Title: Undergraduate Talk

Date: Aug 11, 2010 02:00 PM

URL: http://pirsa.org/10080028

Abstract:

# Bayesian Probability

Probability = Plausibility, tied to state of knowledge

Consequently, all probabilities are of the form of $P(A_i|C)$

There are no "pure" probabilities, i.e. any $P(B)$ is really $P(B|C)$

# What kind of statements can we reason about?

If we have $P(A_i | C)$, $A_i$ must be an Aristotelian (true/false) proposition

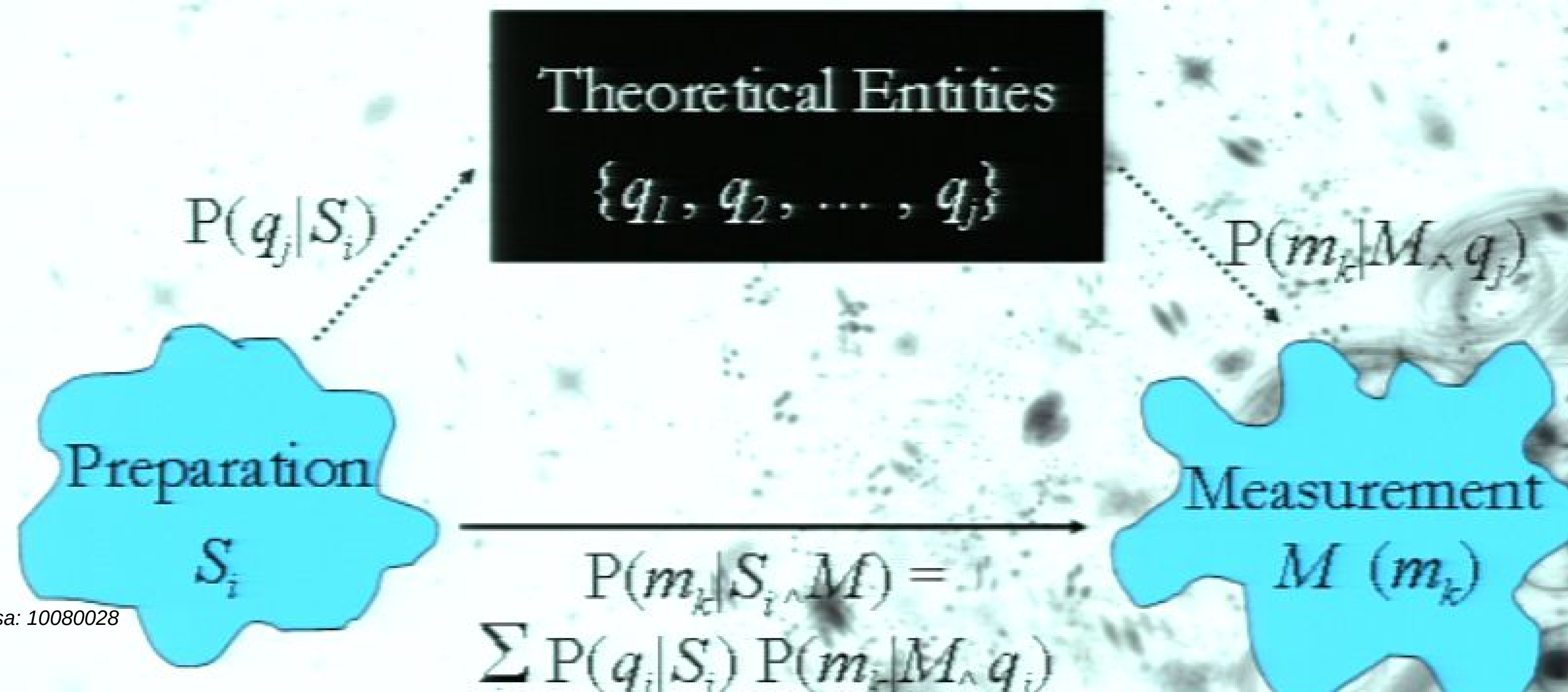
*The Cautious View:*
Only operational statements

Must introduce a theory to reason about theoretical propositions

# The Role of Theory

Adds new true/false propositions

Must provide a means of linking theory and observable world



# For Example…

**Classical statistical mechanics**: $q$'s and $p$'s of constituent entities in system

**Classical E&M**: Electromagnetic field and charges at each point in space

**Quantum Mechanics**:

…the wavefunction…?

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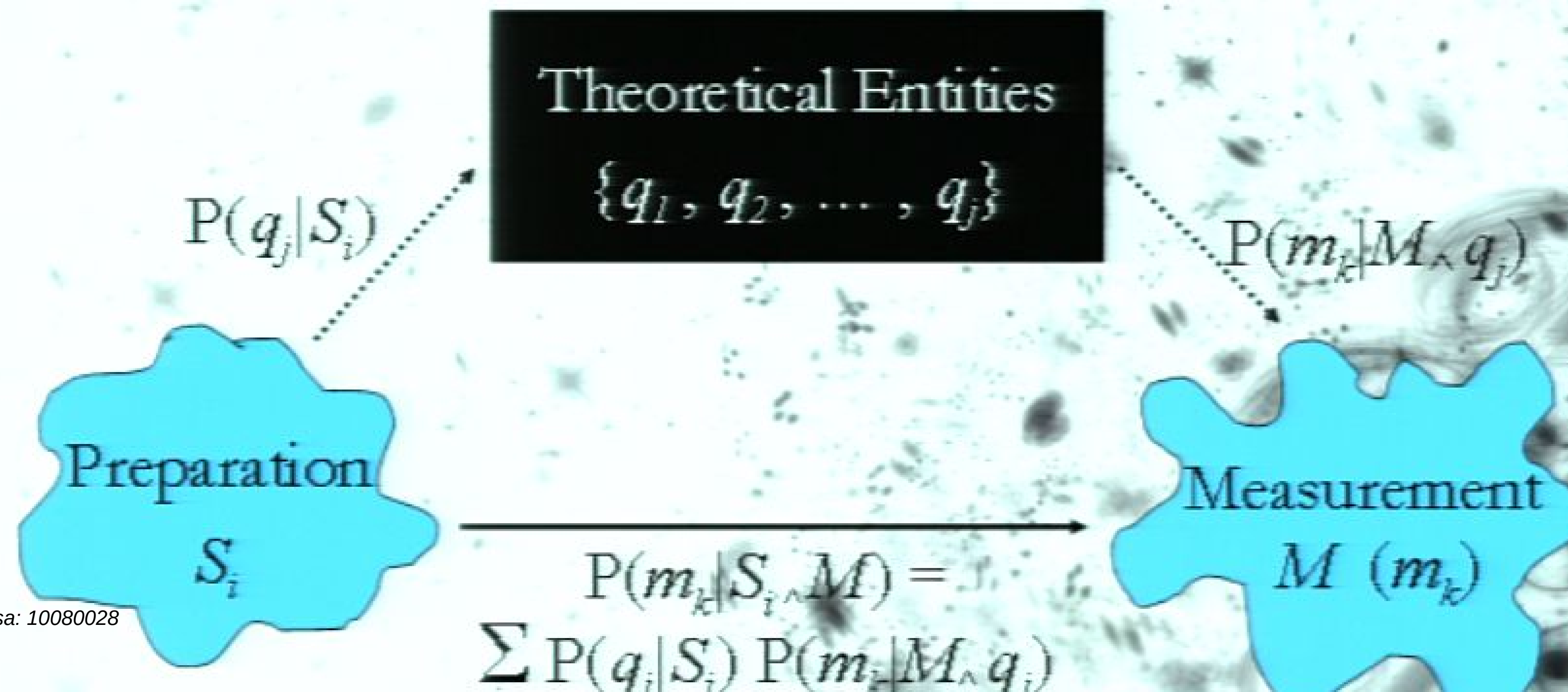

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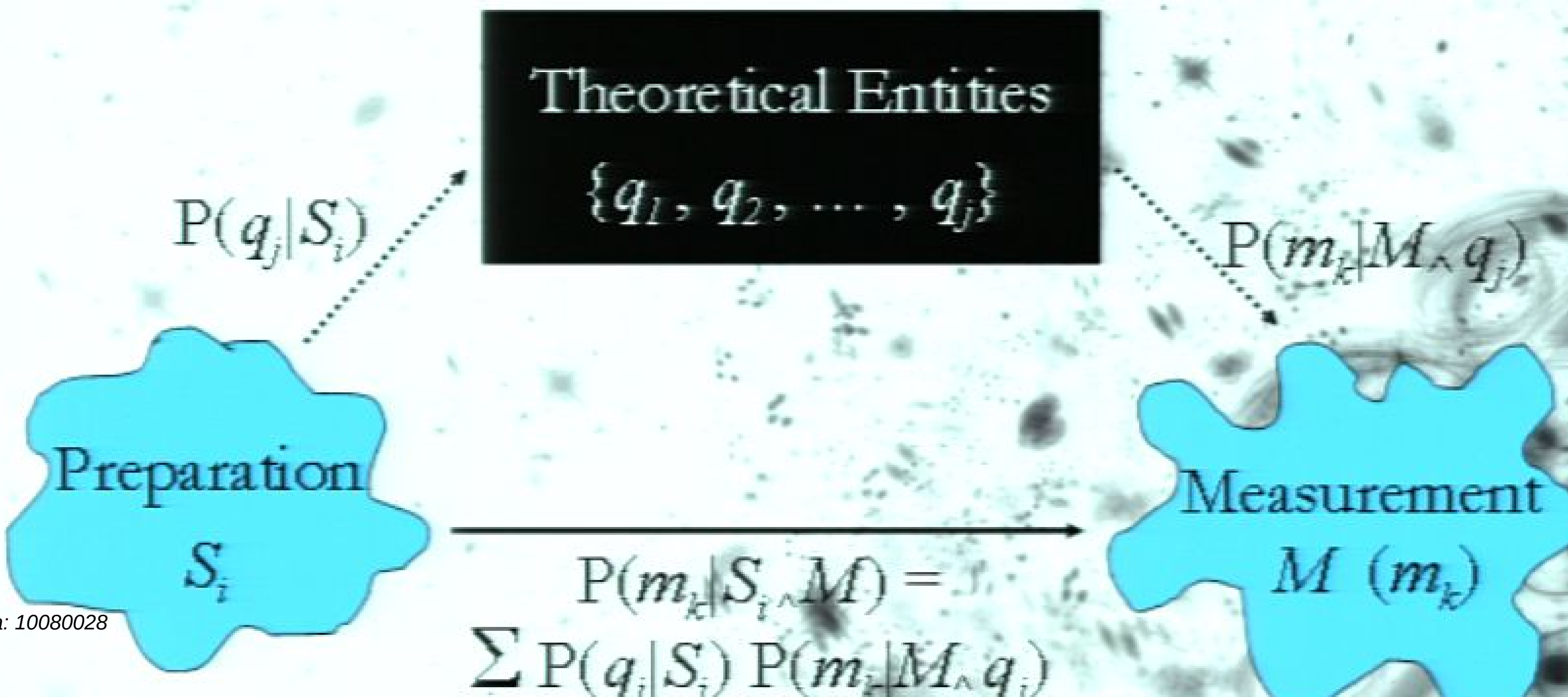

