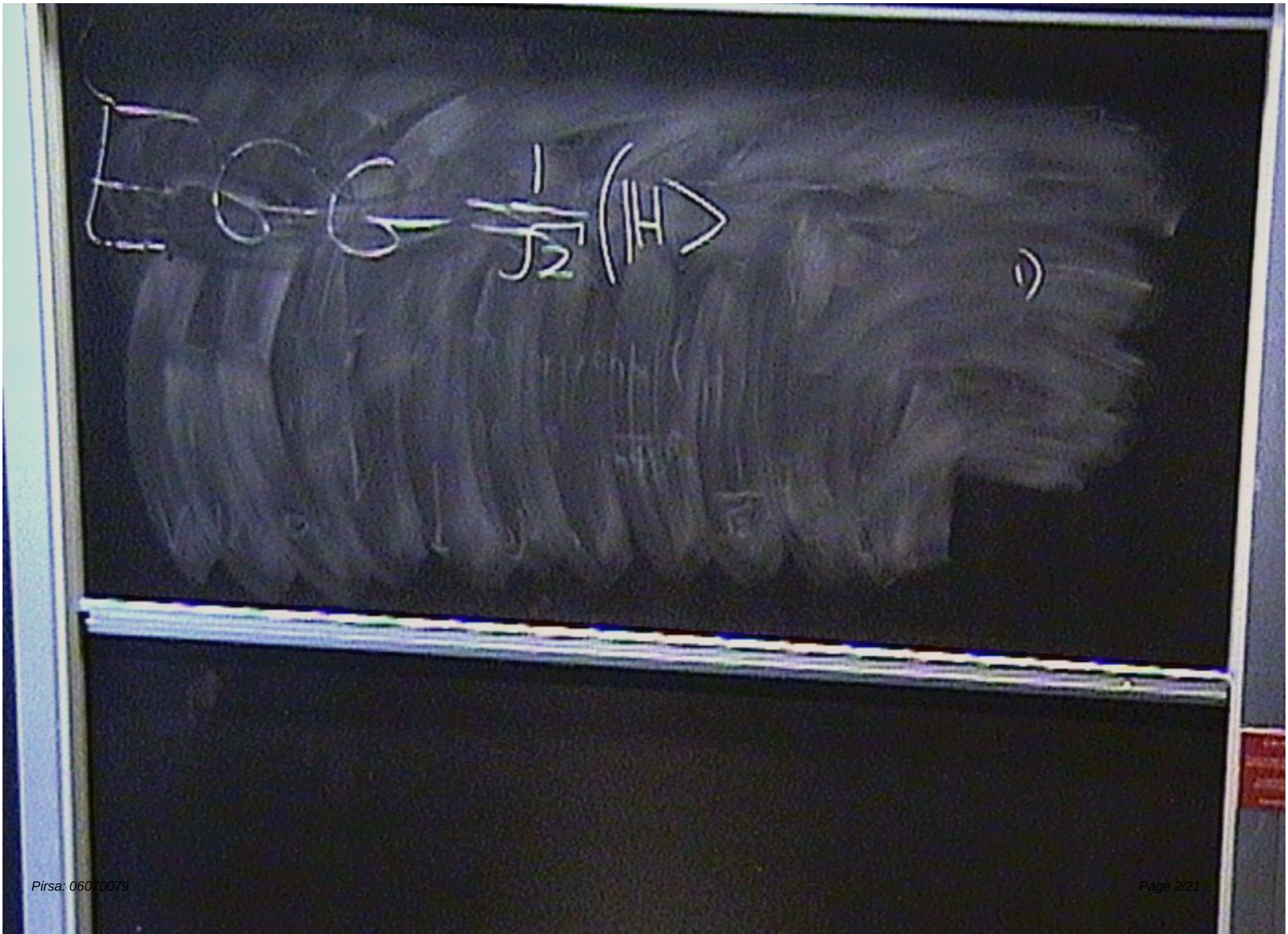
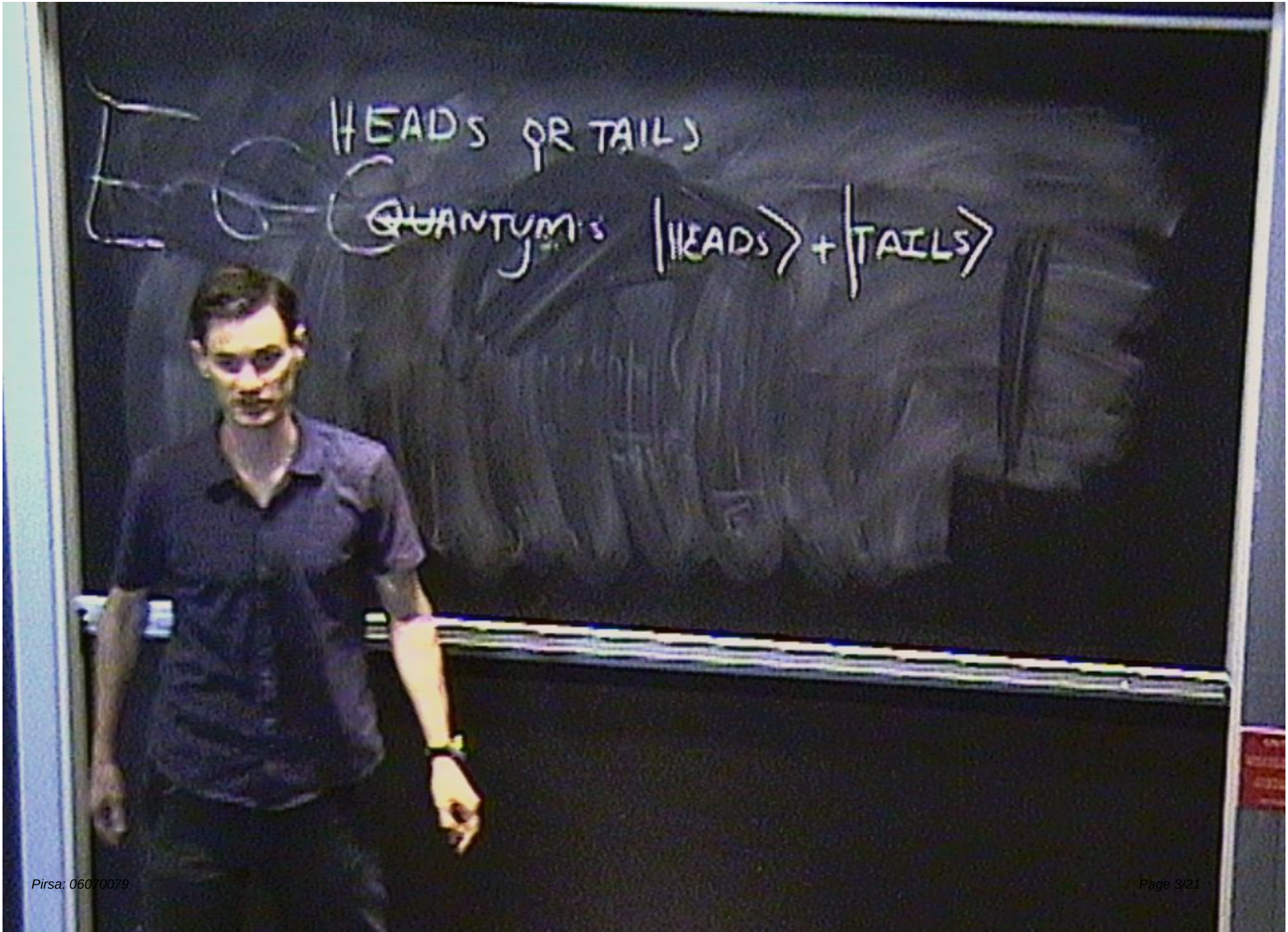
Title: The Weird World of Quantum Physics - Part 8

