Title: Kinetic theory of collisionless self-gravitating systems

Speakers: Uddipan Banik

Series: Cosmology & Gravitation

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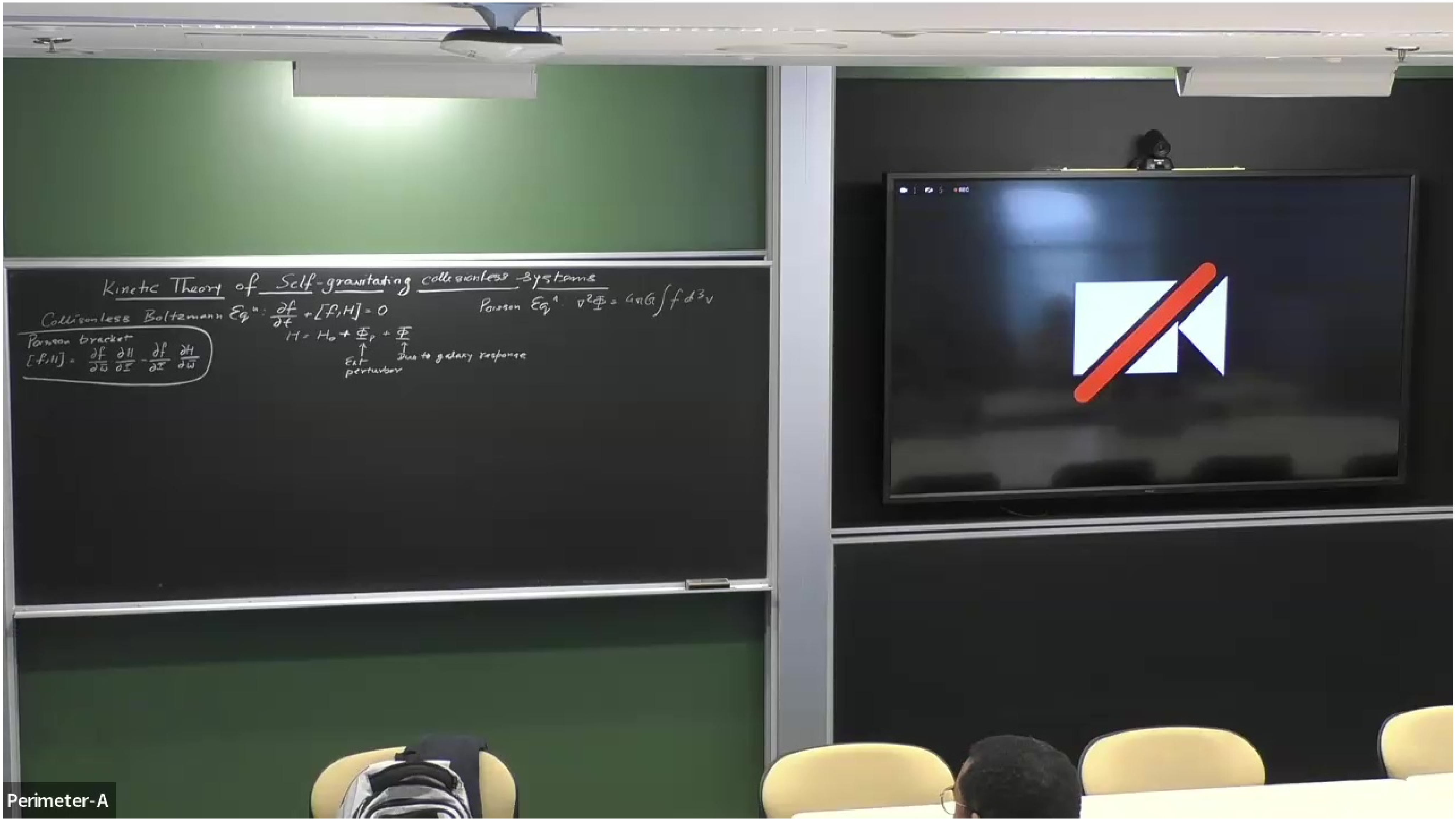
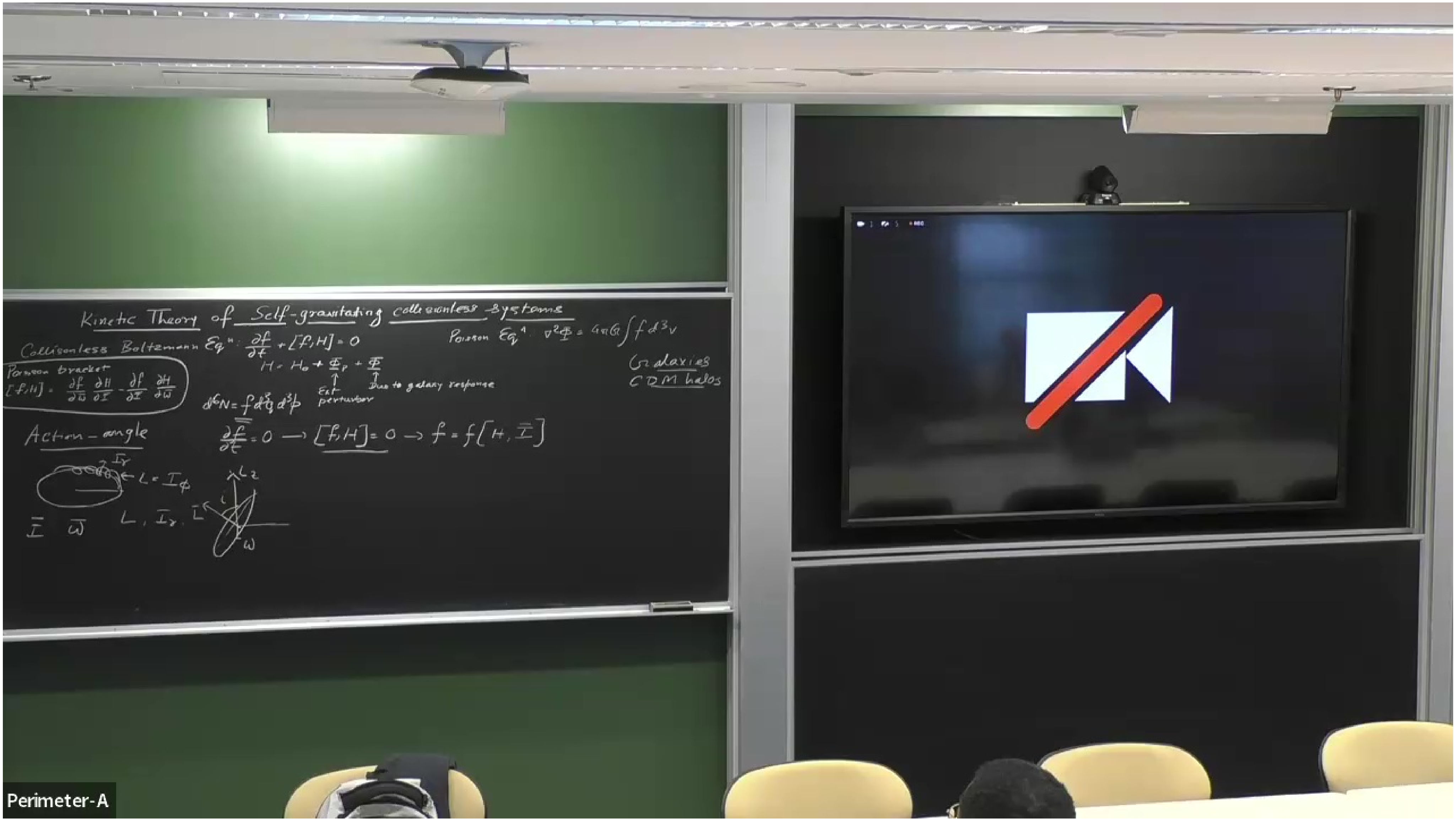