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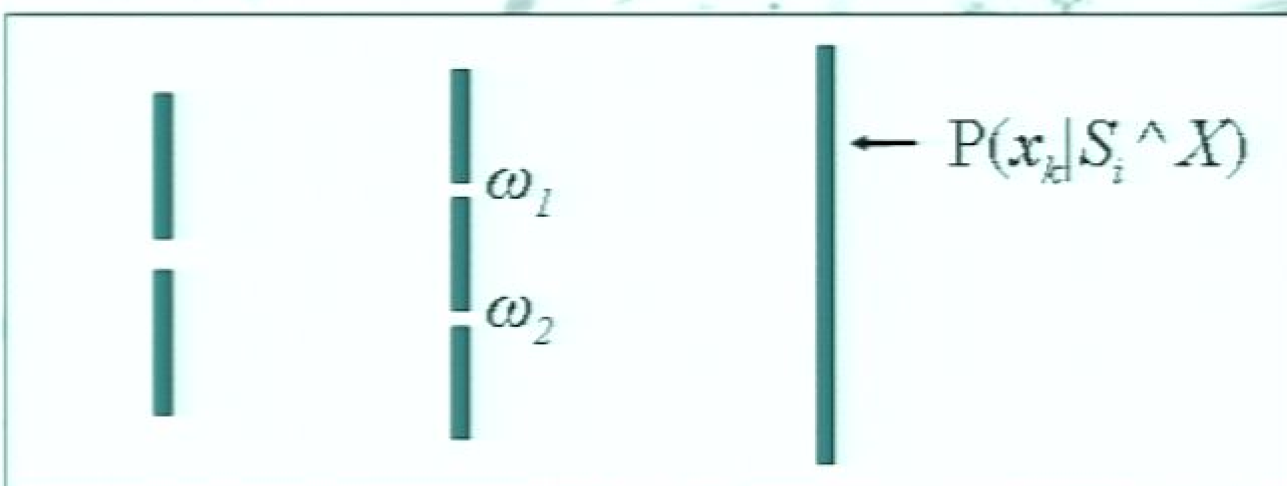
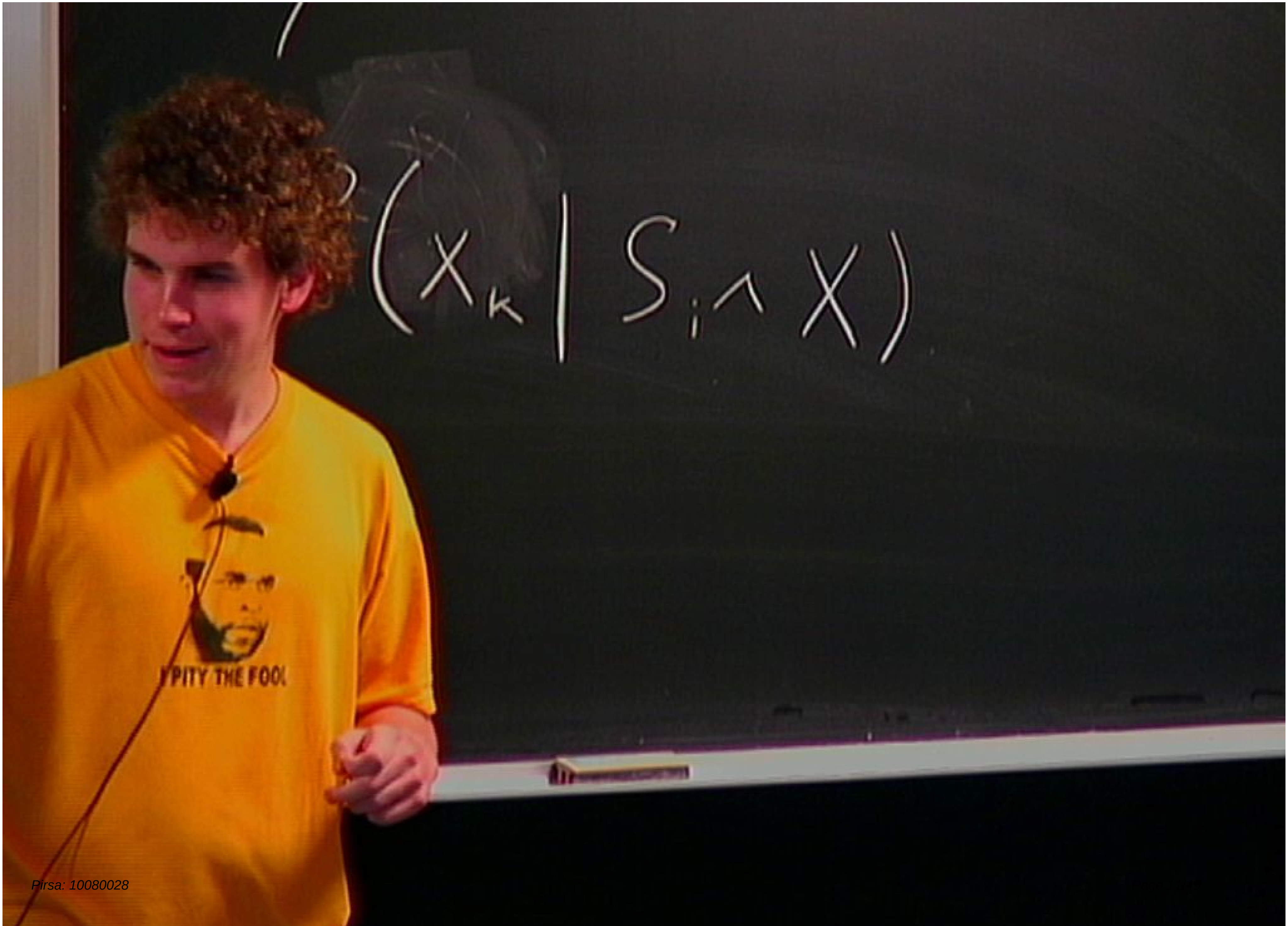
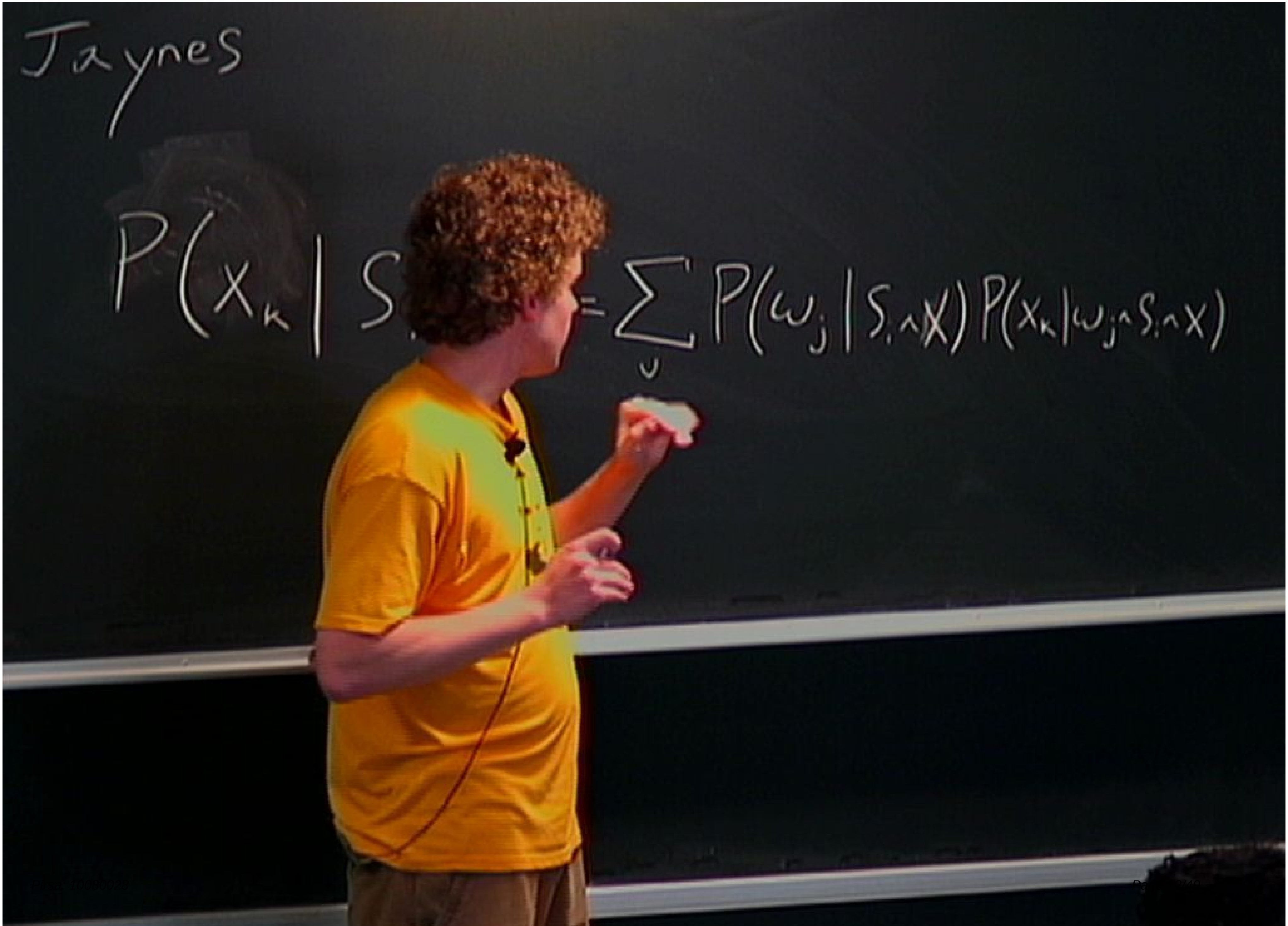
# The Double Slit Experiment

$x_k$ is a measurement outcome, while $\omega_1$ and $\omega_2$ are theoretical entities

$P(x_k) \neq \frac{1}{2}\{P(x_k|\omega_1) + P(x_k|\omega_2)\}$, so have we violated probability theory?




(X_k | S_i ∧ X)
PITY THE FOOL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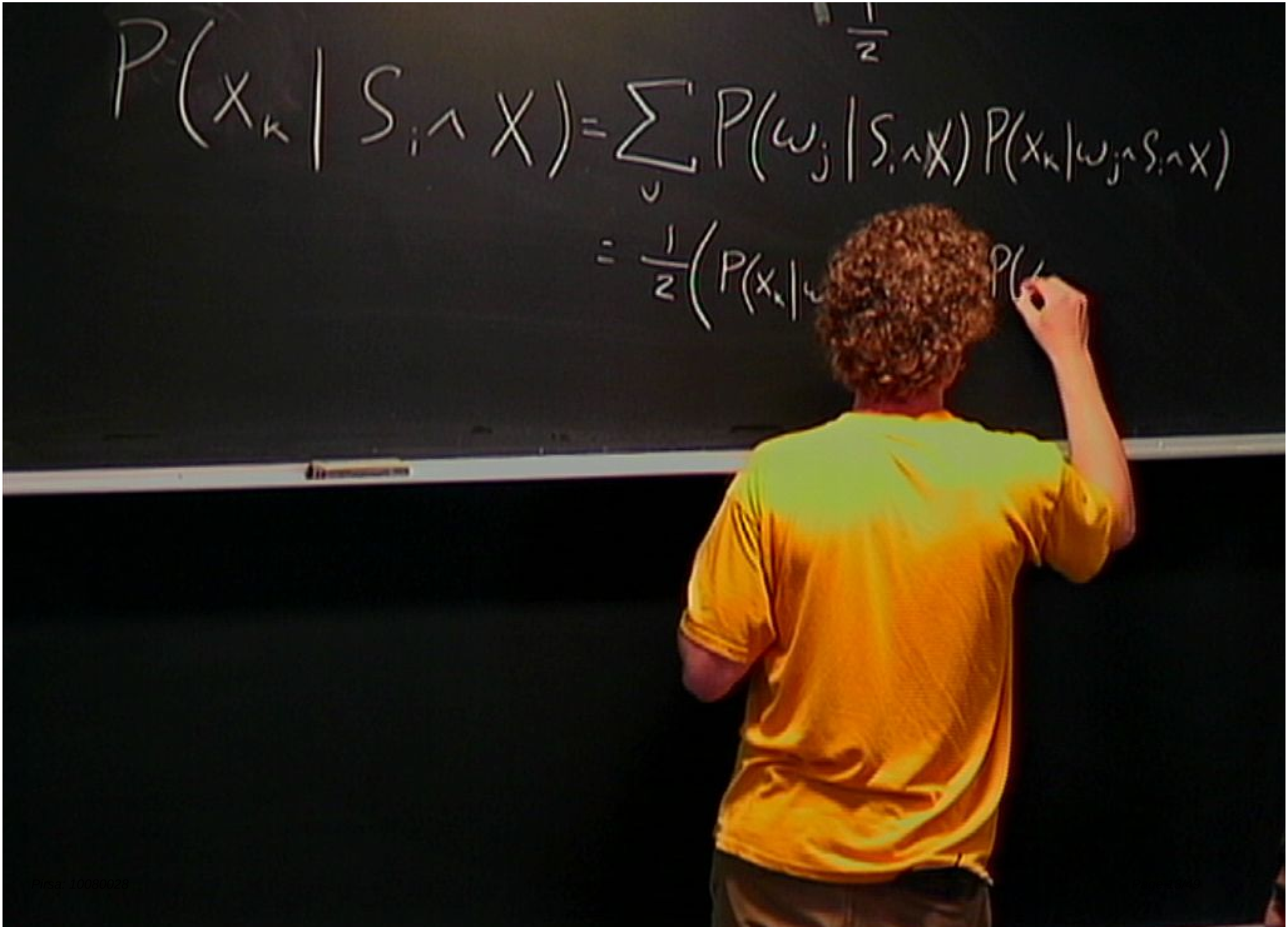
$\frac{1}{2}$
$P(x_k | S_i \wedge X) = \sum_j P(\omega_j | S_i \wedge X) P(x_k | \omega_j \wedge S_i \wedge X)$
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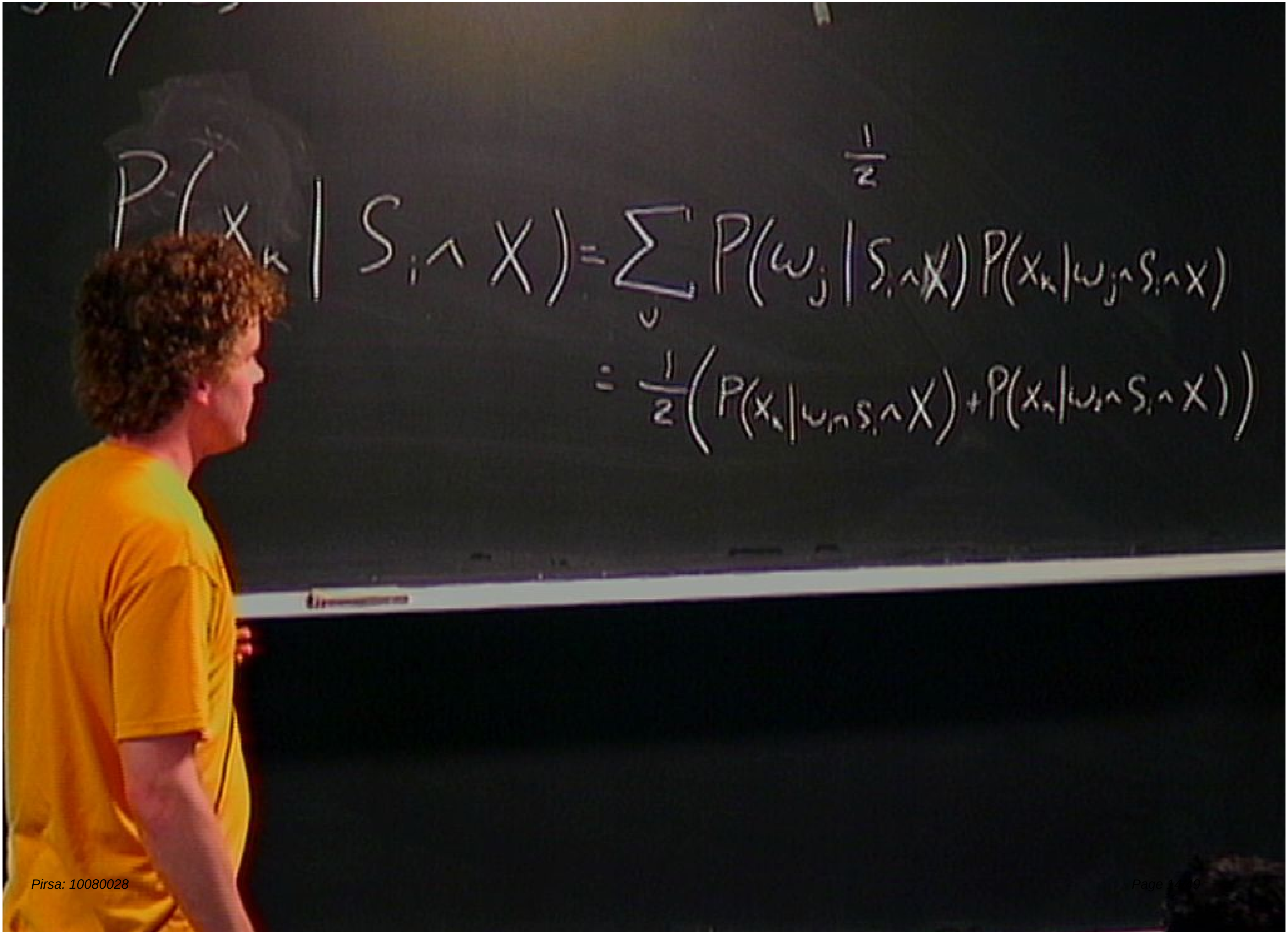
P(x_k | S_i ∧ X) = Σ_j P(ω_j | S_i ∧ X) P(x_k | ω_j ∧ S_i ∧ X)
1/2
= 1/2 ( P(x_k | ω_1 ∧ S_i ∧ X) + P(x_k | ω_2 ∧ S_i ∧ X) )