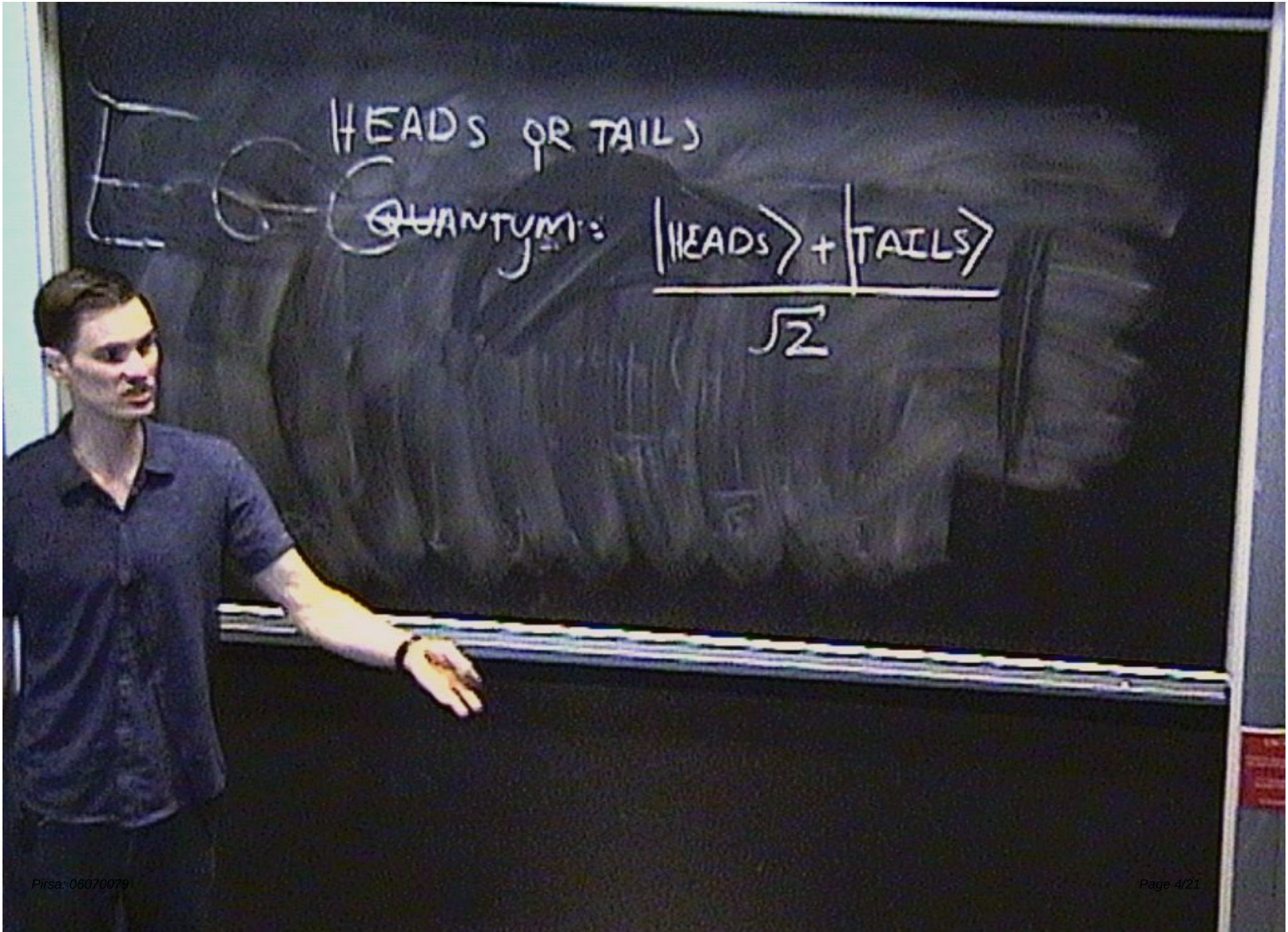
Date: Jul 27, 2006 01:00 PM

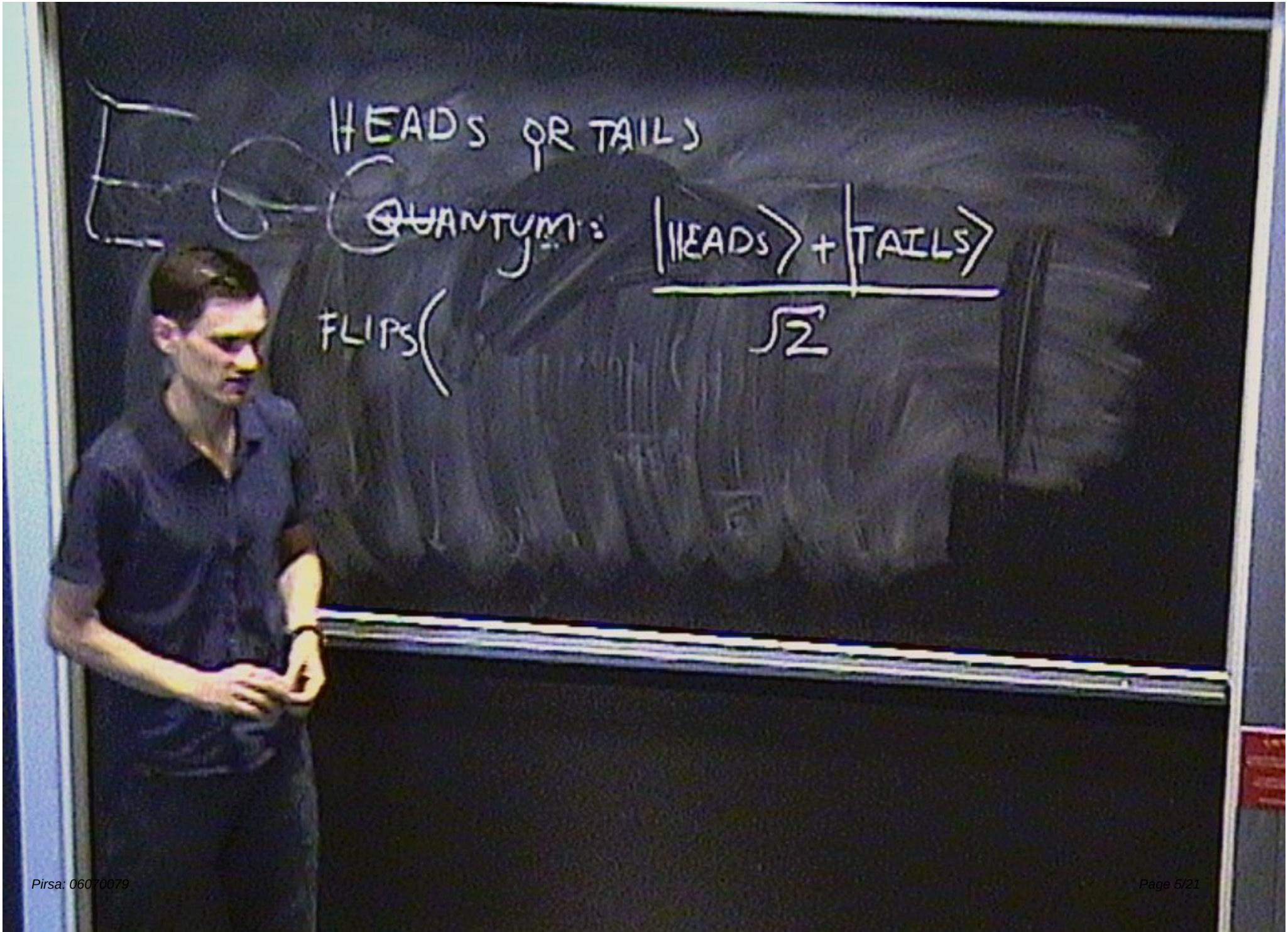
URL: http://pirsa.org/06070079

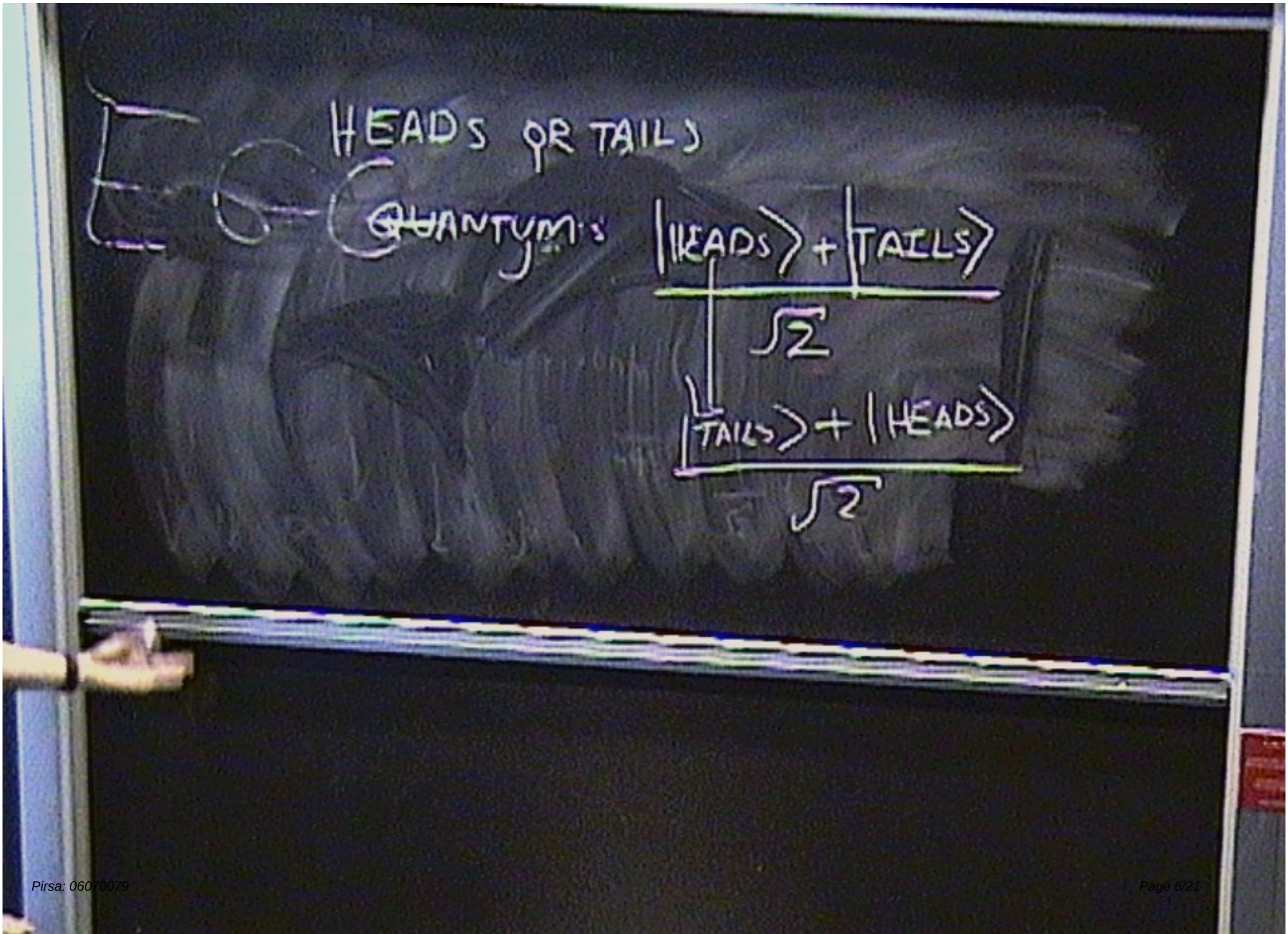
Abstract:

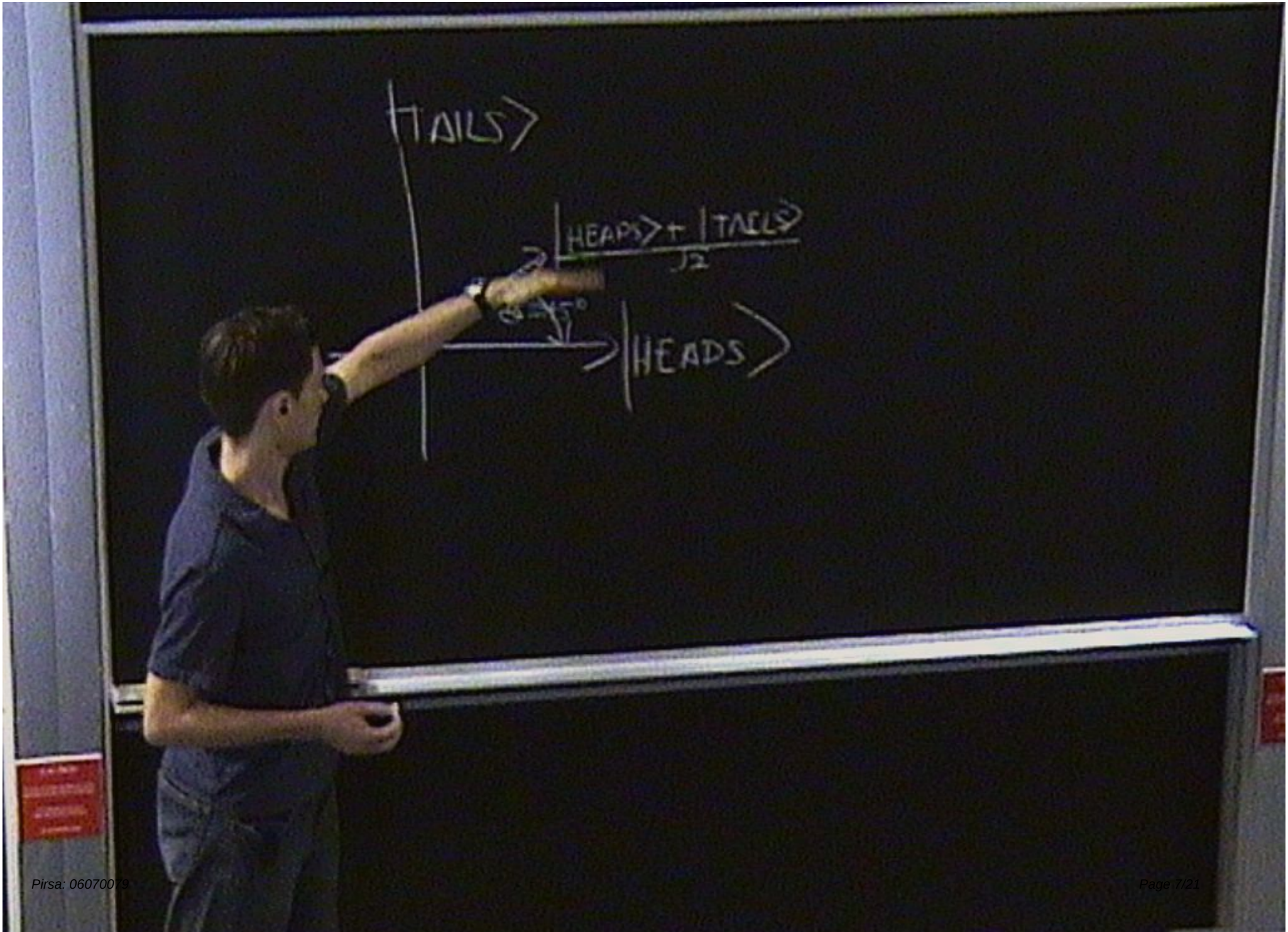

E-G-G-1/J2 (|H>
1)