Abstract: Abstract and Zoom Link: TBD


Kinetic Theory of Self-gravitating collisionless systems
Collisionless Boltzmann Eq^n: $\frac{\partial f}{\partial t} + [f,H] = 0$
Poisson Eq^n: $\nabla^2 \Phi = 4\pi G \int f \, d^3v$
Poisson bracket
$[f,H] = \frac{\partial f}{\partial w}\frac{\partial H}{\partial I} - \frac{\partial f}{\partial I}\frac{\partial H}{\partial w}$
$H = H_0 + \Phi_p + \Phi$
Ext perturber
Due to galaxy response
Perimeter-A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Collisionless Boltzmann Eq^n: $\frac{\partial f}{\partial t} + [f, H] = 0$
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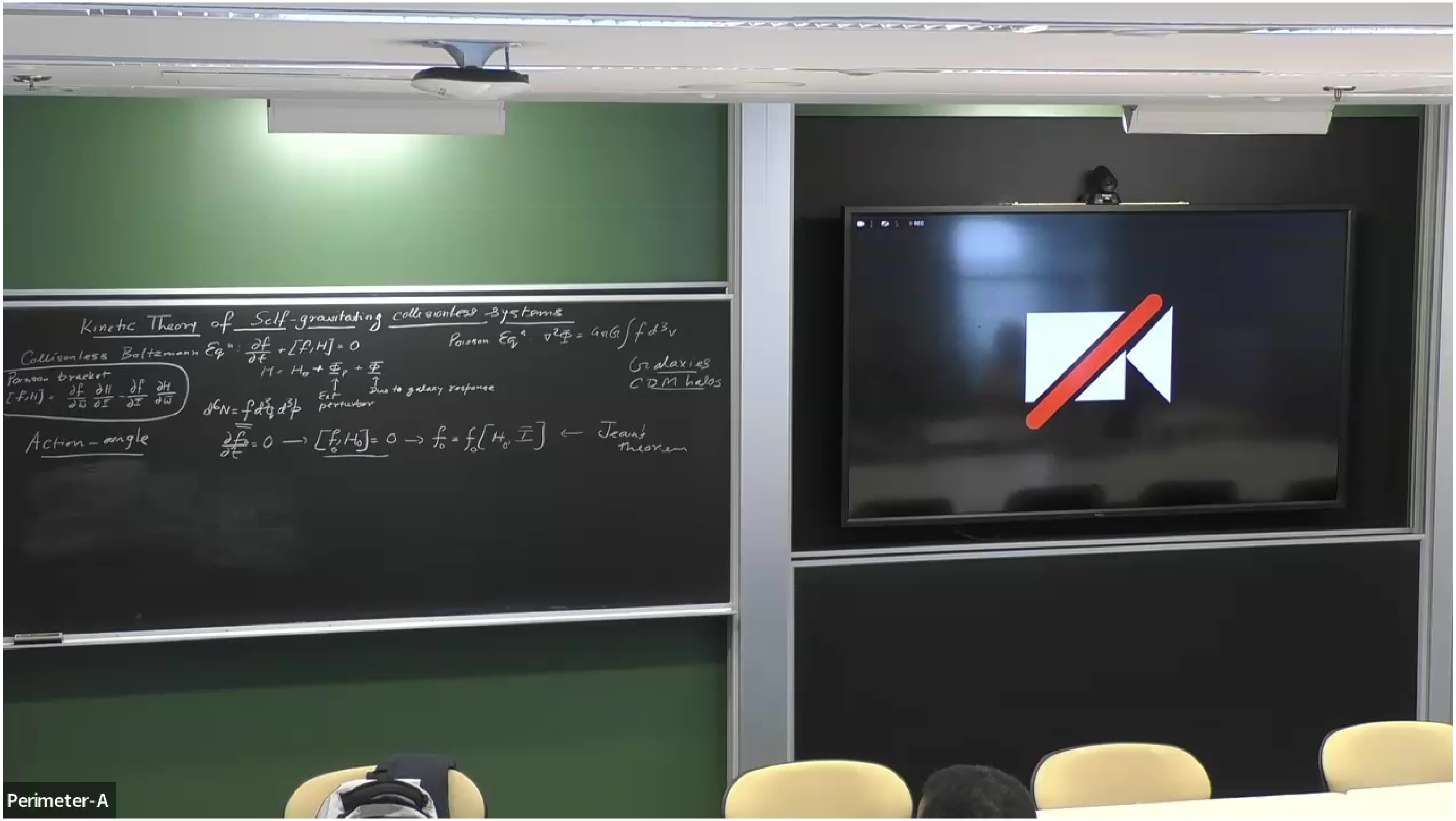
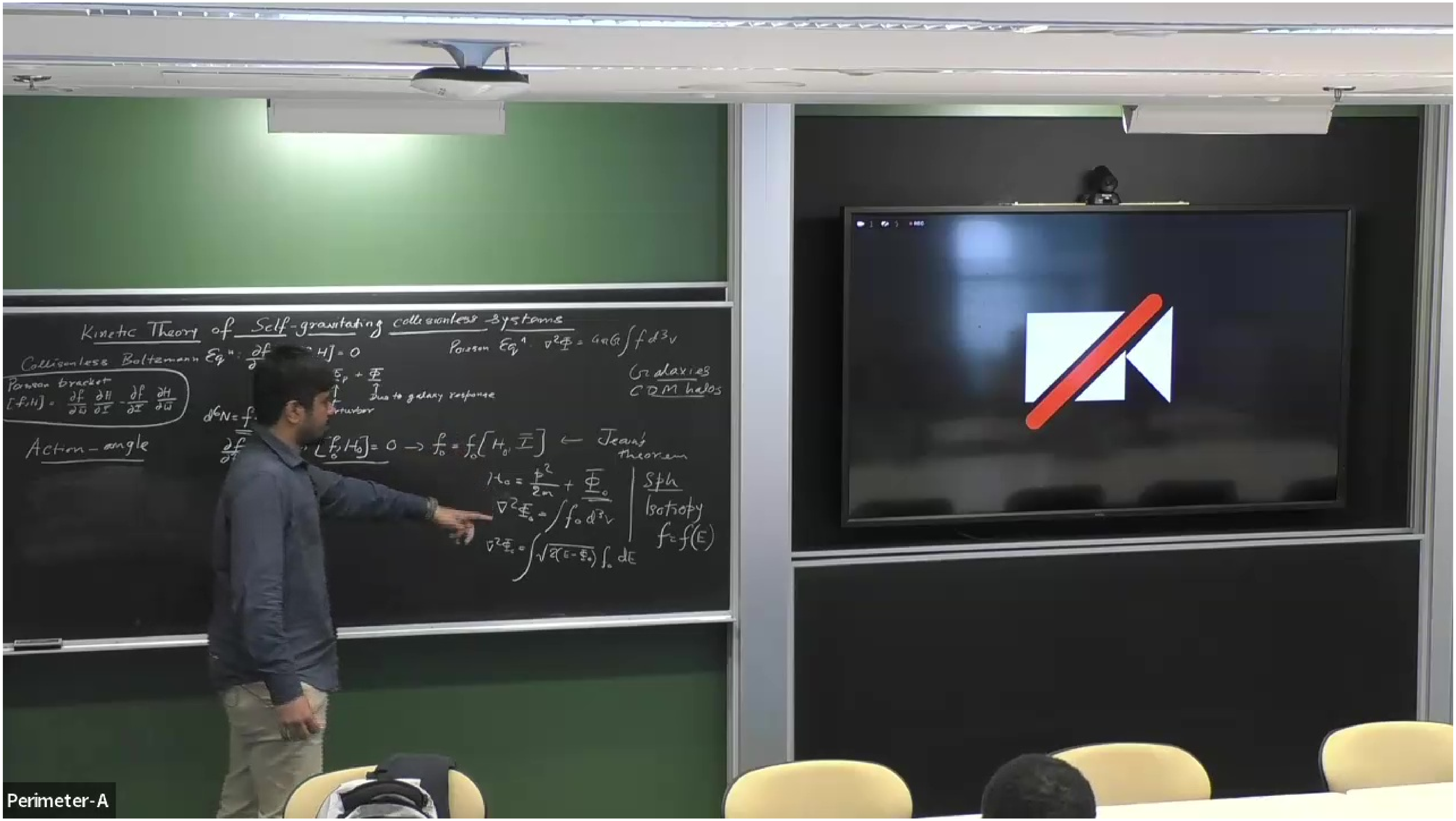