# ...NO!

"P($x_k$)" is an incomplete probability statement

Paradoxical behavior implies that we have left out relevant information

Alternately, perhaps $\omega_1$ and $\omega_2$ aren't valid true/false propositions

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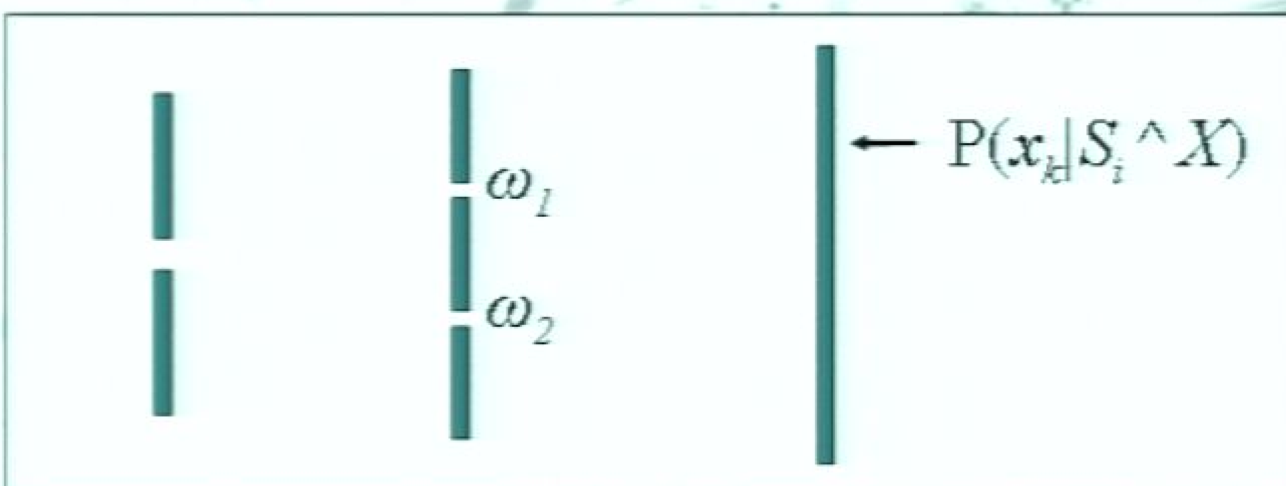

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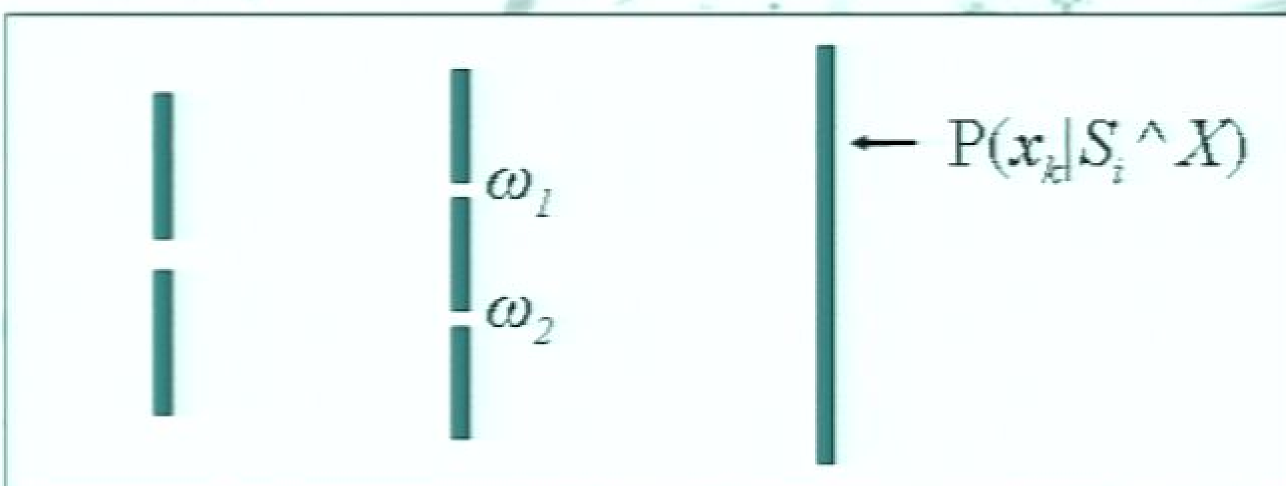