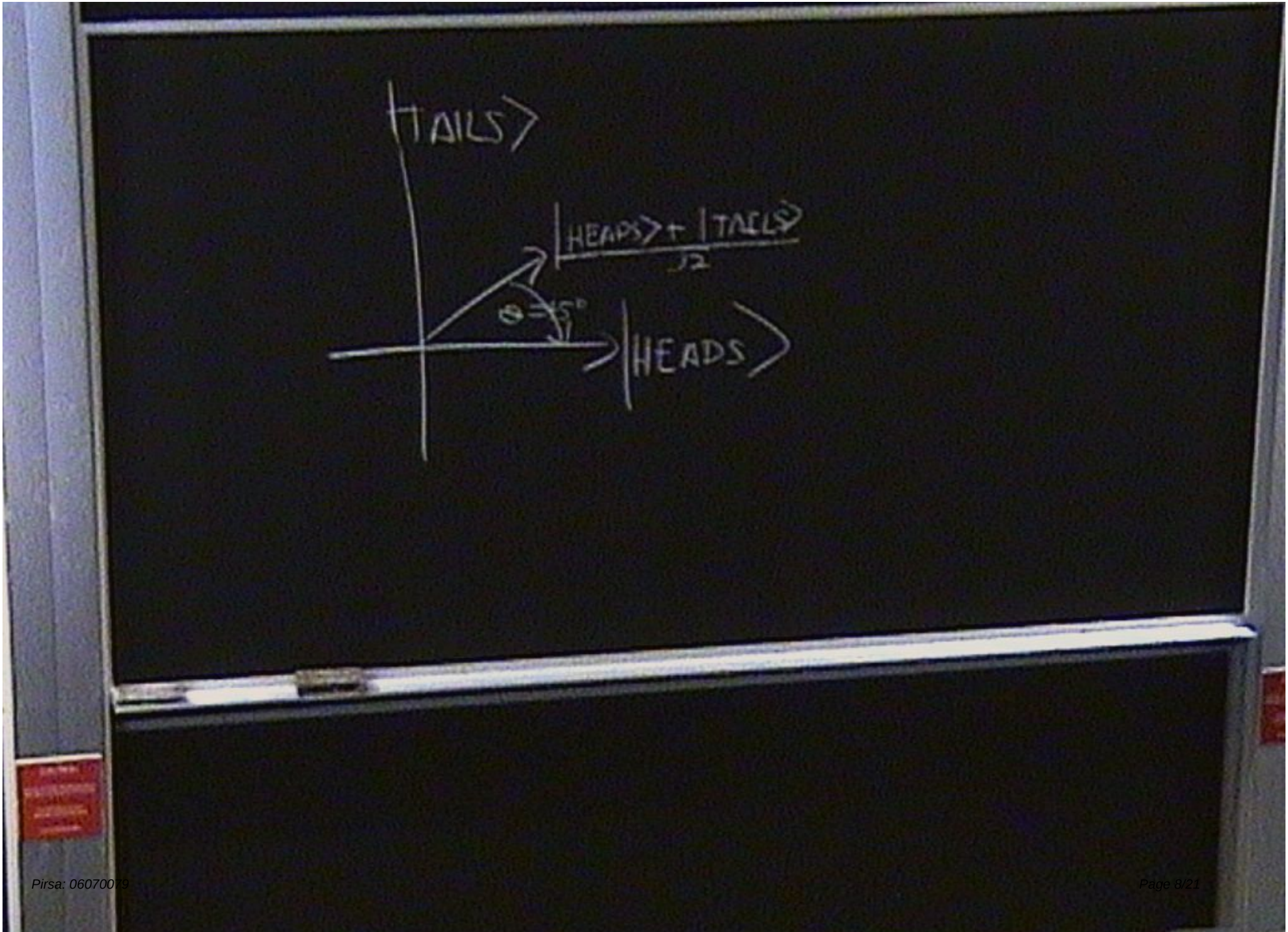

HEADS OR TAILS
QUANTUM: |HEADS⟩ + |TAILS⟩

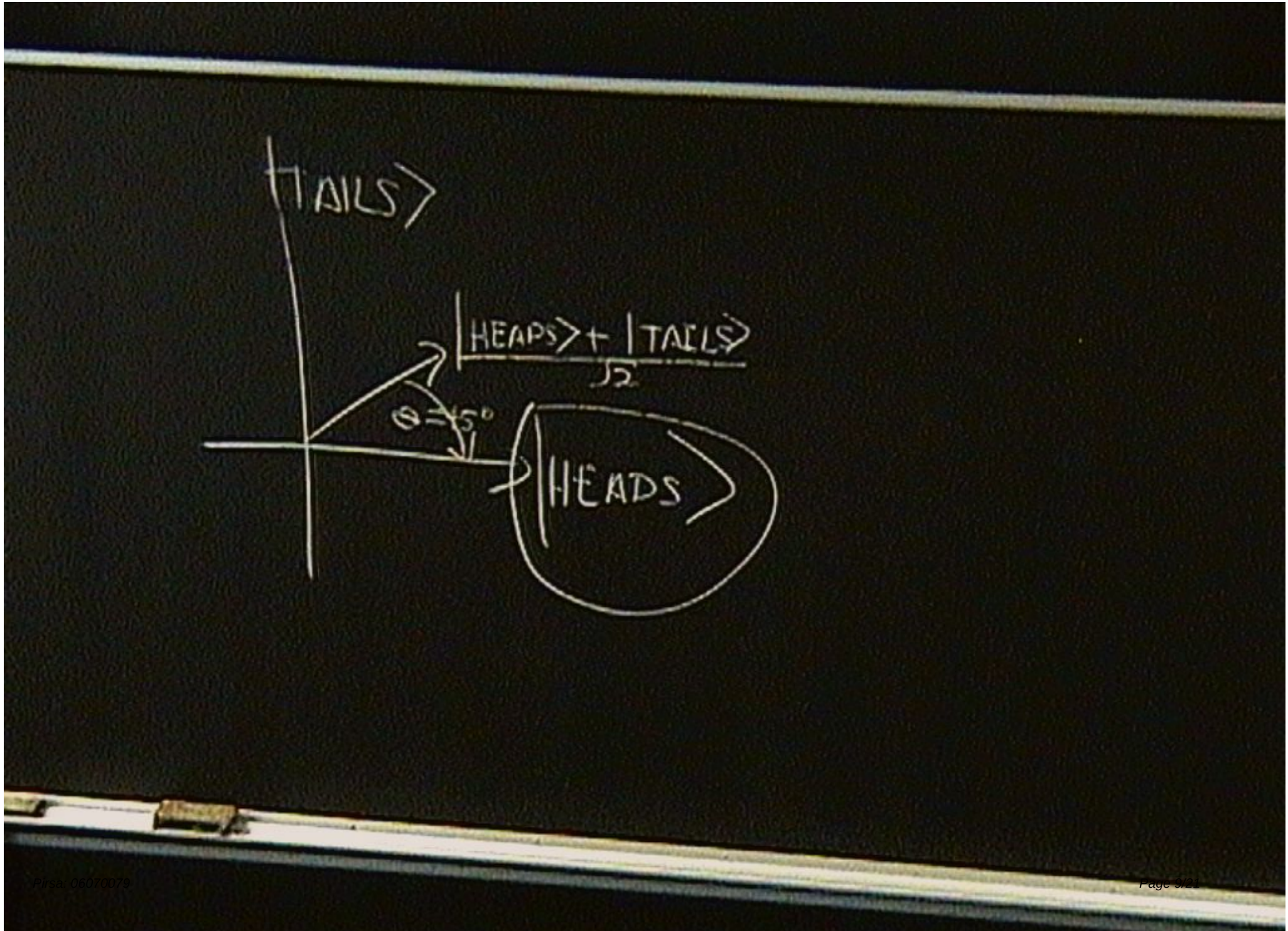

HEADS OR TAILS
QUANTUM: |HEADS⟩ + |TAILS⟩ / √2

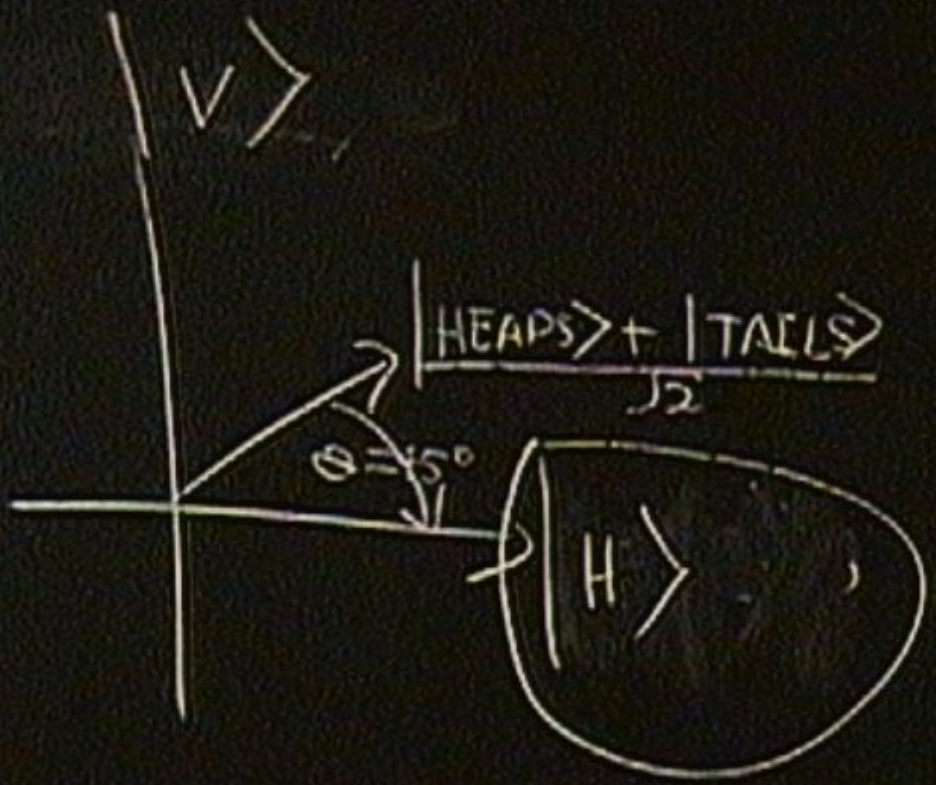

E.G.
HEADS OR TAILS
QUANTUM: |HEADS⟩ + |TAILS⟩ / √2
FLIPS(

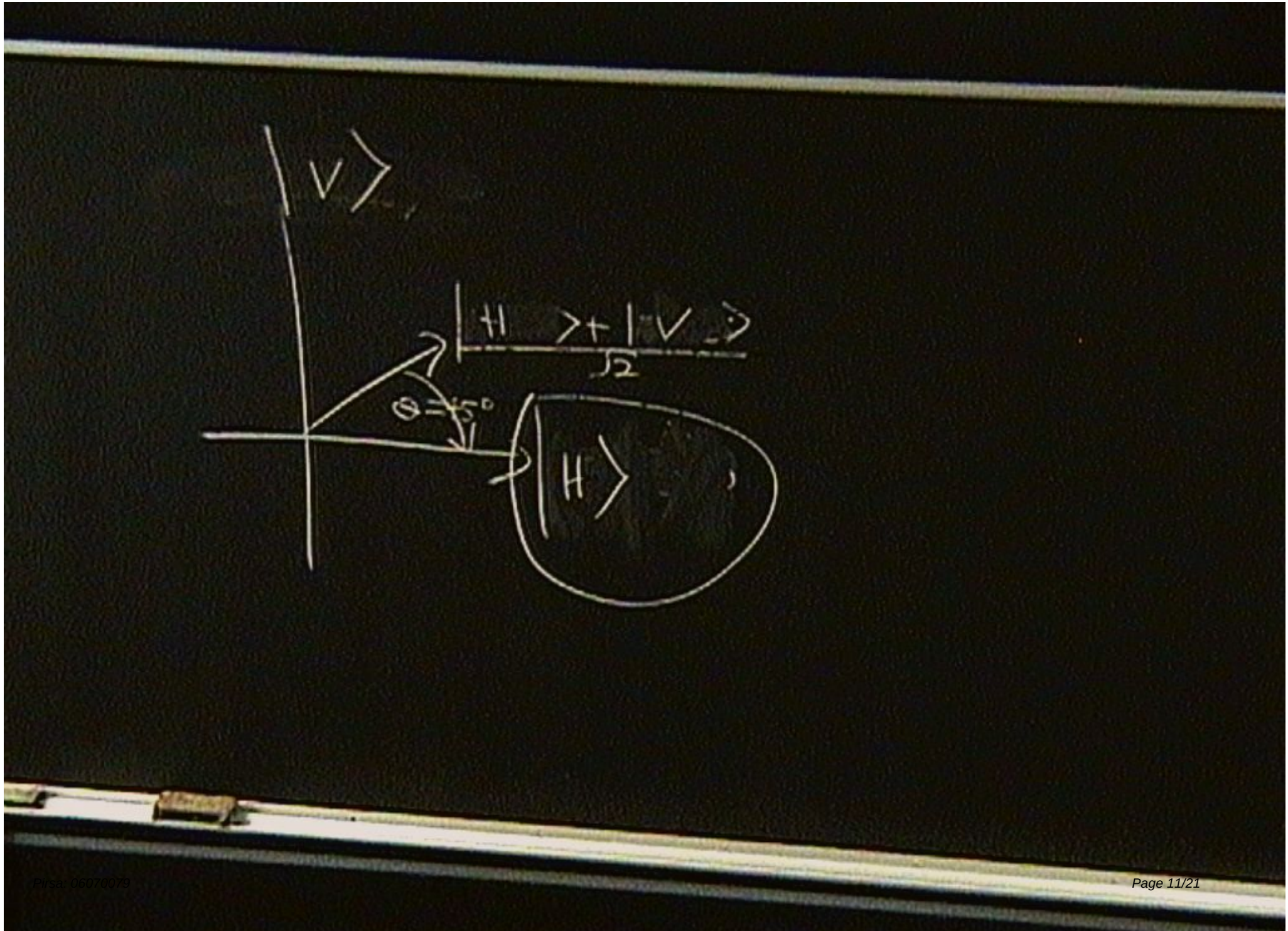

