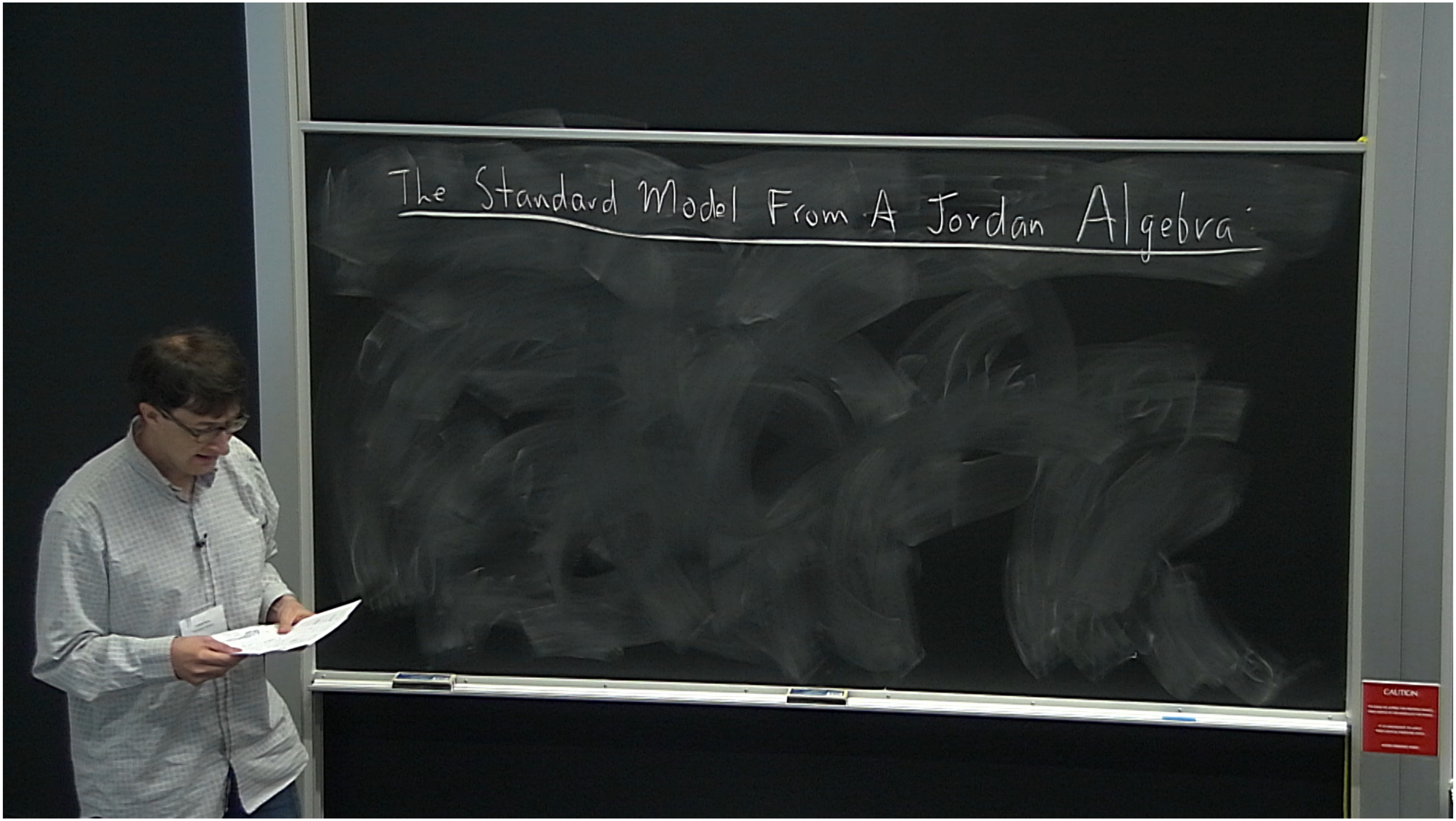
Title: Talk 7