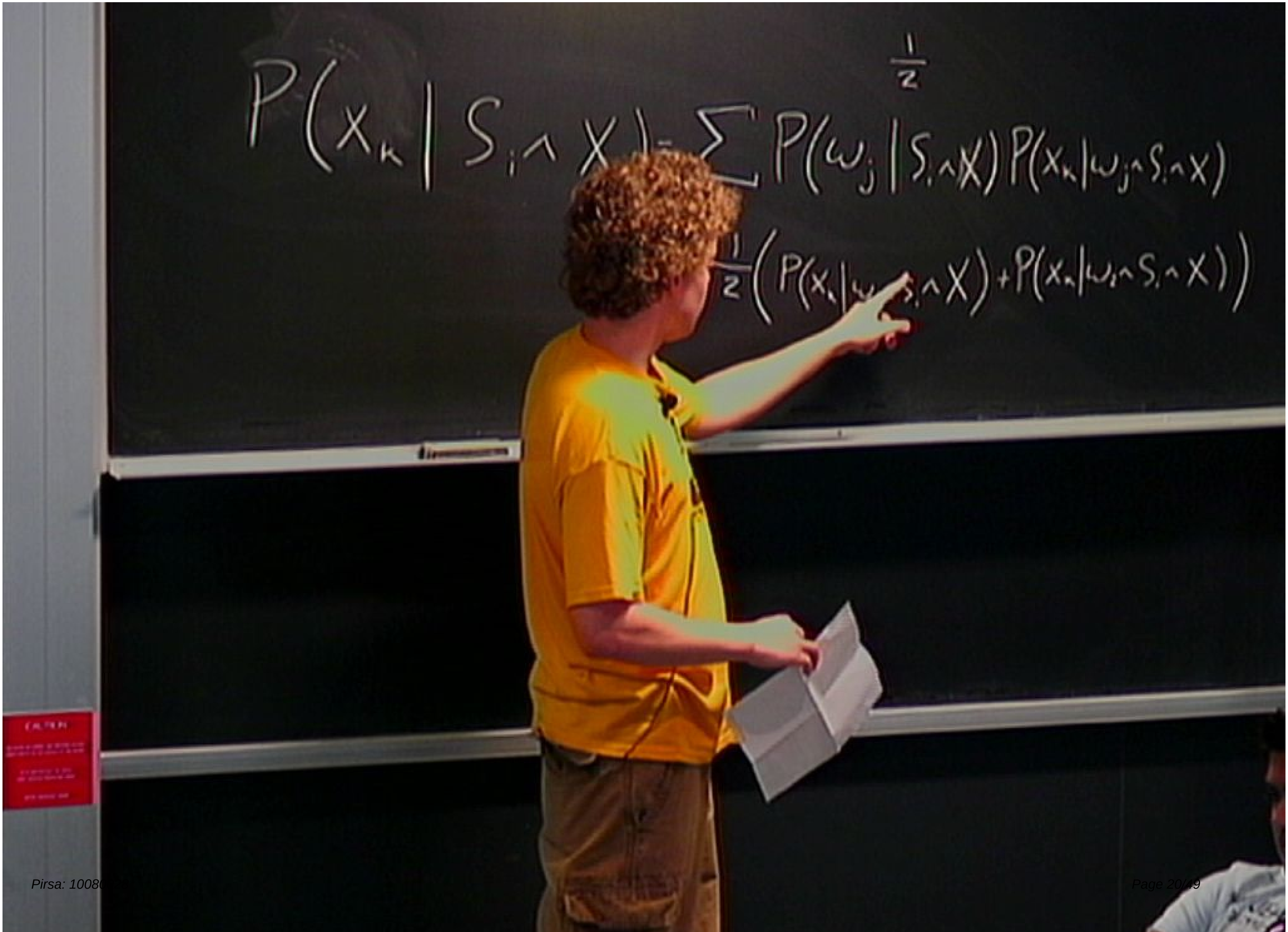

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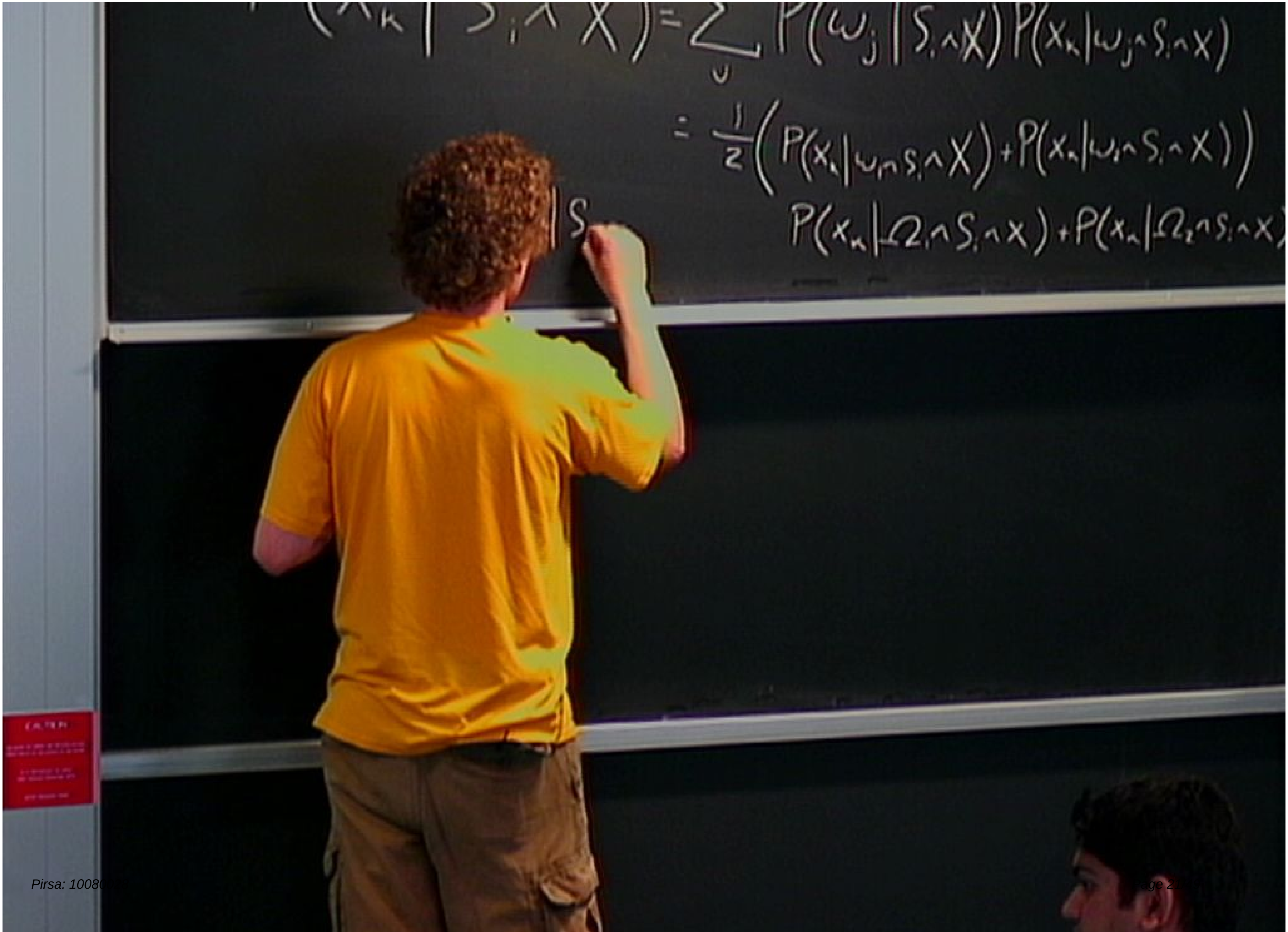
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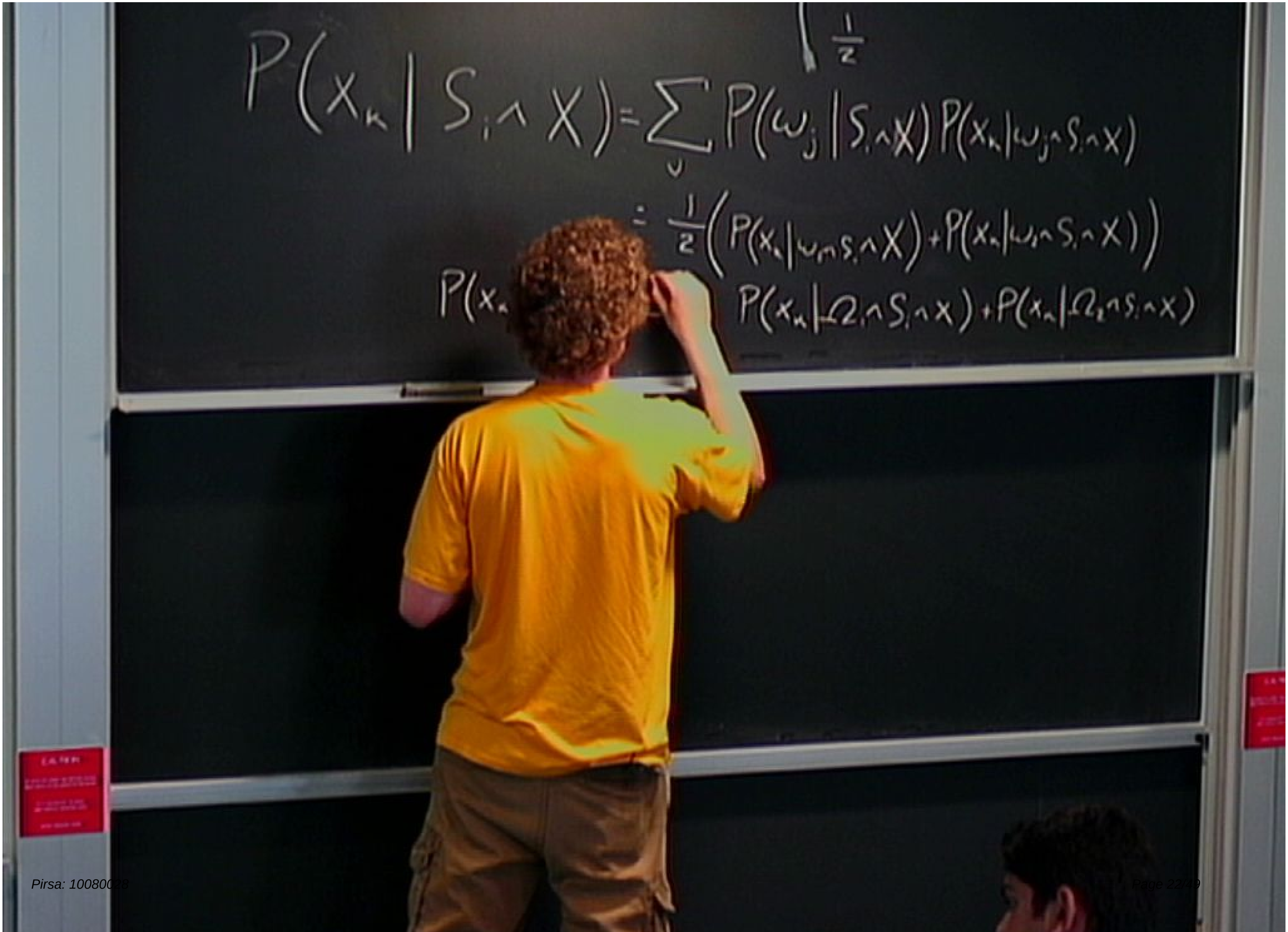
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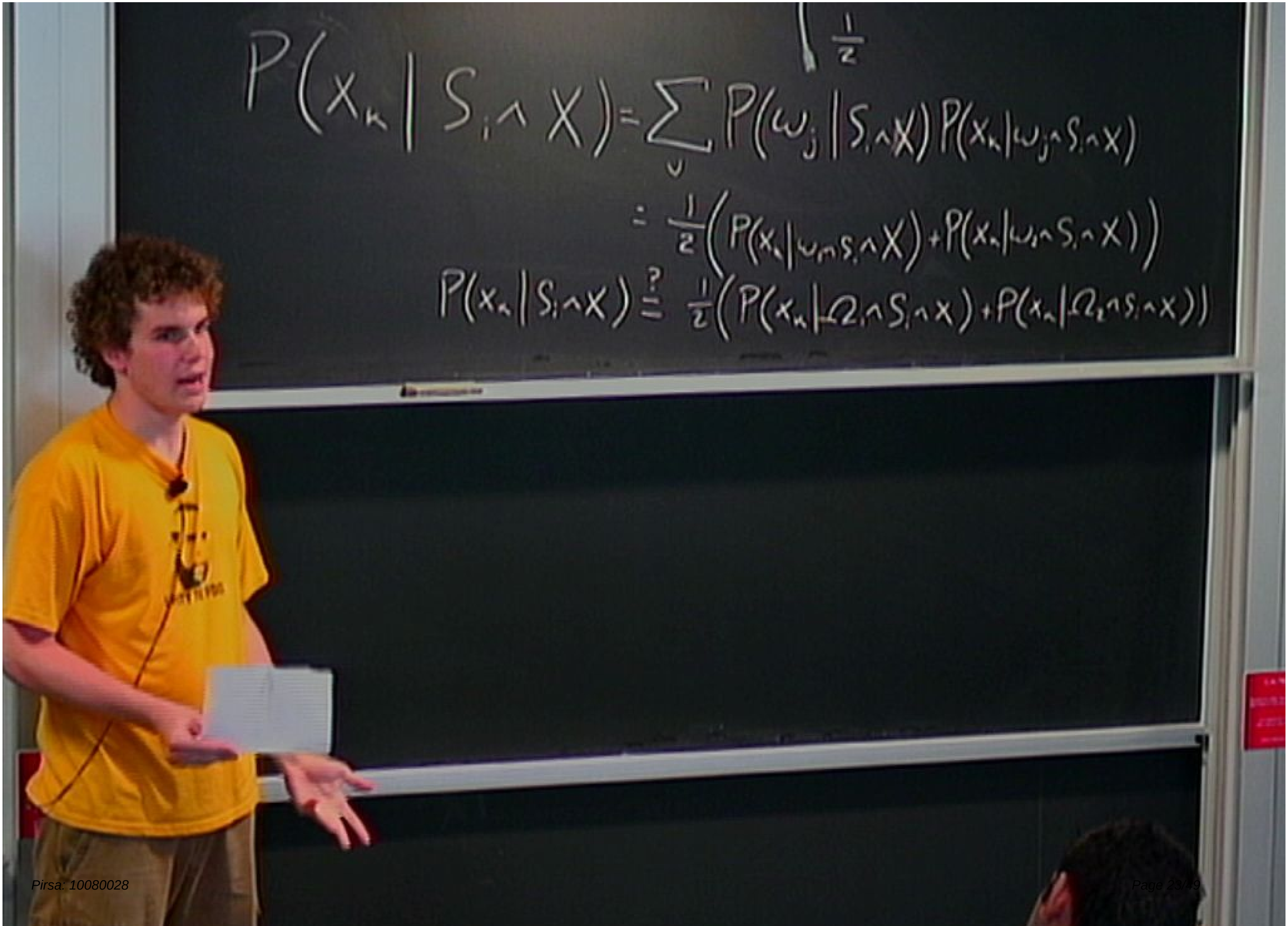

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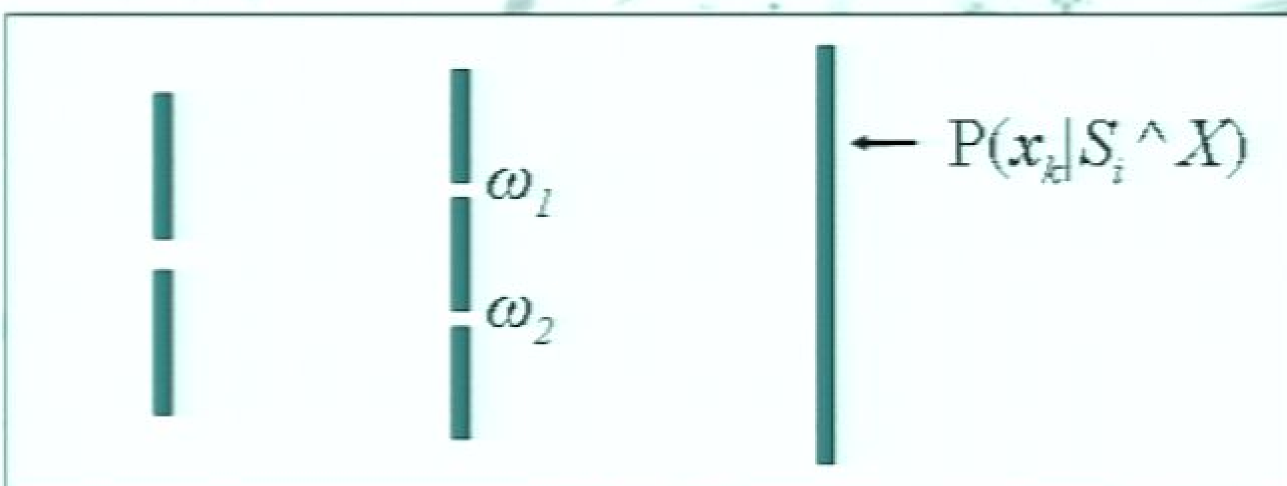