E.G.
HEADS OR TAILS
QUANTUM:
|HEADS⟩ + |TAILS⟩ / √2
|TAILS⟩ + |HEADS⟩ / √2

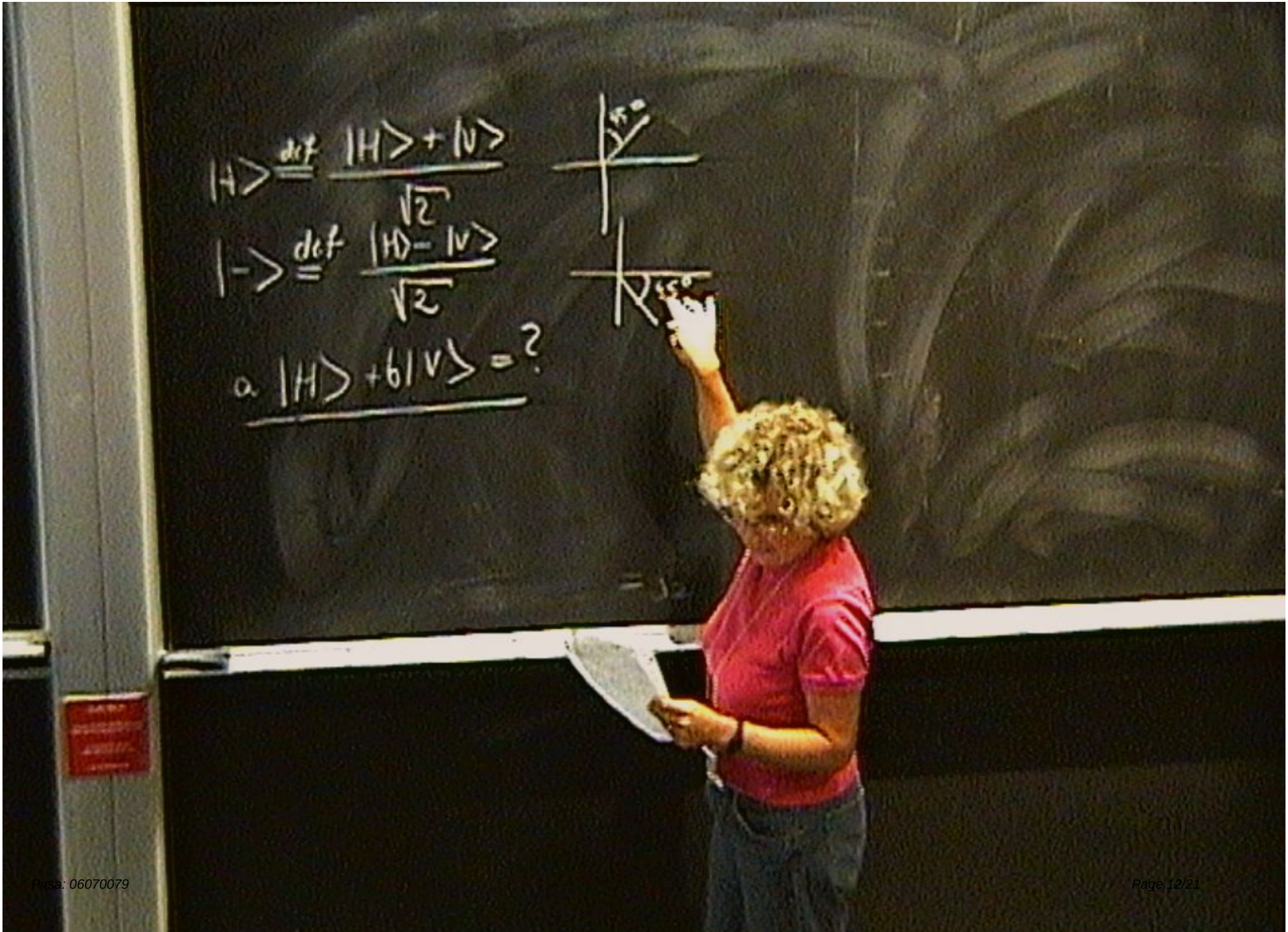

|TAILS>
|HEADS> + |TAILS>
√2
45°
|HEADS>

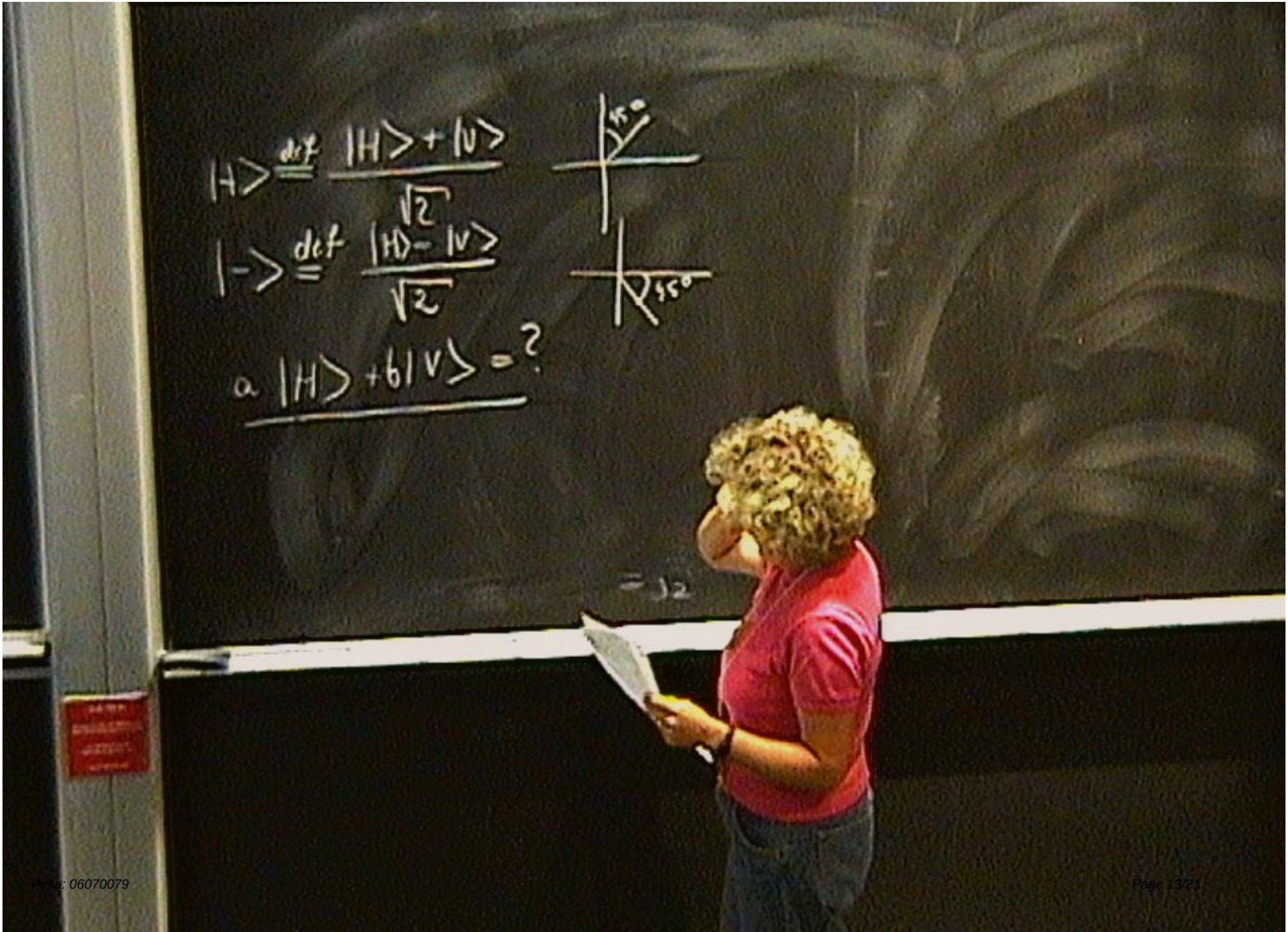

|TAILS>
|HEADS>+|TAILS>
√2
θ=45°
|HEADS>

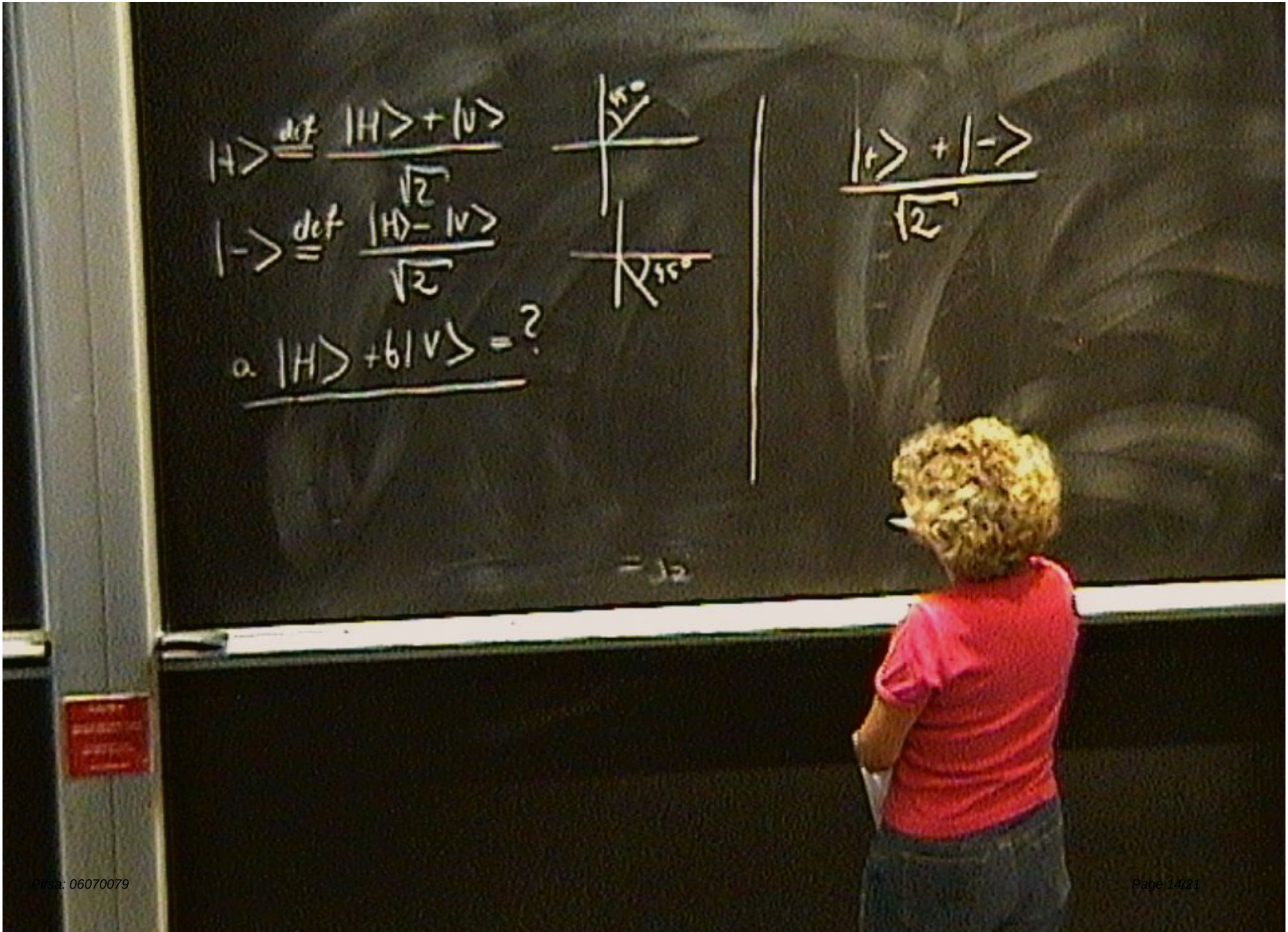

|TAILS⟩
|HEADS⟩ + |TAILS⟩