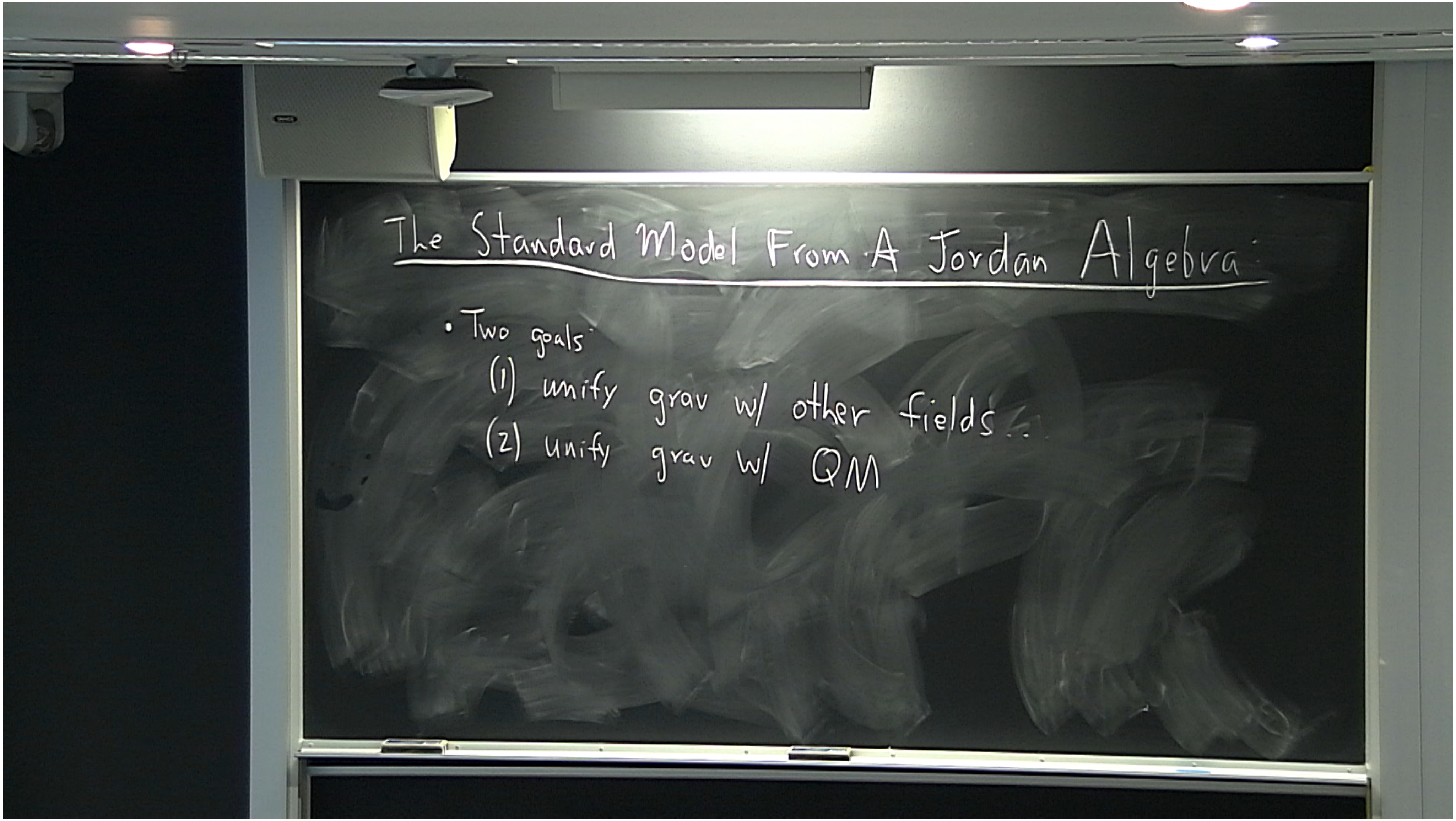
Speakers:

Collection: Simplicity III

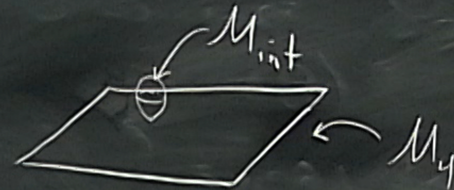
Date: September 10, 2019 - 11:00 AM

URL: http://pirsa.org/19090074

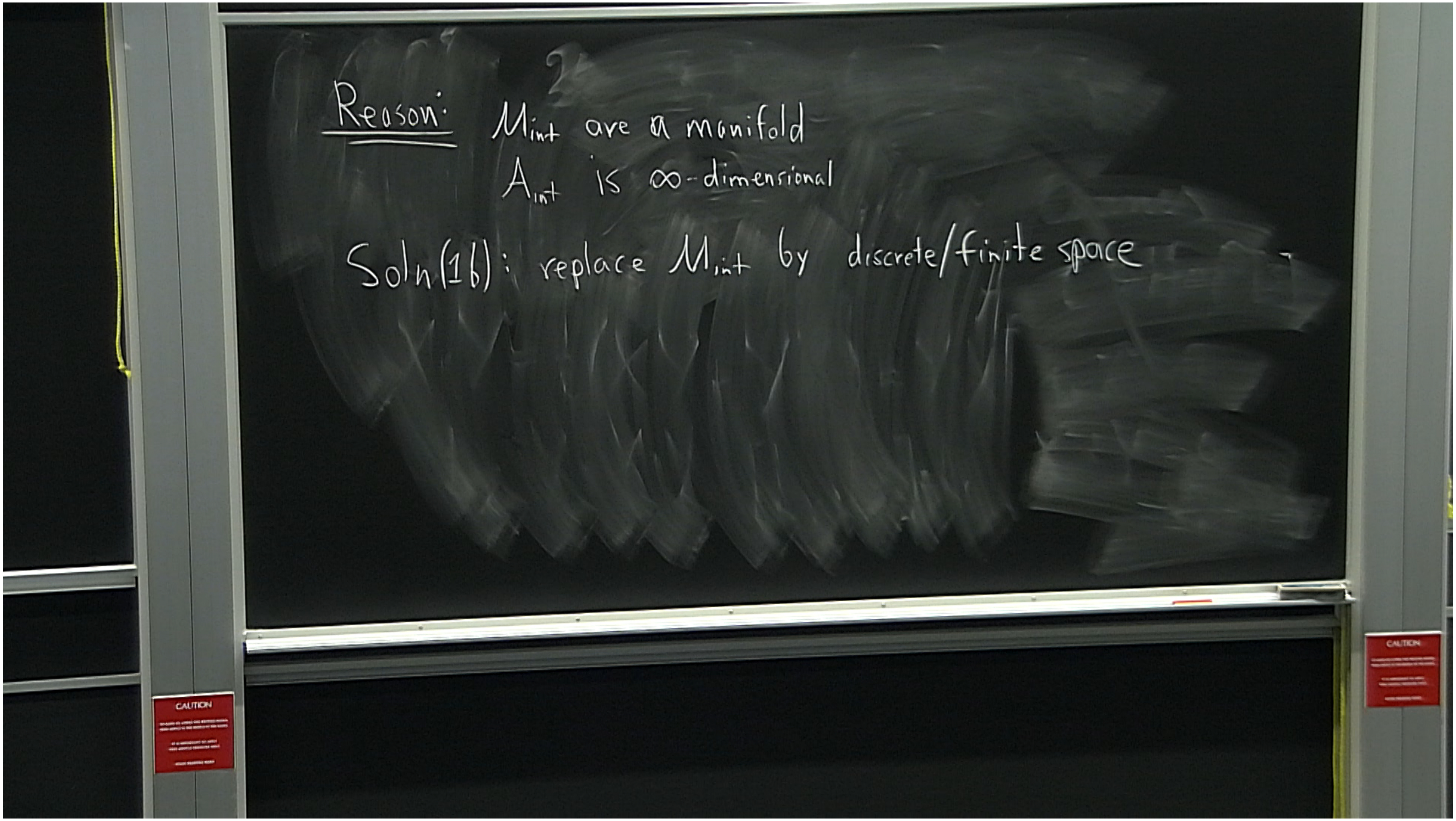

The Standard Model From A Jordan Algebra:

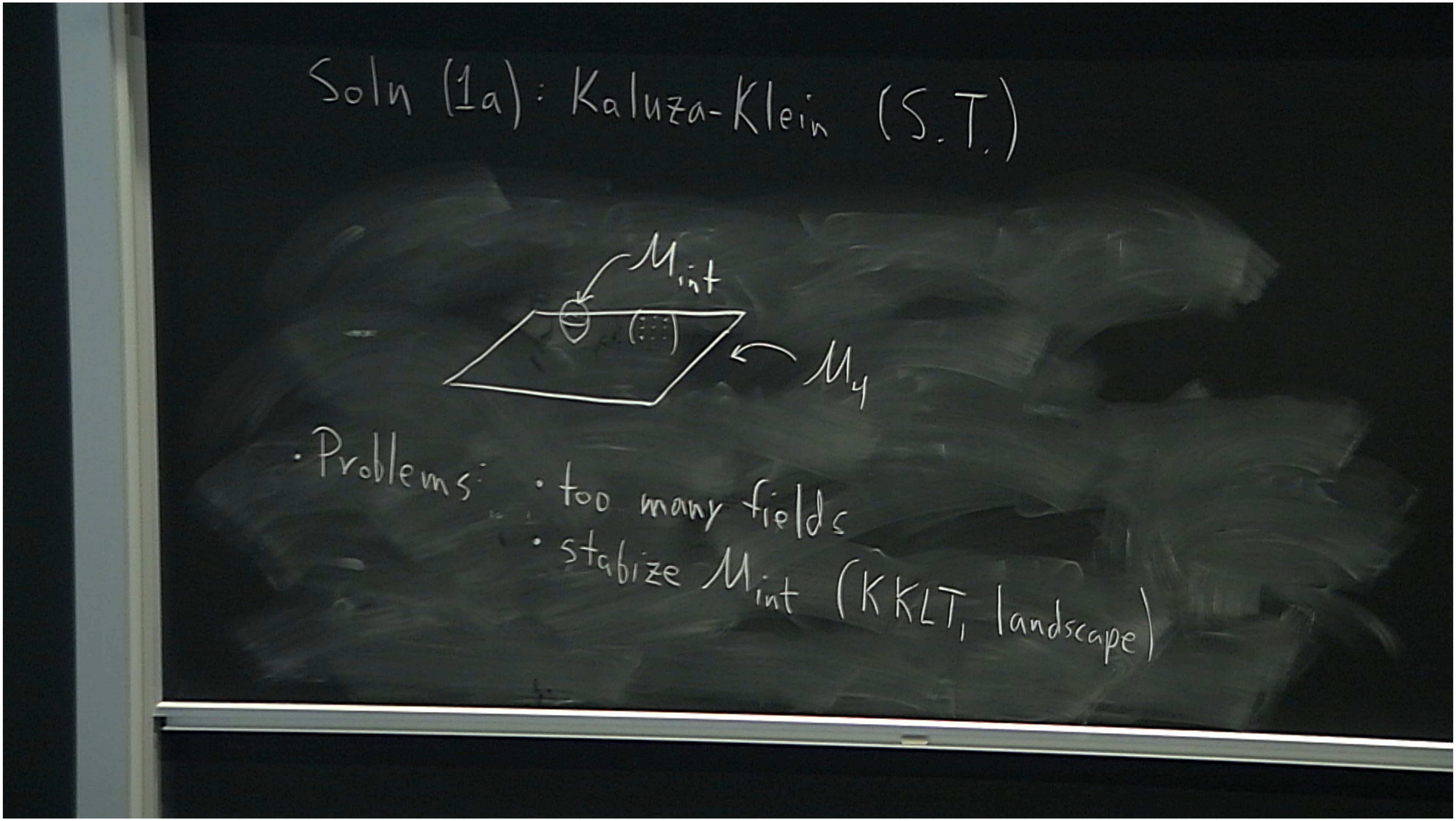

The Standard Model From A Jordan Algebra:
• Two goals:
(1) unify grav w/ other fields...
(2) unify grav w/ QM

Soln (1a): Kaluza-Klein (S.T.)