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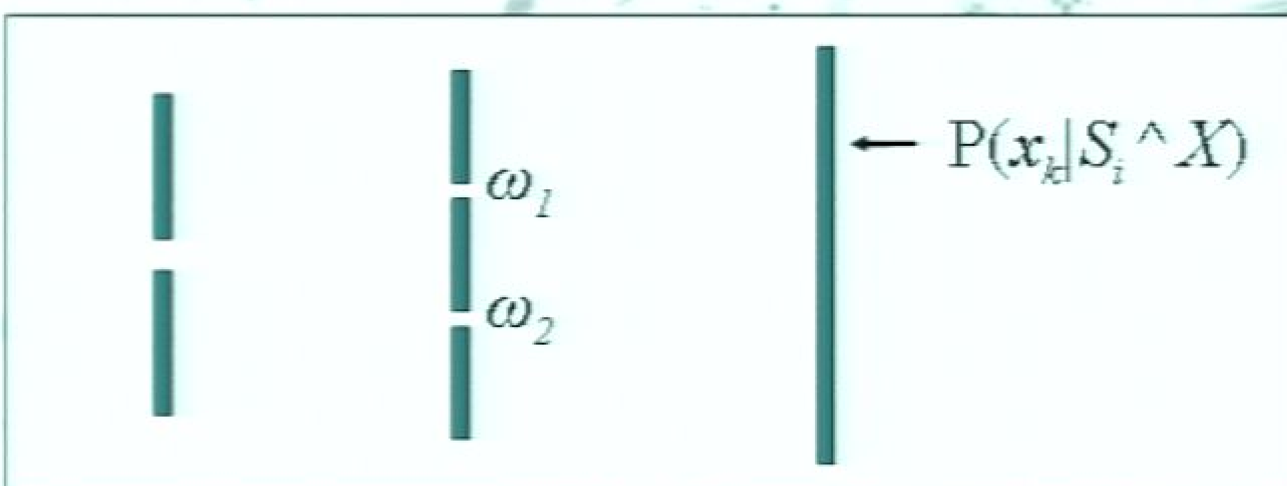

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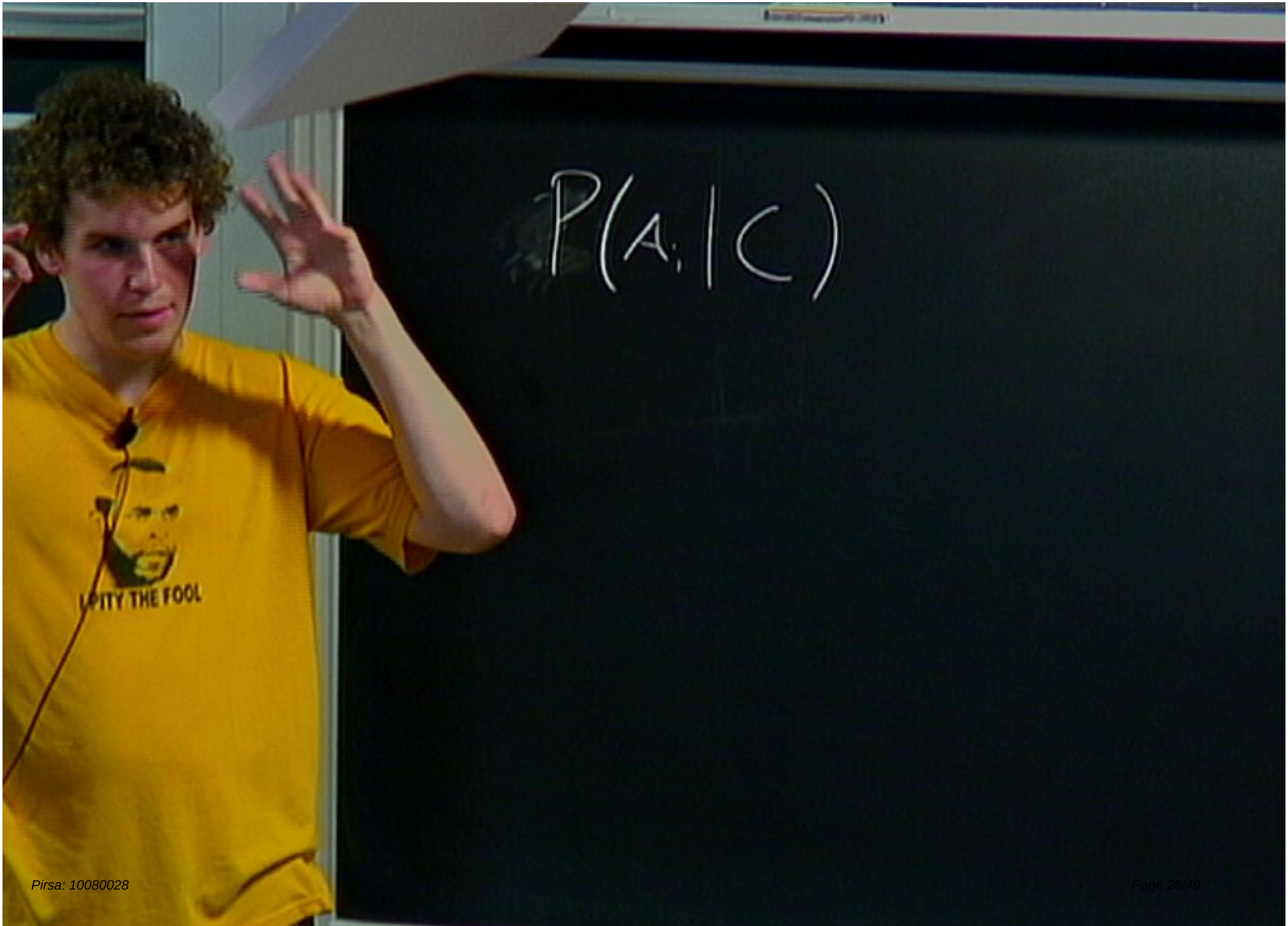
# A Final Consideration

Any observer's information must have a physical representation

This means any observer can in turn be analyzed and observed

Leads to interesting analysis of Landauer's Principle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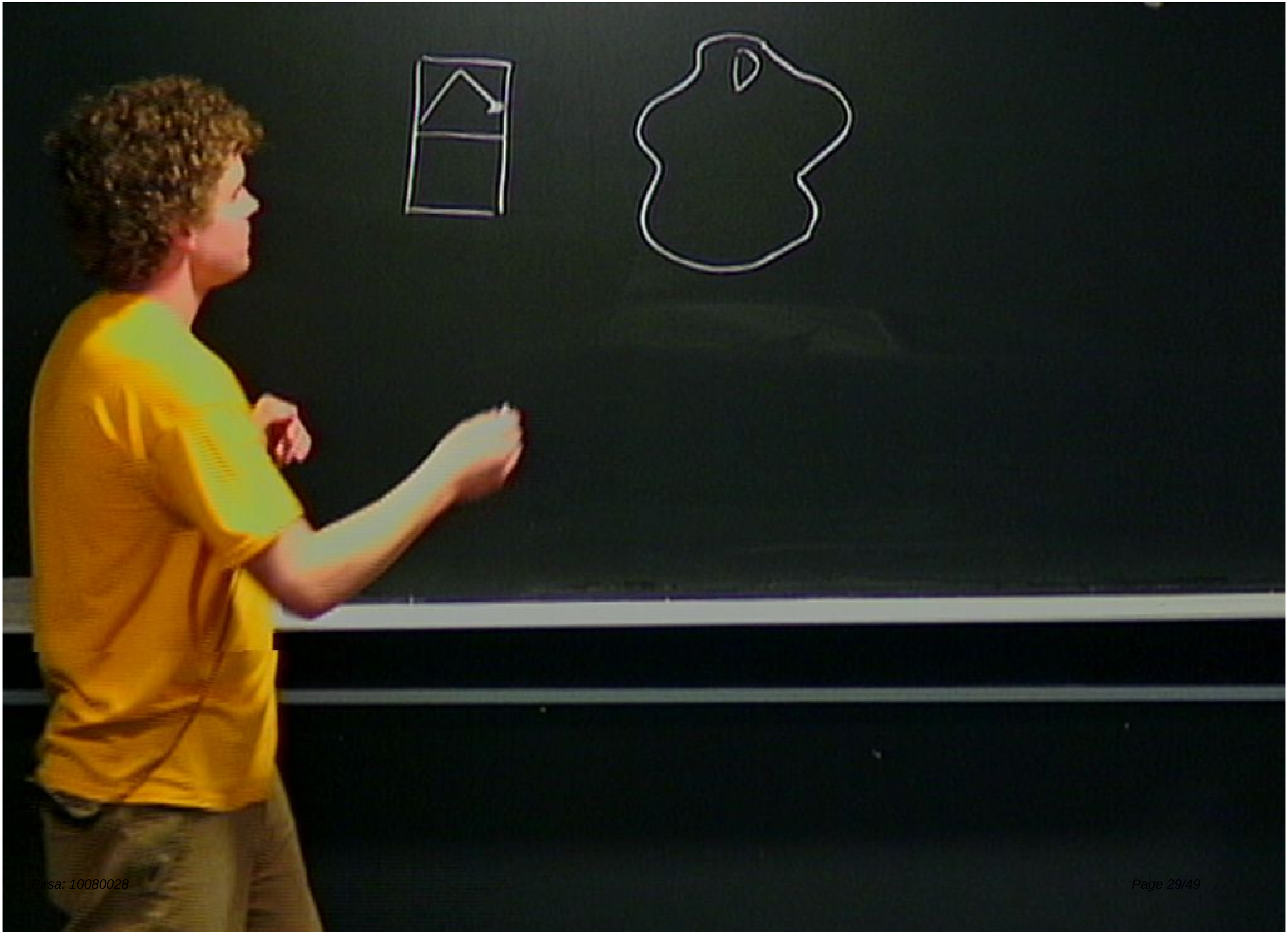