√2
θ = 45°
|HEADS⟩

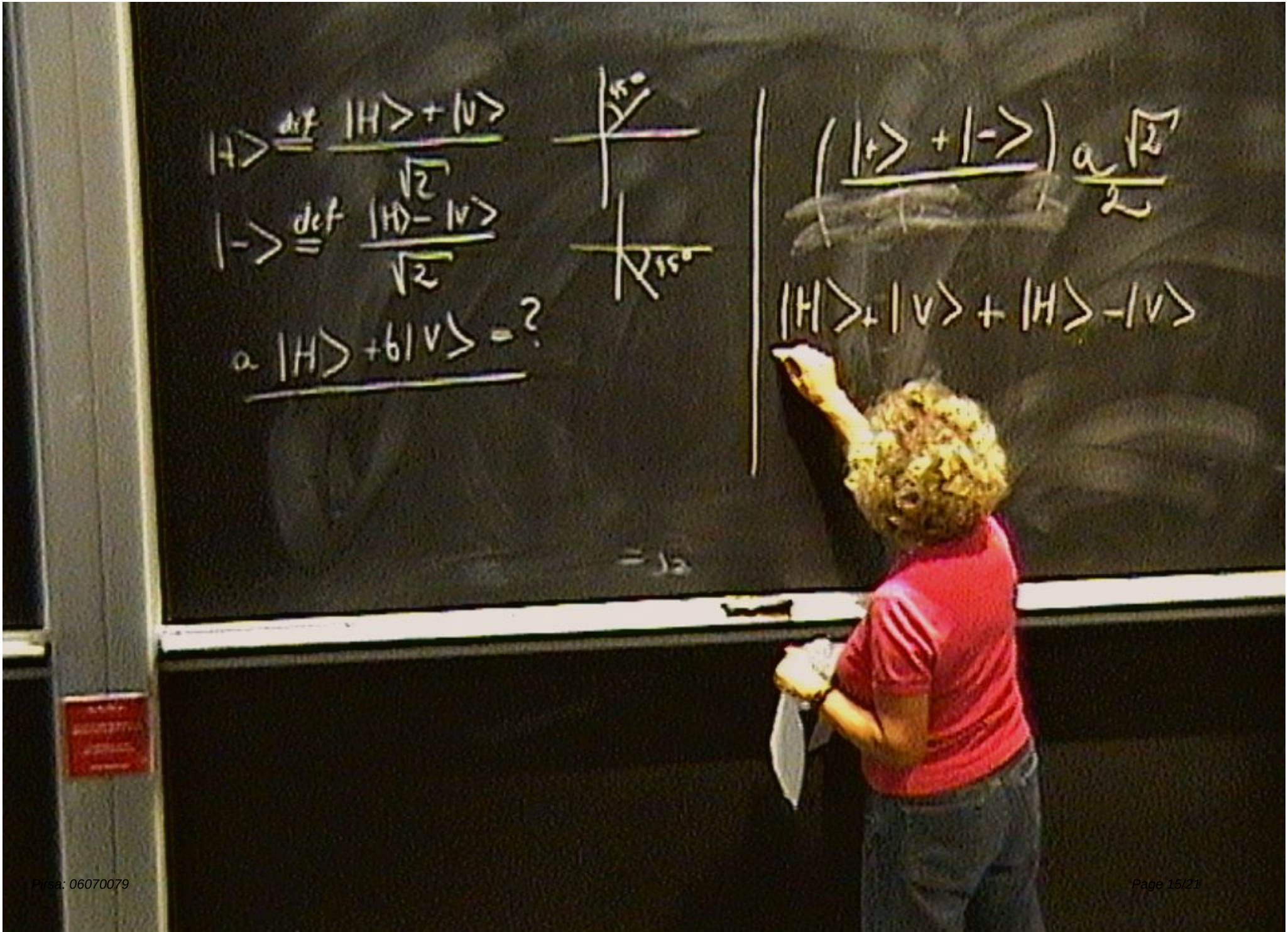

|V⟩
|HEADS⟩ + |TAILS⟩
√2
θ = 45°
|H⟩

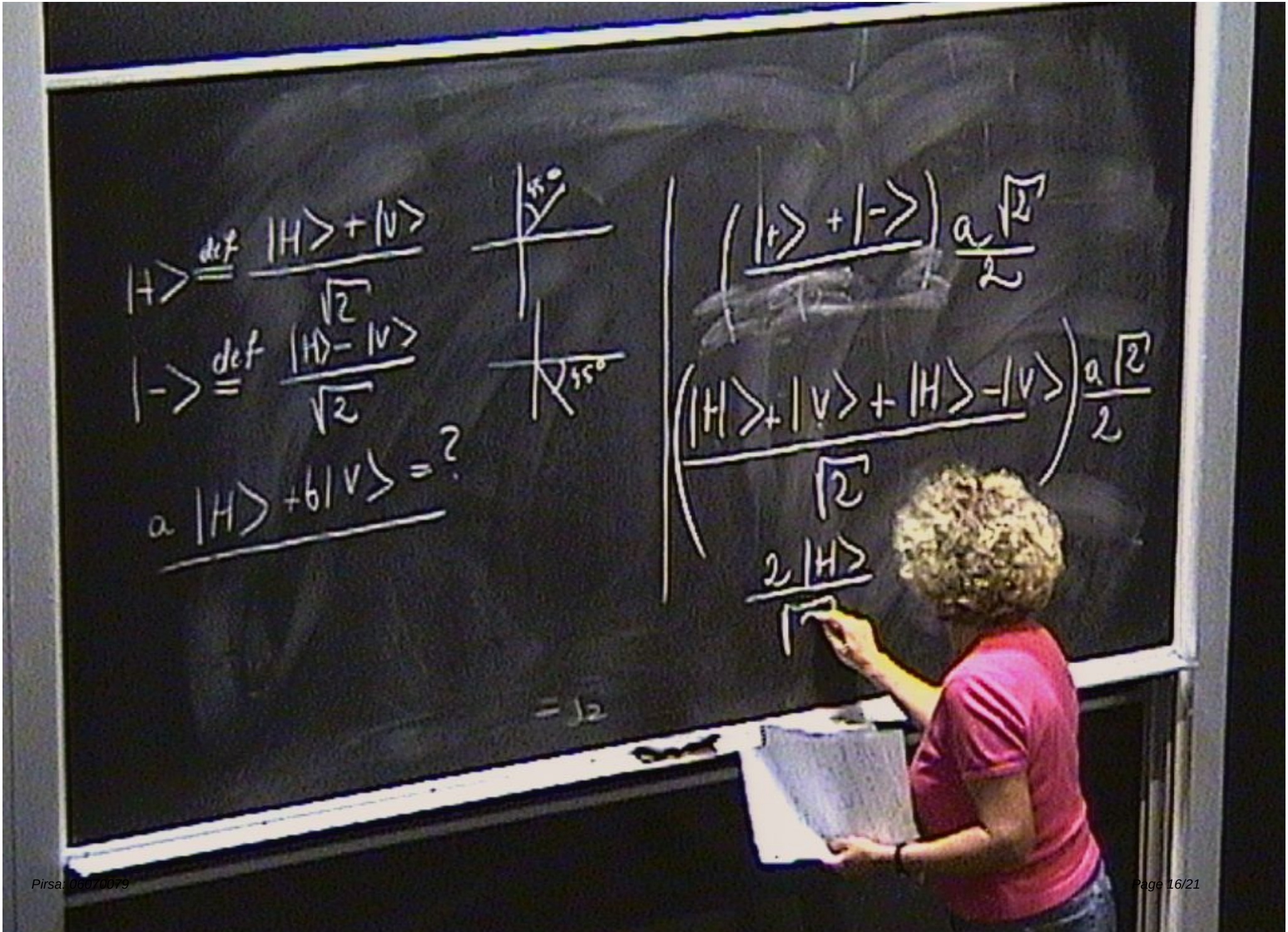

|V>
|+1 >+|-V>
√2
θ=45°
|H>

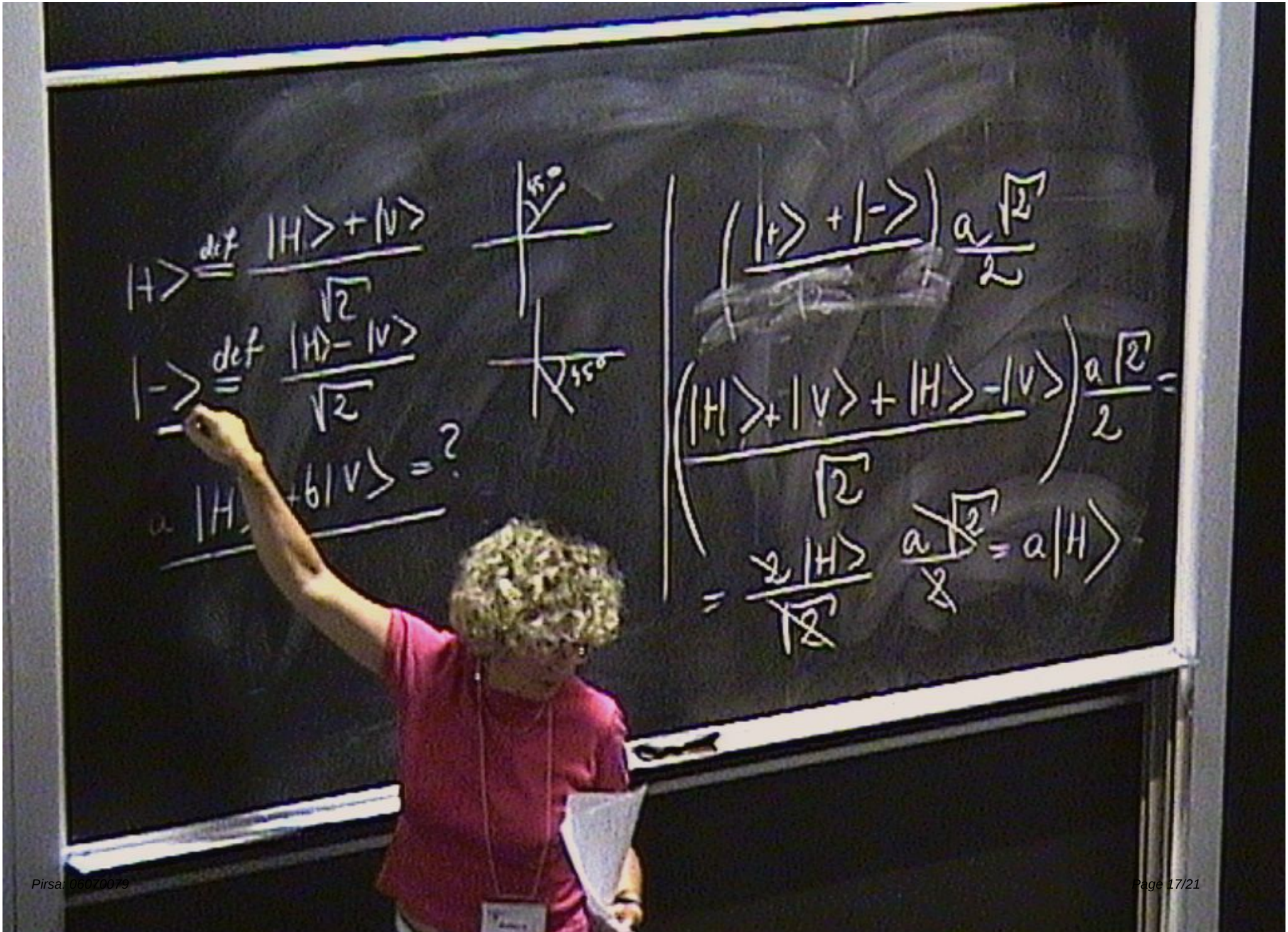

$|H\rangle \stackrel{def}{=} \frac{|H\rangle + |V\rangle}{\sqrt{2}}$