· Problems: · too many fields
· stabize $\mathcal{M}_{int}$ (KKLT, landscape)


Reason: $\mathcal{M}_{int}$ are a manifold
A_{int} is ∞-dimensional
Soln(1b): replace $\mathcal{M}_{int}$ by discrete/finite space


Soln (1a): Kaluza-Klein (S.T.)
$\mathcal{M}_{int}$
$\mathcal{M}_4$
· Problems: · too many fields
· stabize $\mathcal{M}_{int}$ (KKLT, landscape)

Reason: $\mathcal{M}_{int}$ are a manifold

$\underline{A_{int}}$ is ∞-dimensional

Soln (1b): replace $\mathcal{M}_{int}$ by discrete/finite space

A_{int} finite-dimensional

$$Aut[C_\infty(M_4)] = Diff(M_4)$$

$$Aut[C_\infty(M) \otimes A_{int}] = Diff(M) \ltimes Map(M_4, \underbrace{Aut(A_{int})}_{SU(3)\times SU(2)\times U(1)})$$

$$Aut[C_\infty(\underline{M_4 \times M_{int}})]$$

(2) "Quantum geometry"

- Soln (2a): NCG
  - 1st attemp: (1b) also assumed (2a)
    Dubois-Violette, Kerner, Madore, Connes
- NCG is for <u>phase space</u> $[q,p]\neq 0$ (symplectic geom)
  not <u>spacetime</u> $[q,q']=0$ (pseudo-Riemann)
- Soln (2b): replace NCG by Jordan geometry
  A_{int} = Jordan algebra