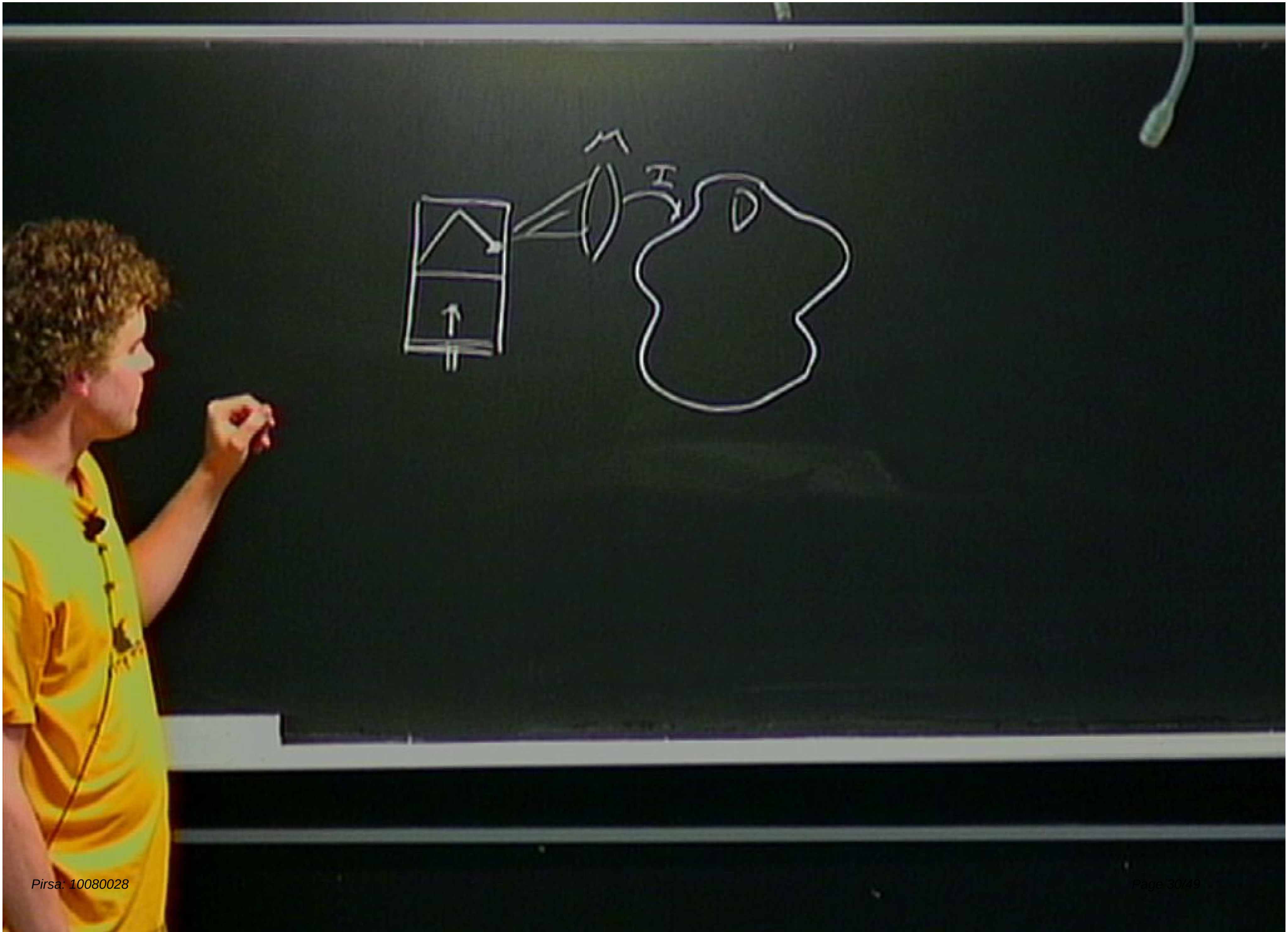

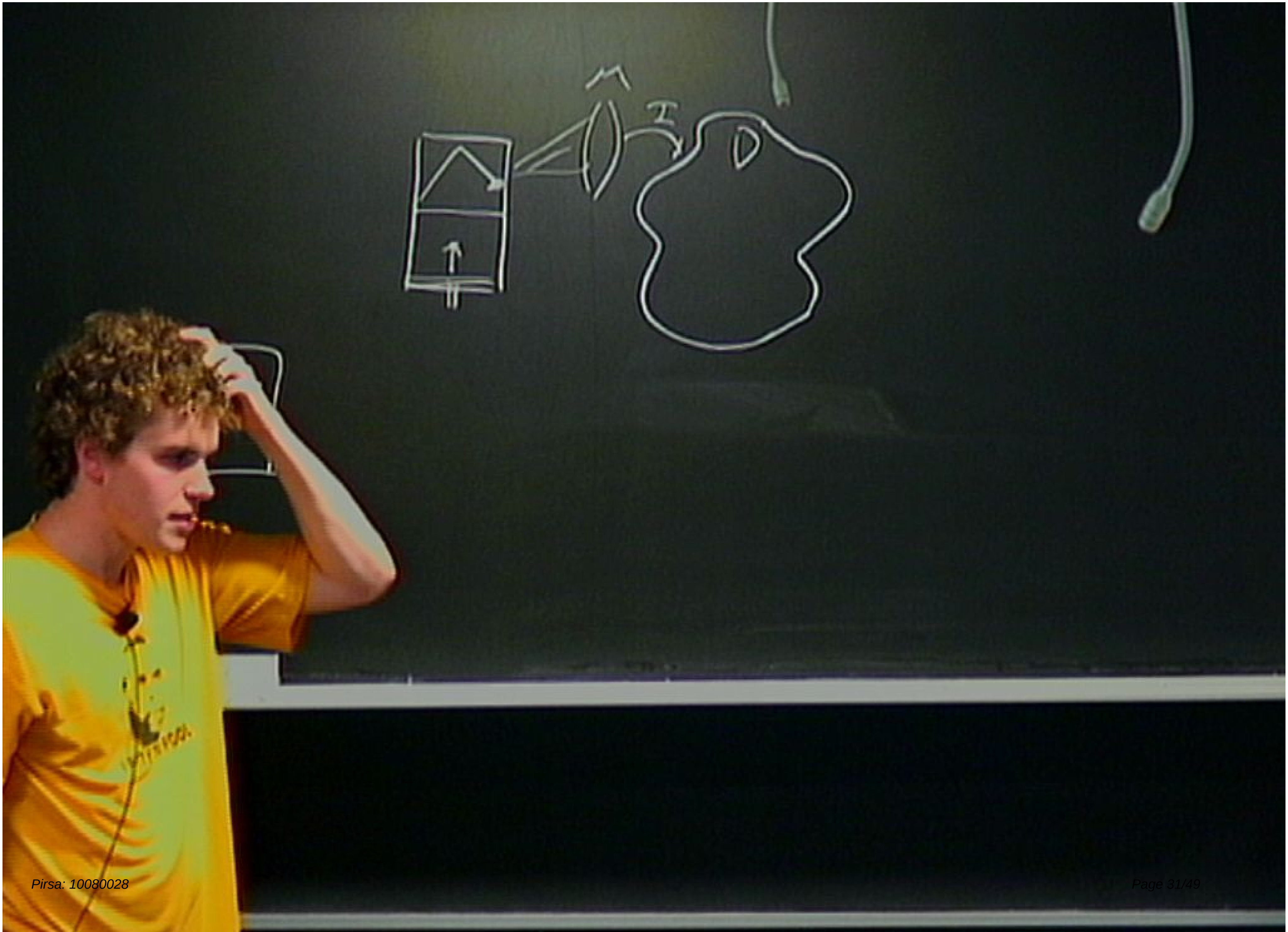

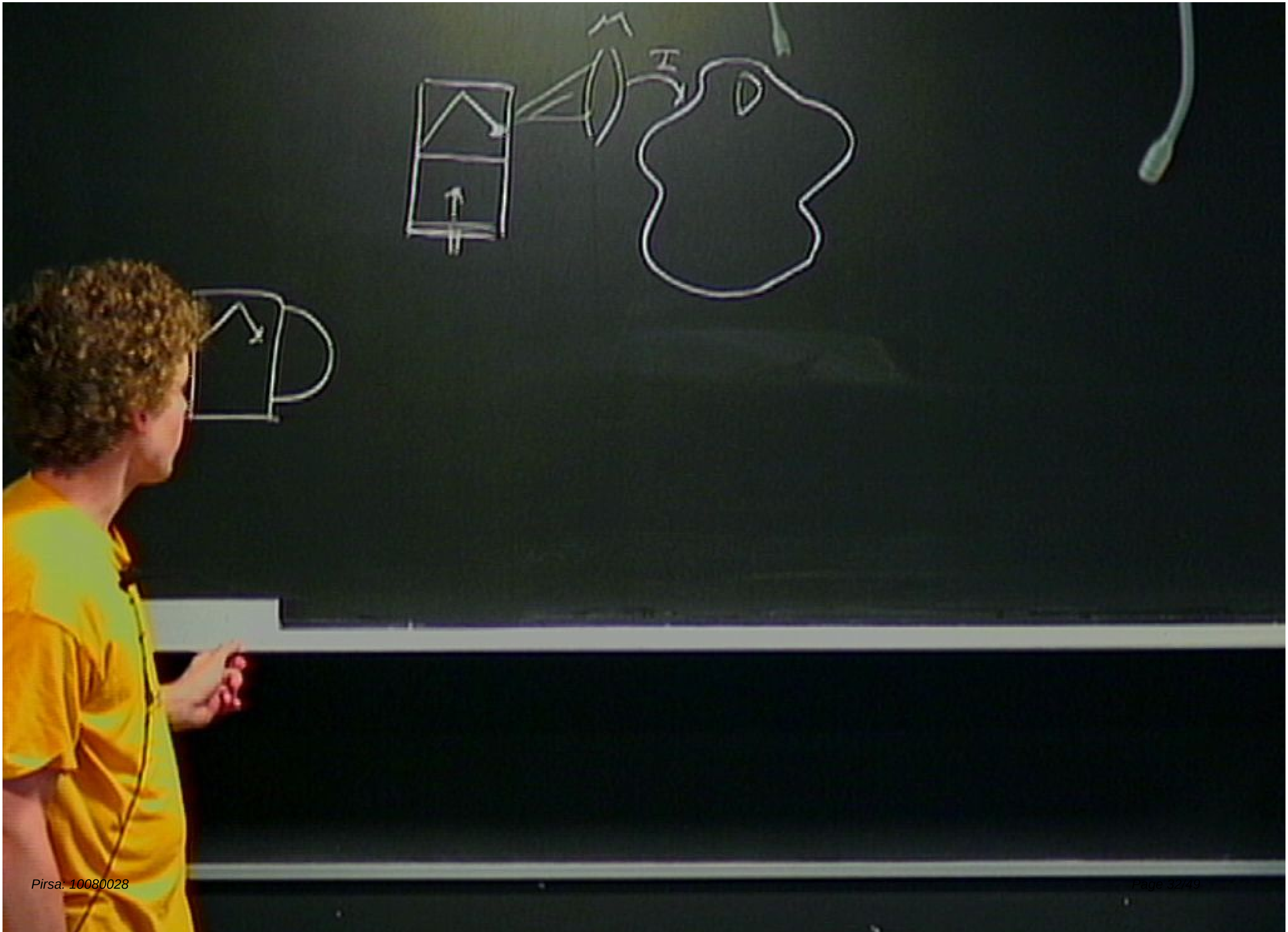

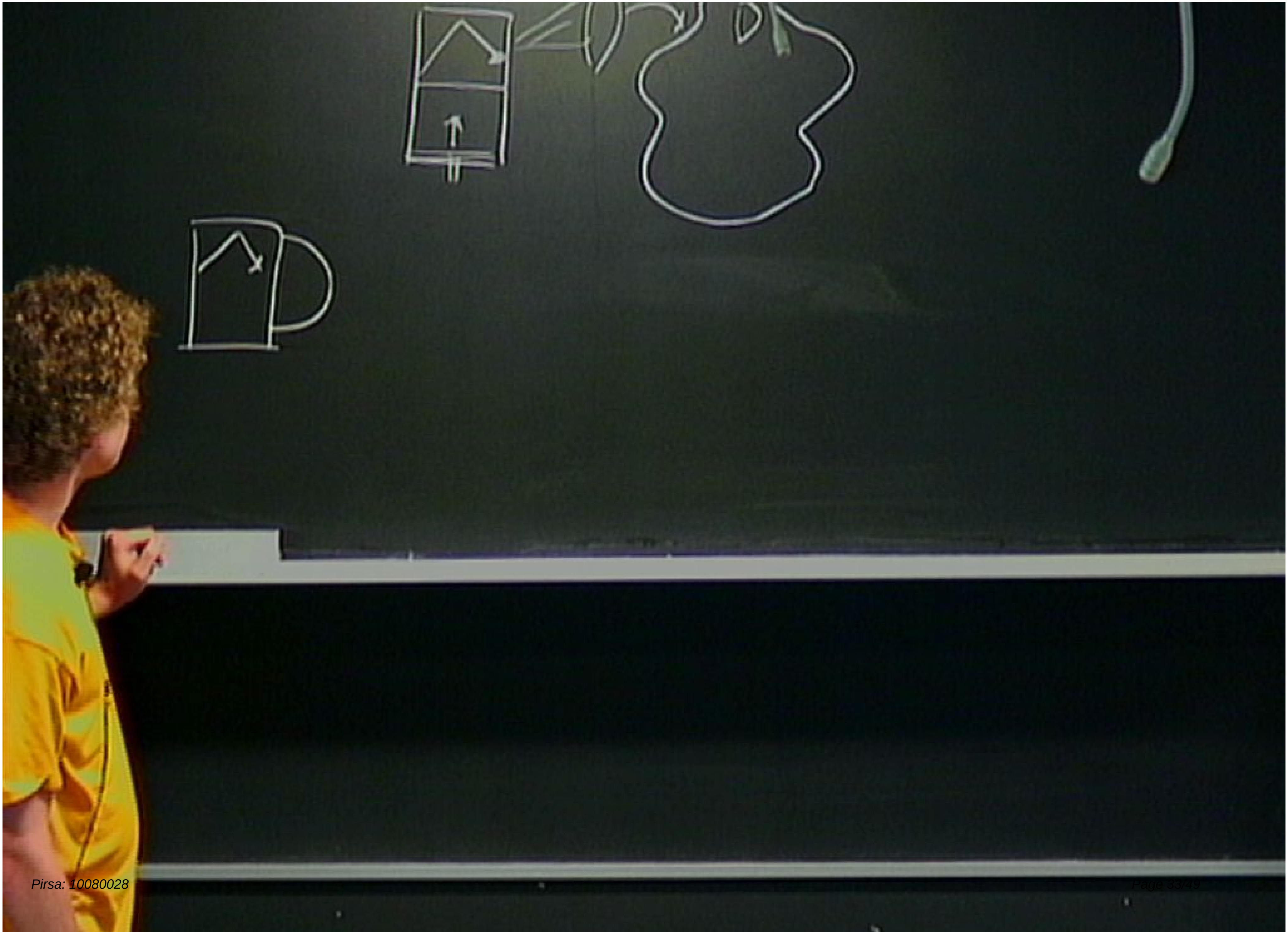


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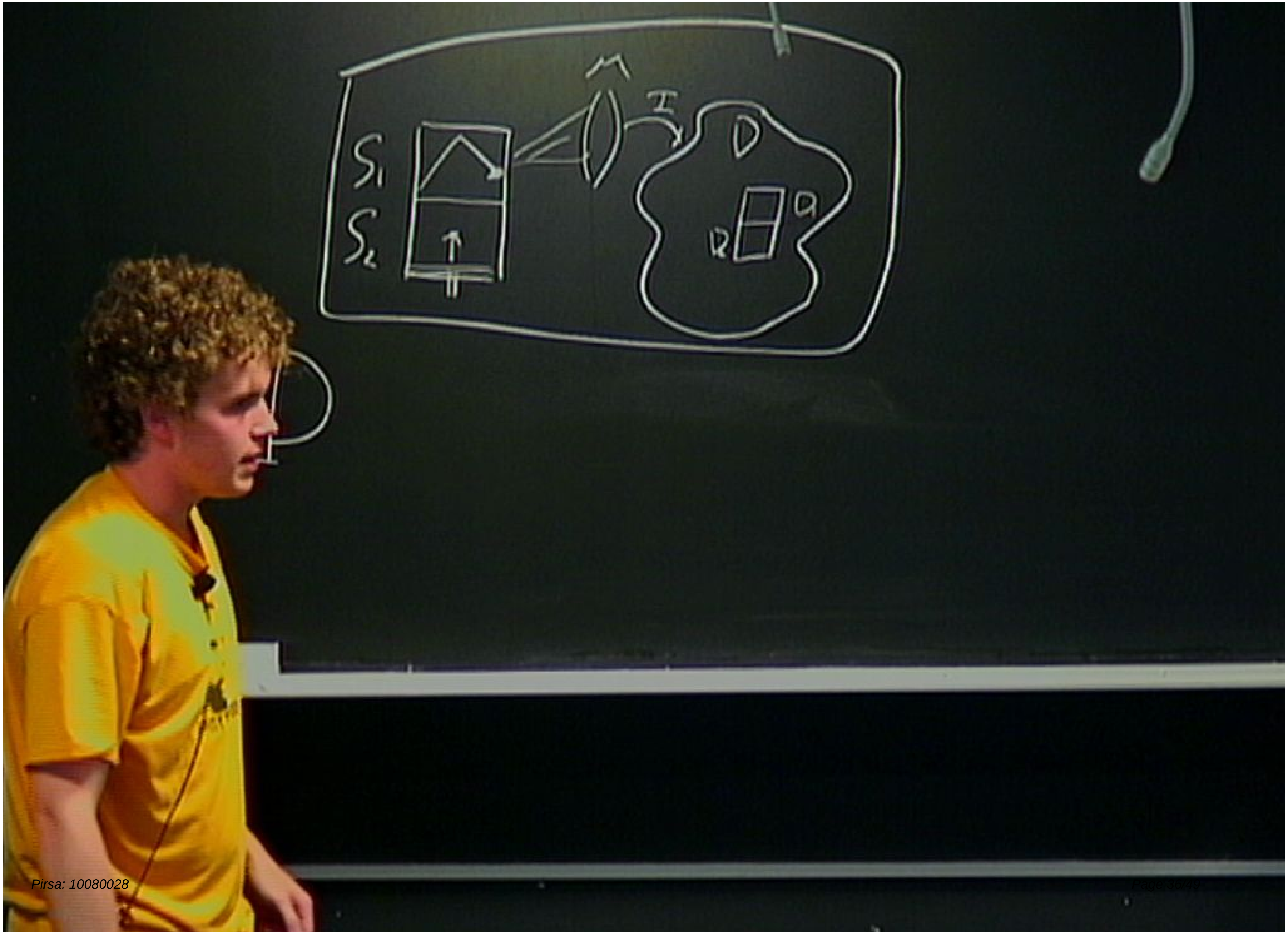