$|-\rangle \stackrel{def}{=} \frac{|H\rangle - |V\rangle}{\sqrt{2}}$
a. $|H\rangle + b|V\rangle = ?$

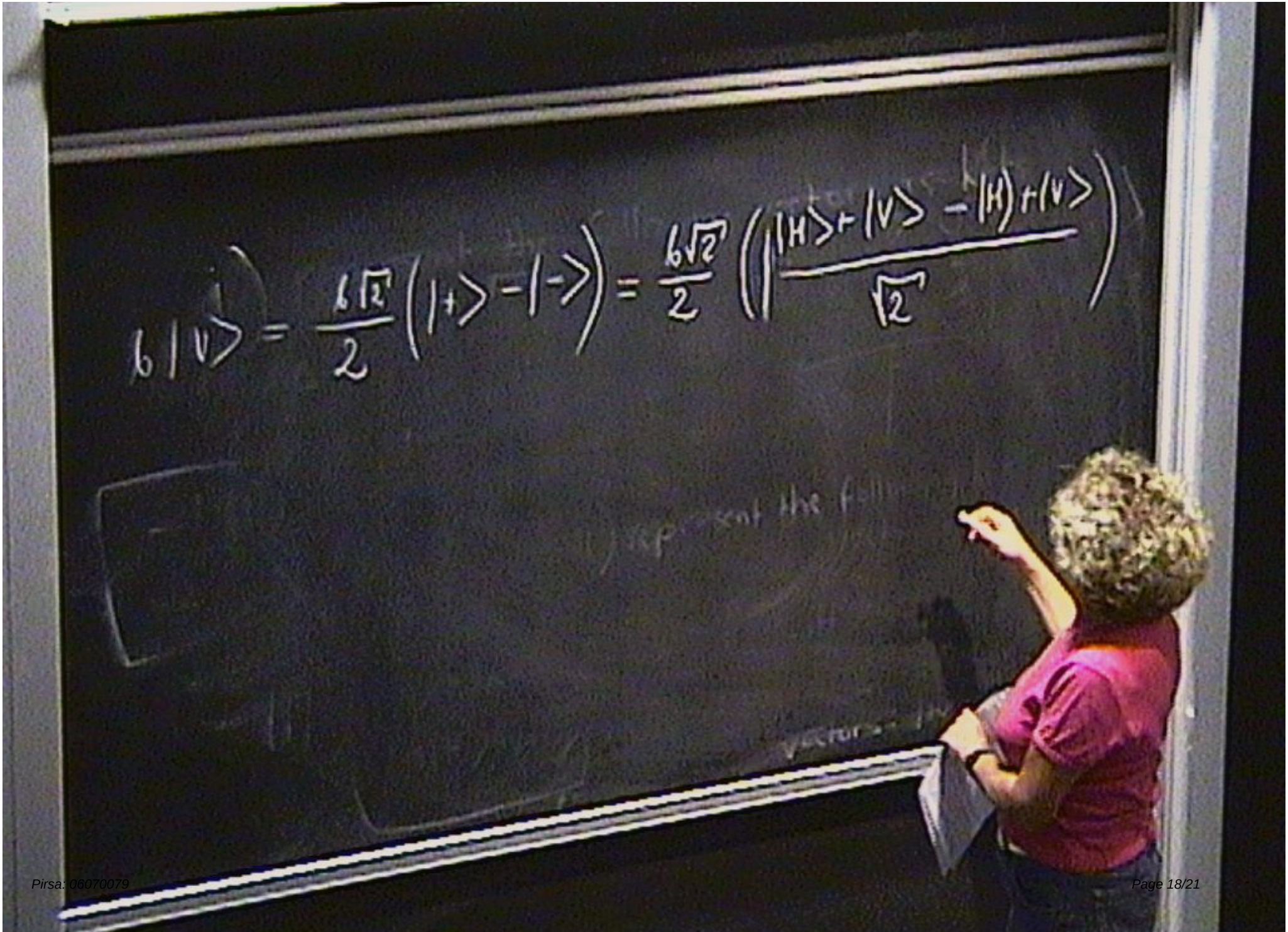

$|H\rangle \stackrel{def}{=} \frac{|H\rangle + |V\rangle}{\sqrt{2}}$
$|-\rangle \stackrel{def}{=} \frac{|H\rangle - |V\rangle}{\sqrt{2}}$
45°
R 45°
a $|H\rangle + b|V\rangle = ?$
$= \sqrt{2}$