$\{H_1, H_2\}$ Jordan $\quad \{\{H_1, H_2\}, H_3\} = \{H$

$[A_1, A_2]$ Lie $\quad [a,b] = ab - ba \neq 0$

$[a,b,c] = (ab)c - a(bc) \neq 0$

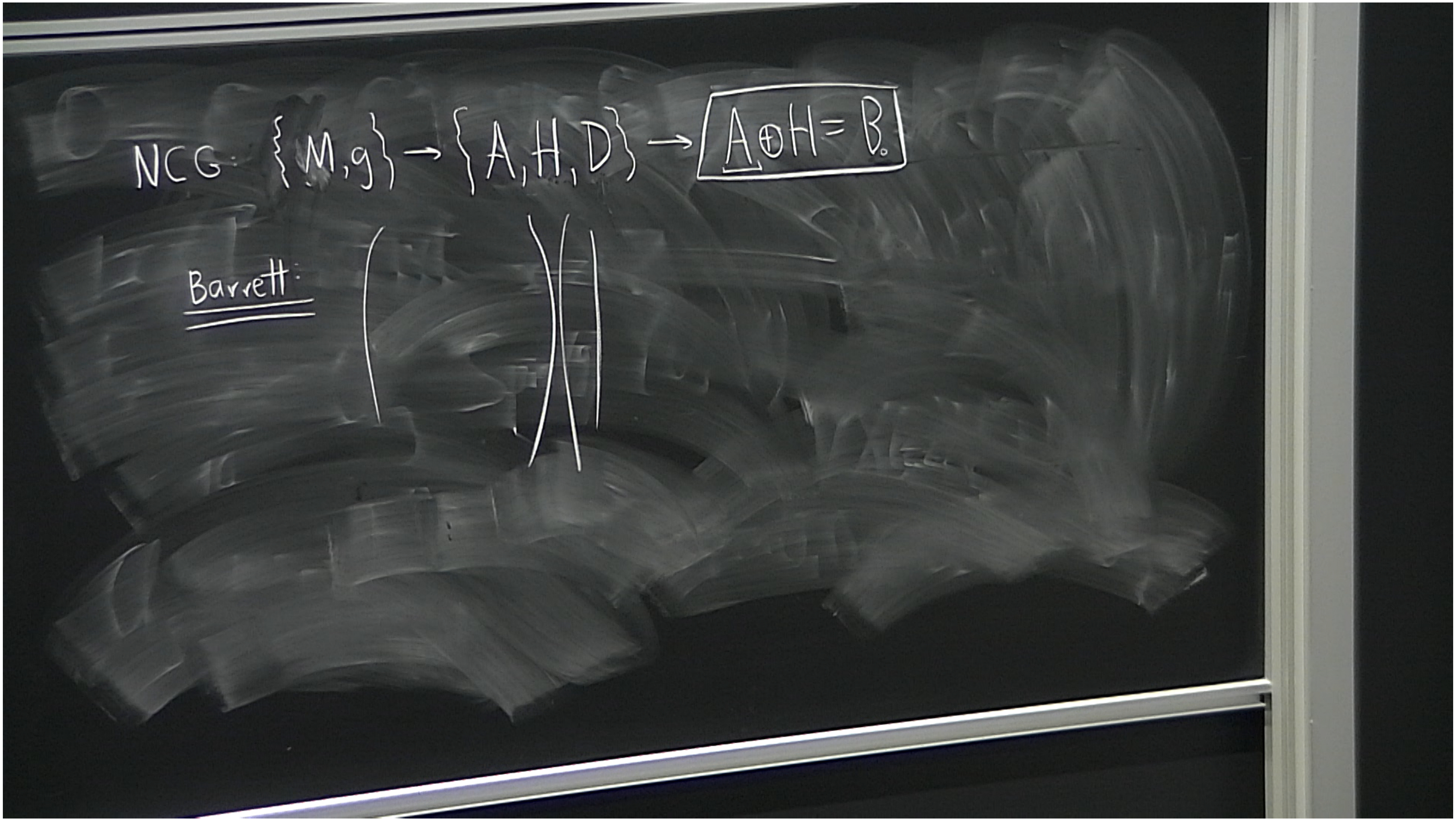
Jordan + von N + Wigner

$\underline{JSpin(n)}$, $J_n(\mathbb{R})$, $J_n(\mathbb{C})$, $J_n(\mathbb{H})$, $J_3(\mathbb{O})$

$(q,p) \to q$

$O \to H = \frac{1}{2}(O + O^\dagger) \leftarrow$

$A = \frac{1}{2}(O - O^\dagger)$


NCG: {M,g} → {A,H,D} → A⊕H = B
Barrett:

$$\text{NCG: } \{M, g\} \to \{A, H, D\} \to \boxed{\underline{A} \oplus H = B}$$

$$SU(3) \times SU(2) \times U(1)$$

Barrett:

$$\left(\begin{array}{c|c} 4\times 4 & \\ \hline & 4\times 4 \end{array}\right) \quad \left(\begin{array}{c|c} & \psi_{4\times 4} \\ \hline \psi^{\dagger}_{4\times 4} & \end{array}\right)$$

$$\left(\begin{array}{c|c} J_2(\mathbb{C}) & \\ \quad JSpin(2) & \\ \hline & J_3(\mathbb{C}) \\ & \quad \mathbb{R} \end{array}\right)$$

	$SU(3)$	$SU(2)$	$U(1)$	$U(1)_{B-L}$
q_L	3	2	0 (1/6)	1/3
u_R	3	1	1/2 (2/3)	1/3
d_R	3	1	-1/2 (-1/3)	1/3
l_L	1	2	0 (-1/2)	-1
ν_R	1	1	1/2 (0)	-1
e_R	1	1	-1/2 (-1)	-1