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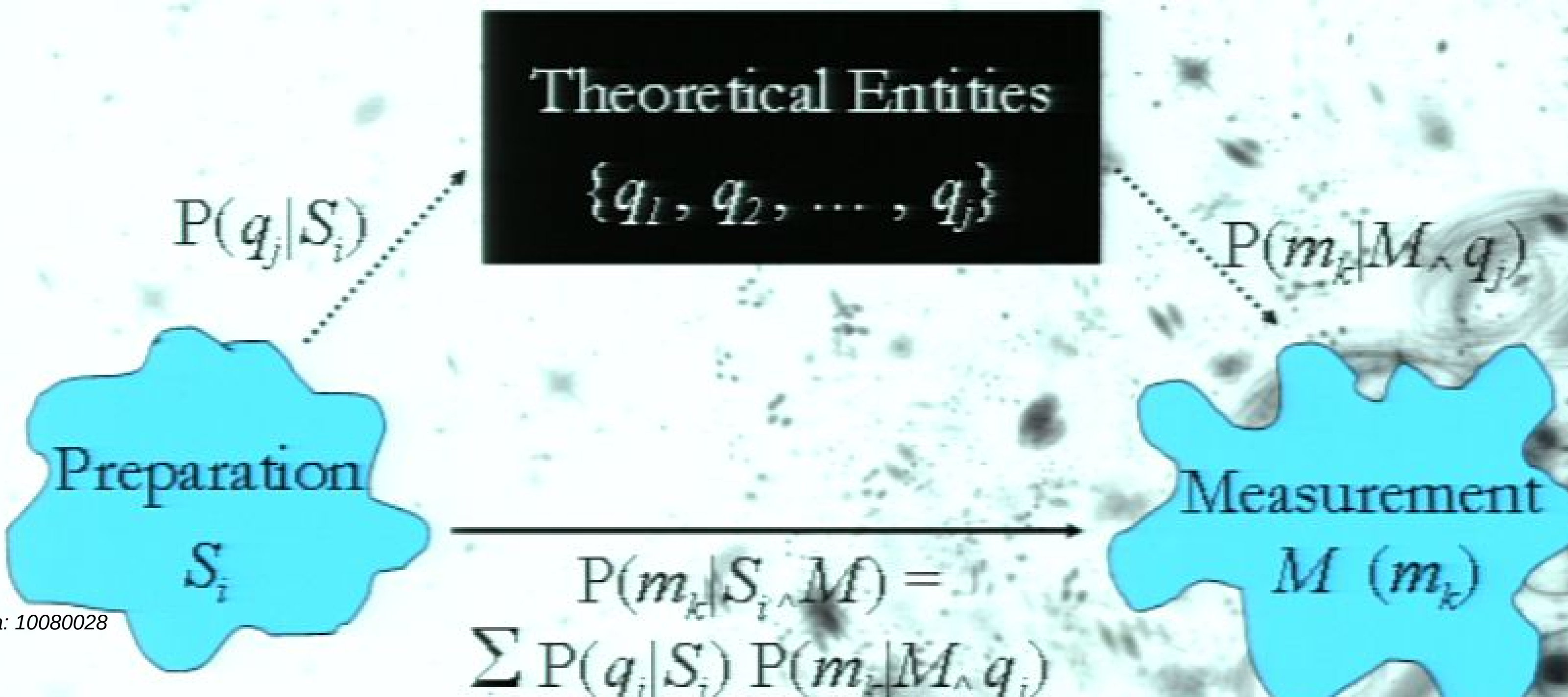

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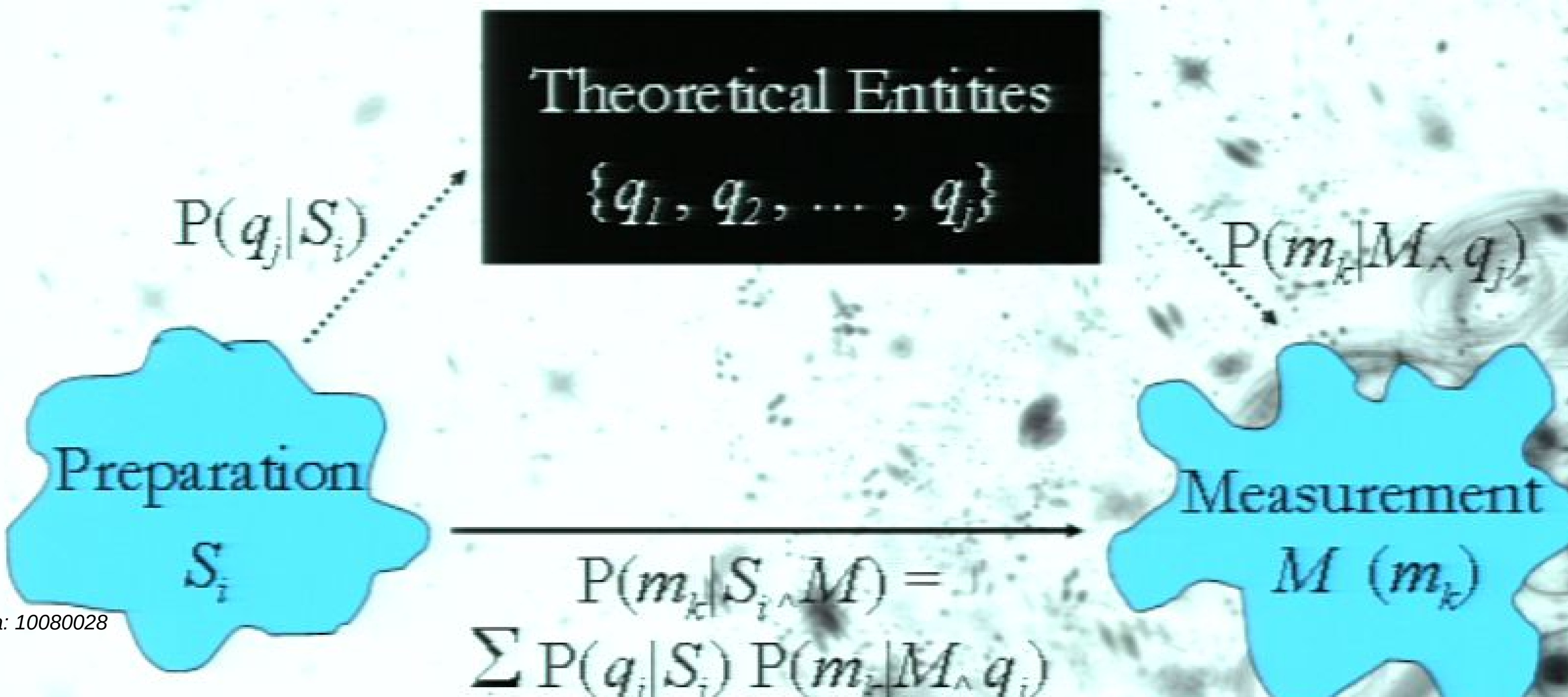

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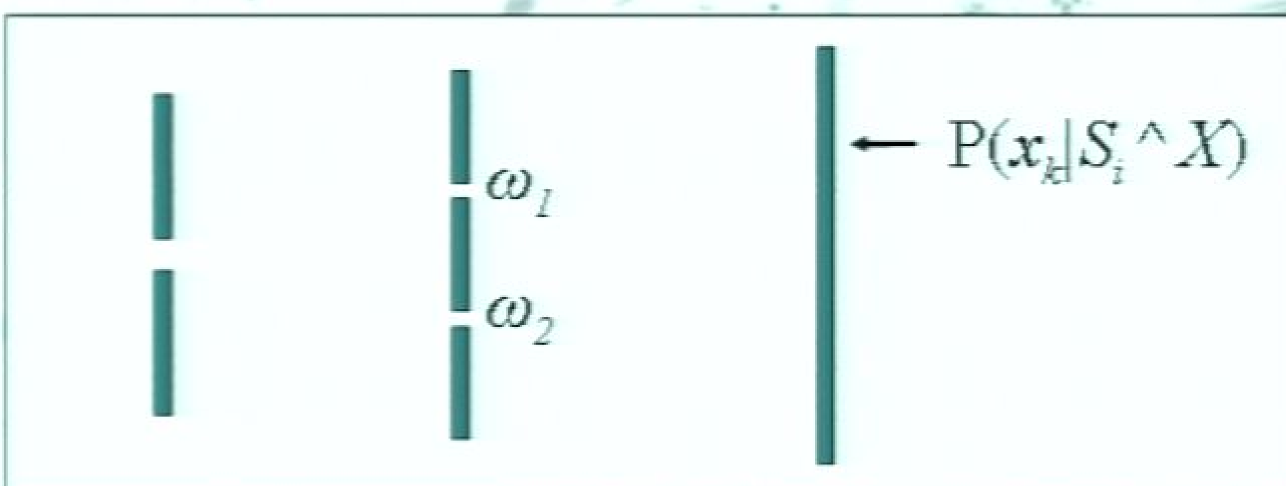