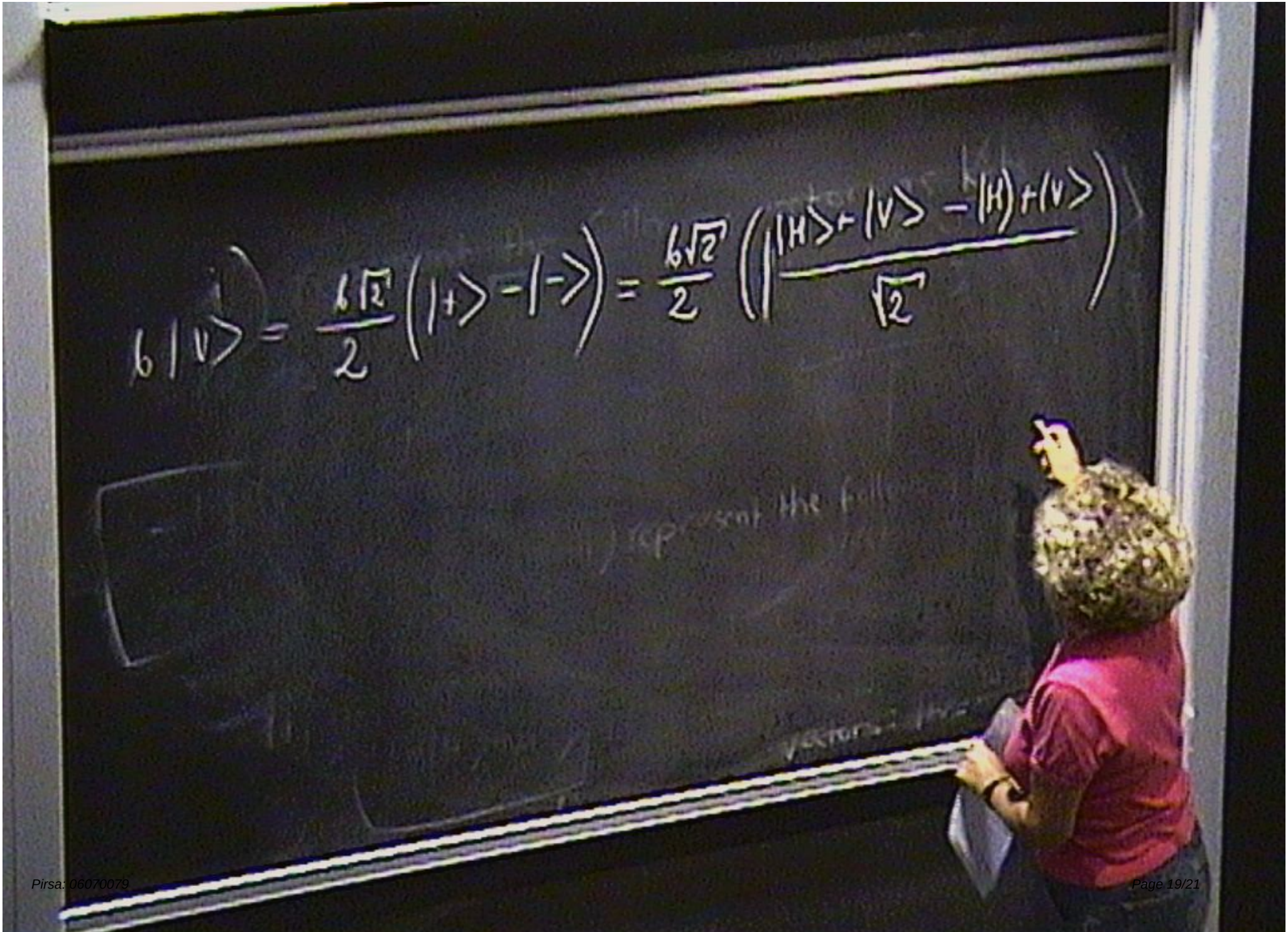

$|H\rangle \stackrel{def}{=} \frac{|H\rangle + |V\rangle}{\sqrt{2}}$
$|-\rangle \stackrel{def}{=} \frac{|H\rangle - |V\rangle}{\sqrt{2}}$
a. $|H\rangle + 6|V\rangle = ?$
$\frac{|+\rangle + |-\rangle}{\sqrt{2}}$

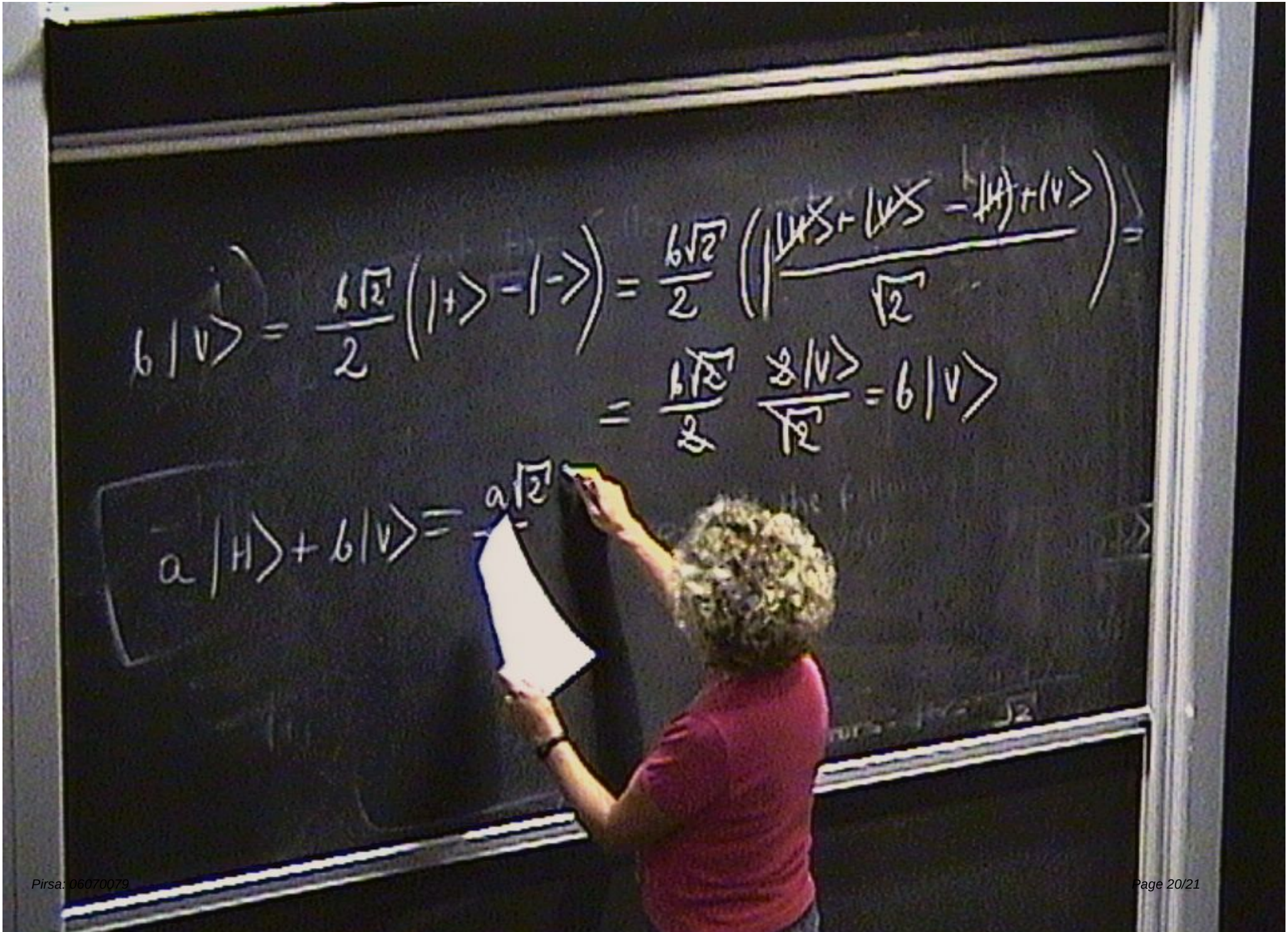

$|+\rangle \stackrel{def}{=} \frac{|H\rangle + |V\rangle}{\sqrt{2}}$
$|-\rangle \stackrel{def}{=} \frac{|H\rangle - |V\rangle}{\sqrt{2}}$
$a|H\rangle + b|V\rangle = ?$
45°
R 45°
$\left(\frac{|+\rangle + |-\rangle}{2}\right) a\frac{\sqrt{2}}{2}$
$|H\rangle + |V\rangle + |H\rangle - |V\rangle$
$= 1a$


$|+\rangle \stackrel{def}{=} \frac{|H\rangle + |V\rangle}{\sqrt{2}}$
$|-\rangle \stackrel{def}{=} \frac{|H\rangle - |V\rangle}{\sqrt{2}}$
$a|H\rangle + b|V\rangle = ?$
$\frac{(|+\rangle + |-\rangle)}{\sqrt{2}} \frac{a\sqrt{2}}{2}$
$\left(\frac{|H\rangle + |V\rangle + |H\rangle - |V\rangle}{\sqrt{2}}\right) \frac{a\sqrt{2}}{2}$
$\frac{2|H\rangle}{\sqrt{2}}$
$= \sqrt{2}$


$|+\rangle \stackrel{def}{=} \frac{|H\rangle + |V\rangle}{\sqrt{2}}$
$|-\rangle \stackrel{def}{=} \frac{|H\rangle - |V\rangle}{\sqrt{2}}$
$a|H\rangle + b|V\rangle = ?$
45°
R 45°
$\frac{(|+\rangle + |-\rangle)}{\sqrt{2}} \frac{a\sqrt{2}}{2}$
$\left(\frac{|H\rangle + |V\rangle + |H\rangle - |V\rangle}{\sqrt{2}}\right) \frac{a\sqrt{2}}{2} =$
$= \frac{2|H\rangle}{\sqrt{2}} \frac{a\sqrt{2}}{2} = a|H\rangle$


$b|V\rangle = \frac{b\sqrt{2}}{2}(|+\rangle - |-\rangle) = \frac{b\sqrt{2}}{2}\left(\frac{|H\rangle + |V\rangle - |H\rangle + |V\rangle}{\sqrt{2}}\right)$


$6|V\rangle = \frac{6\sqrt{2}}{2}(|+\rangle - |-\rangle) = \frac{6\sqrt{2}}{2}\left(\frac{|H\rangle + |V\rangle - |H\rangle + |V\rangle}{\sqrt{2}}\right)$


$b|V\rangle = \frac{b\sqrt{2}}{2}\left(|+\rangle - |-\rangle\right) = \frac{b\sqrt{2}}{2}\left(\frac{|H\rangle + |V\rangle - |H\rangle + |V\rangle}{\sqrt{2}}\right) =$
$= \frac{b\sqrt{2}}{2}\,\frac{2|V\rangle}{\sqrt{2}} = b|V\rangle$
$a|H\rangle + b|V\rangle =$

$$b|V\rangle = \frac{b\sqrt{2}}{2}\left(|+\rangle - |-\rangle\right) = \frac{b\sqrt{2}}{2}\left(\frac{|H\rangle + |V\rangle}{\sqrt{2}} - \frac{|H\rangle - |V\rangle}{\sqrt{2}}\right) =$$

$$= \frac{b\sqrt{2}}{2}\,\frac{2|V\rangle}{\sqrt{2}} = b|V\rangle$$

$$a|H\rangle + b|V\rangle = \frac{a\sqrt{2}}{2}\left(|+\rangle + |-\rangle\right) + \frac{b\sqrt{2}}{2}\left(|+\rangle - |-\rangle\right)$$