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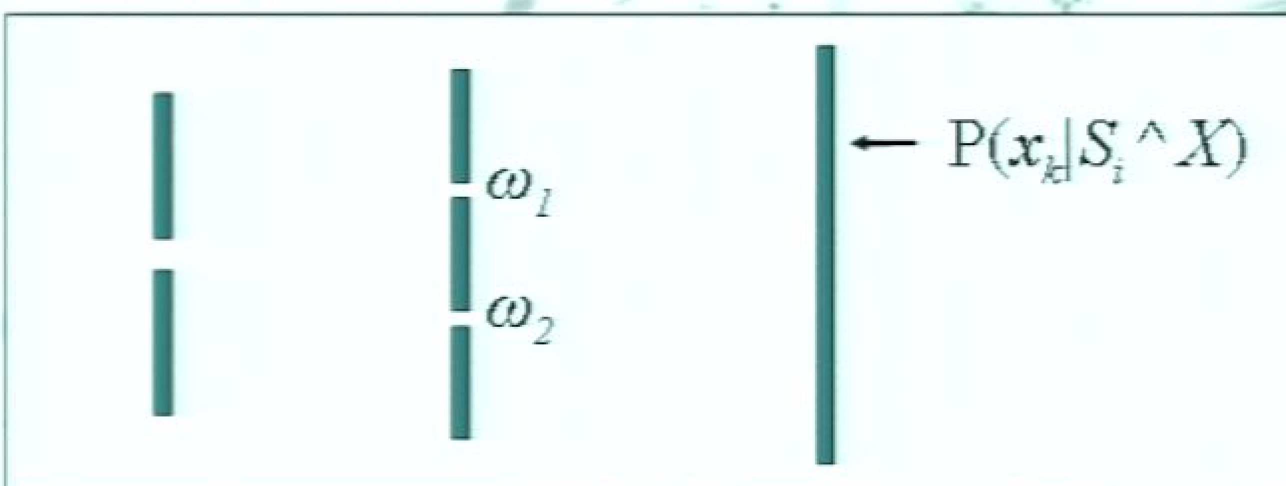

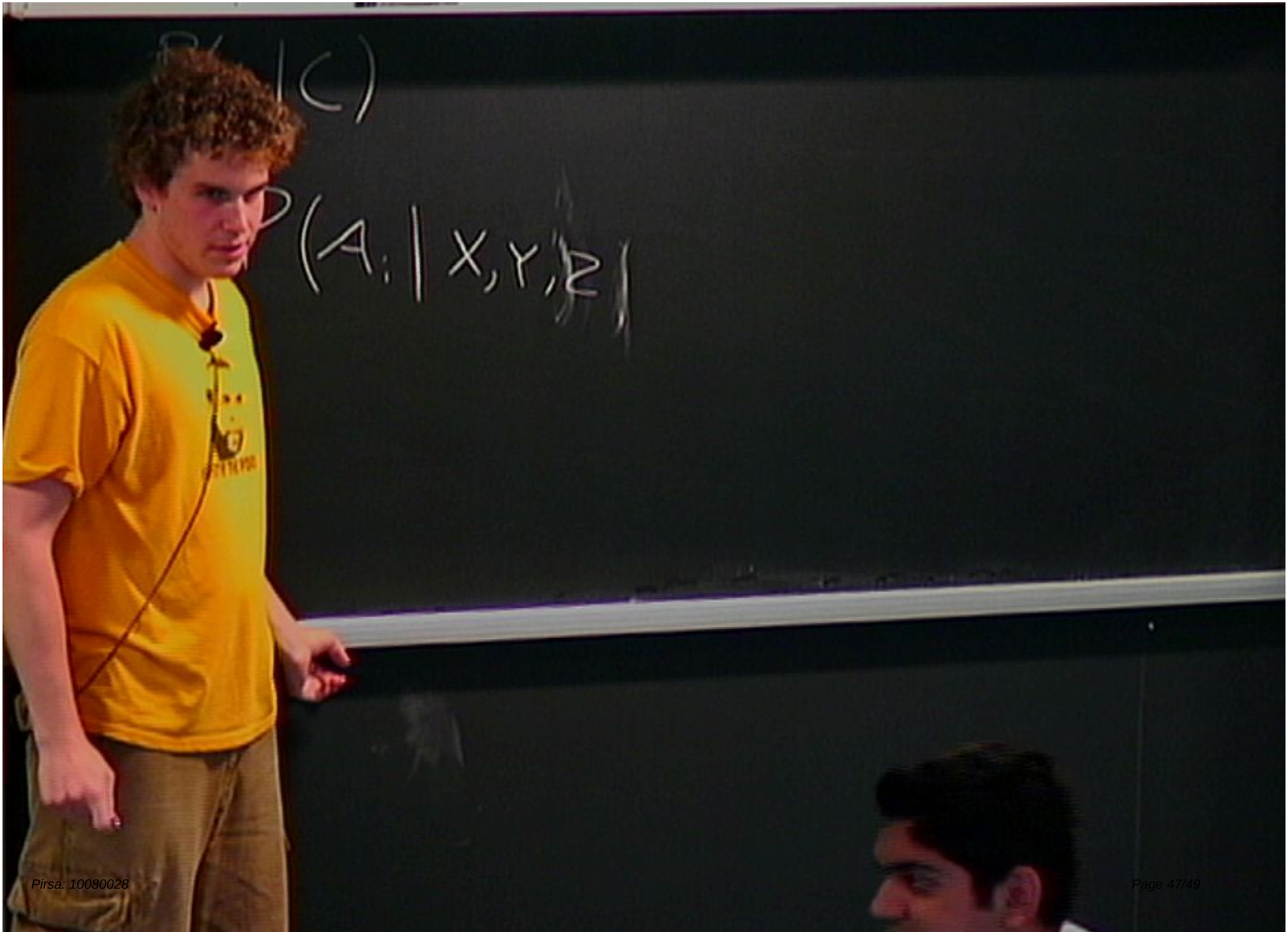
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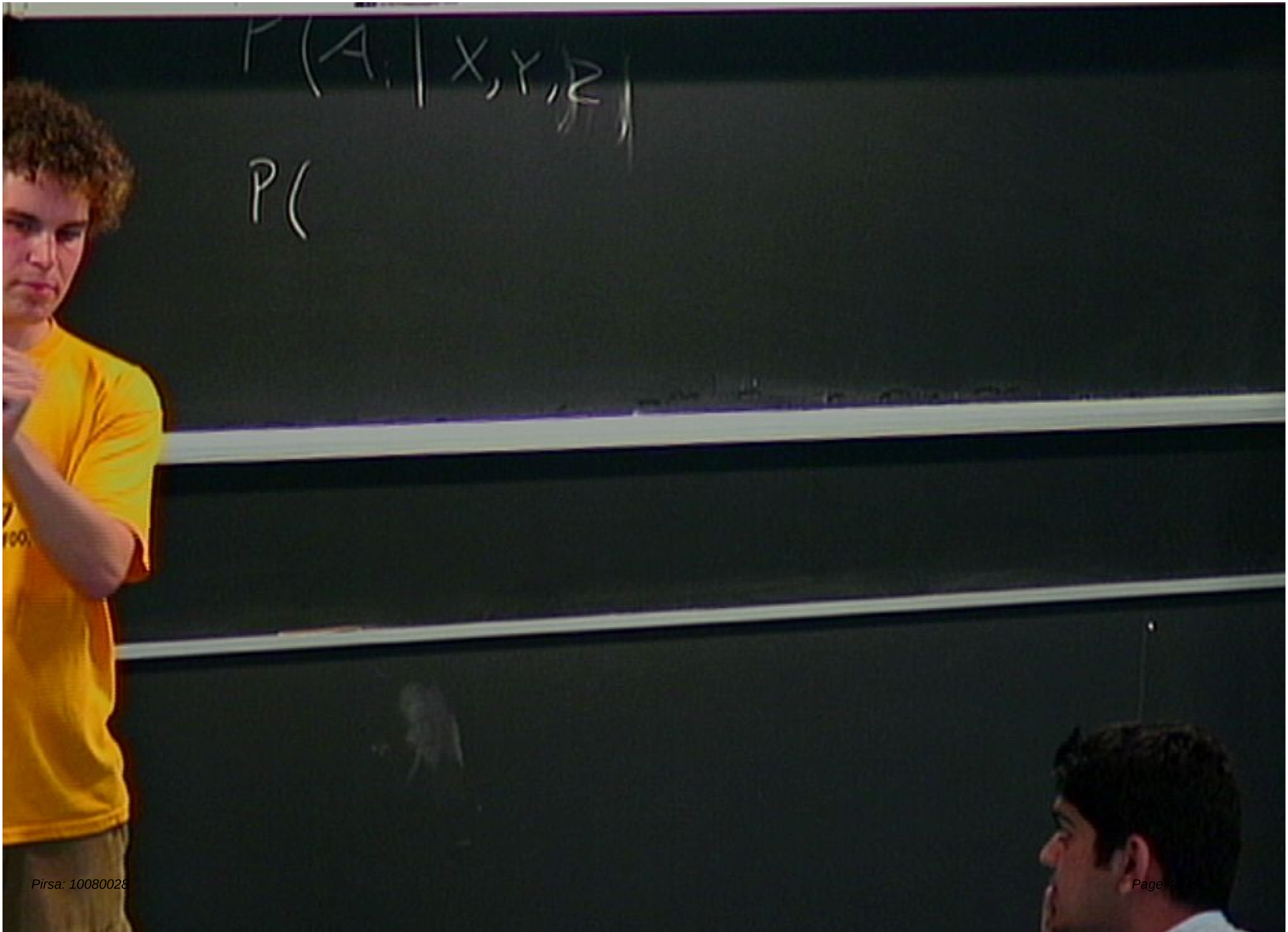
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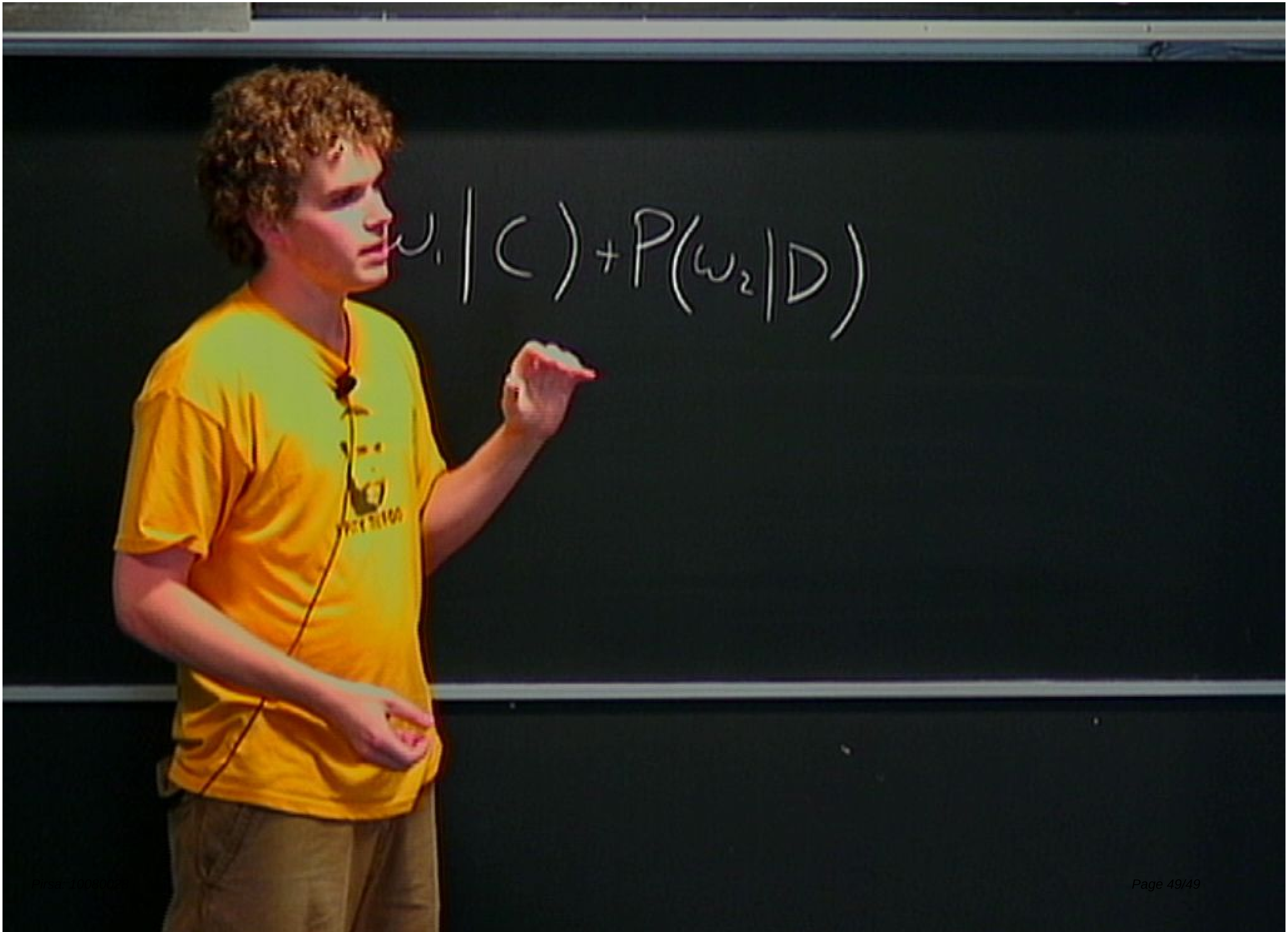
ω1|C)+P(ω2|D)