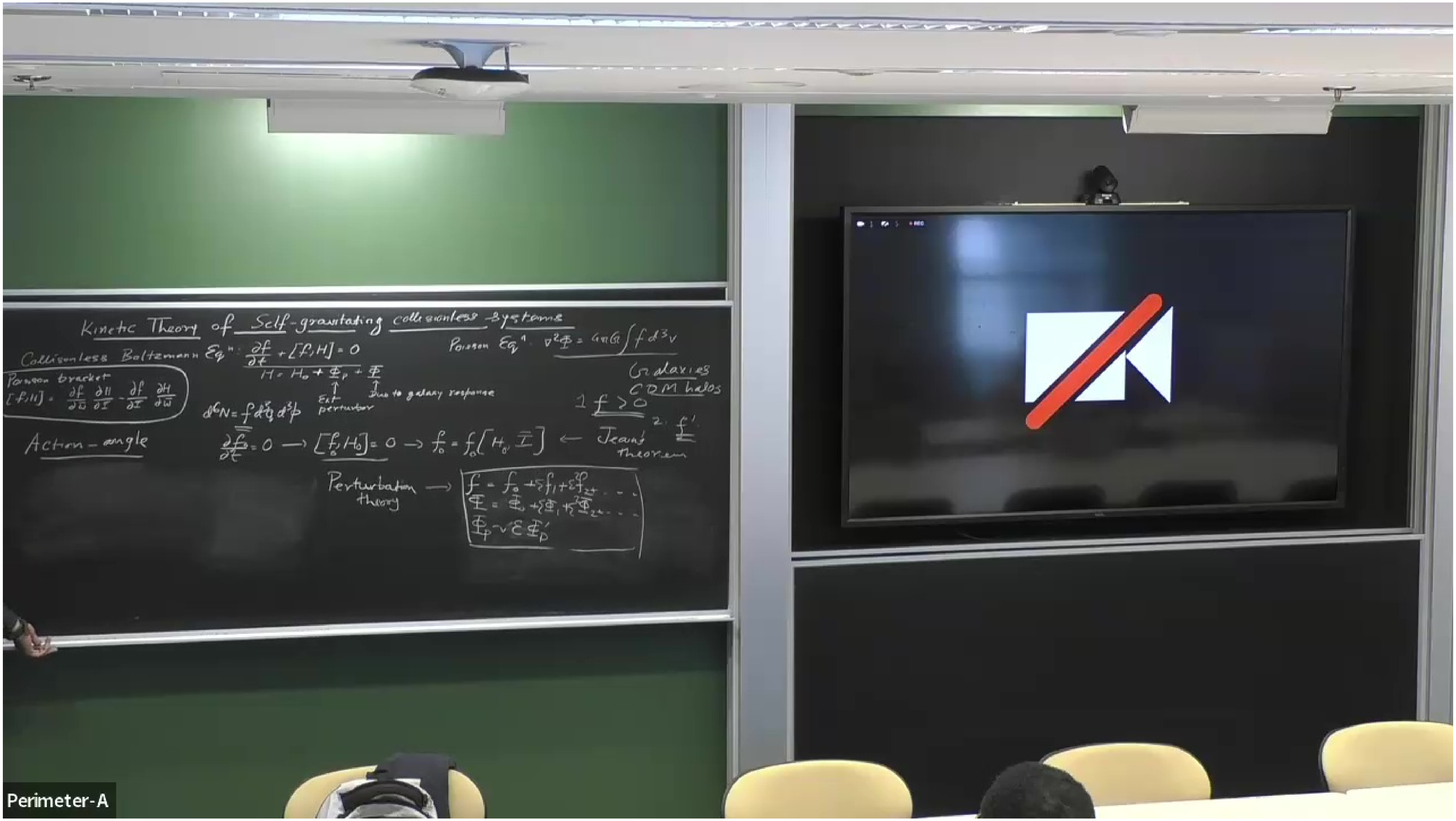
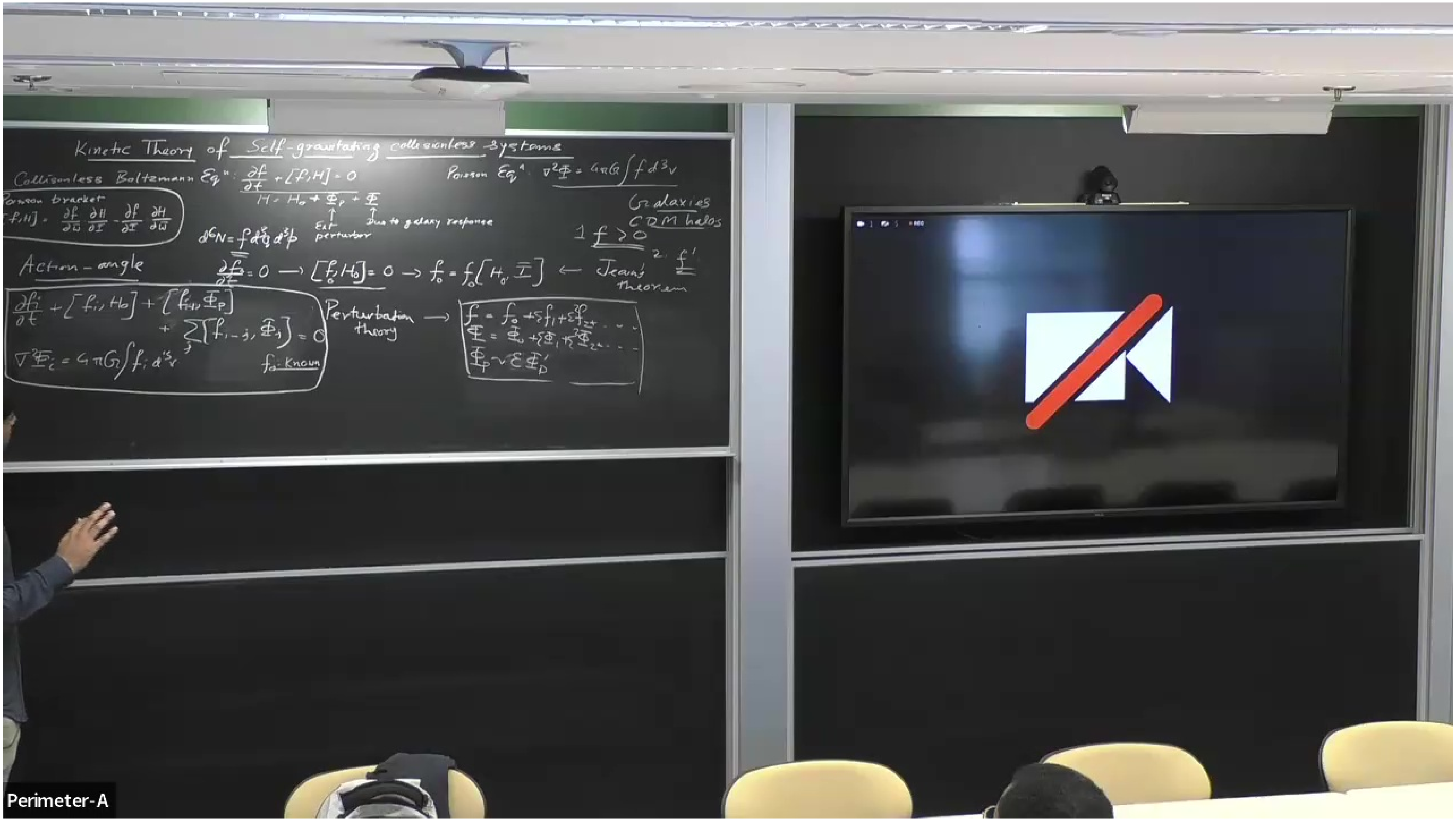
Poisson bracket
$[f,H] = \frac{\partial f}{\partial \bar{w}} \frac{\partial H}{\partial \bar{I}} - \frac{\partial f}{\partial \bar{I}} \frac{\partial H}{\partial \bar{w}}$
$H = H_0 + \Phi_p + \Phi$
Ext perturber
Due to galaxy response
Galaxies
CDM halos
Action-angle
$\frac{\partial f}{\partial t} = 0 \rightarrow [f,H] = 0 \rightarrow f = f[H, \bar{I}]$
$L = I_\phi$
L, I_r
Perimeter-A

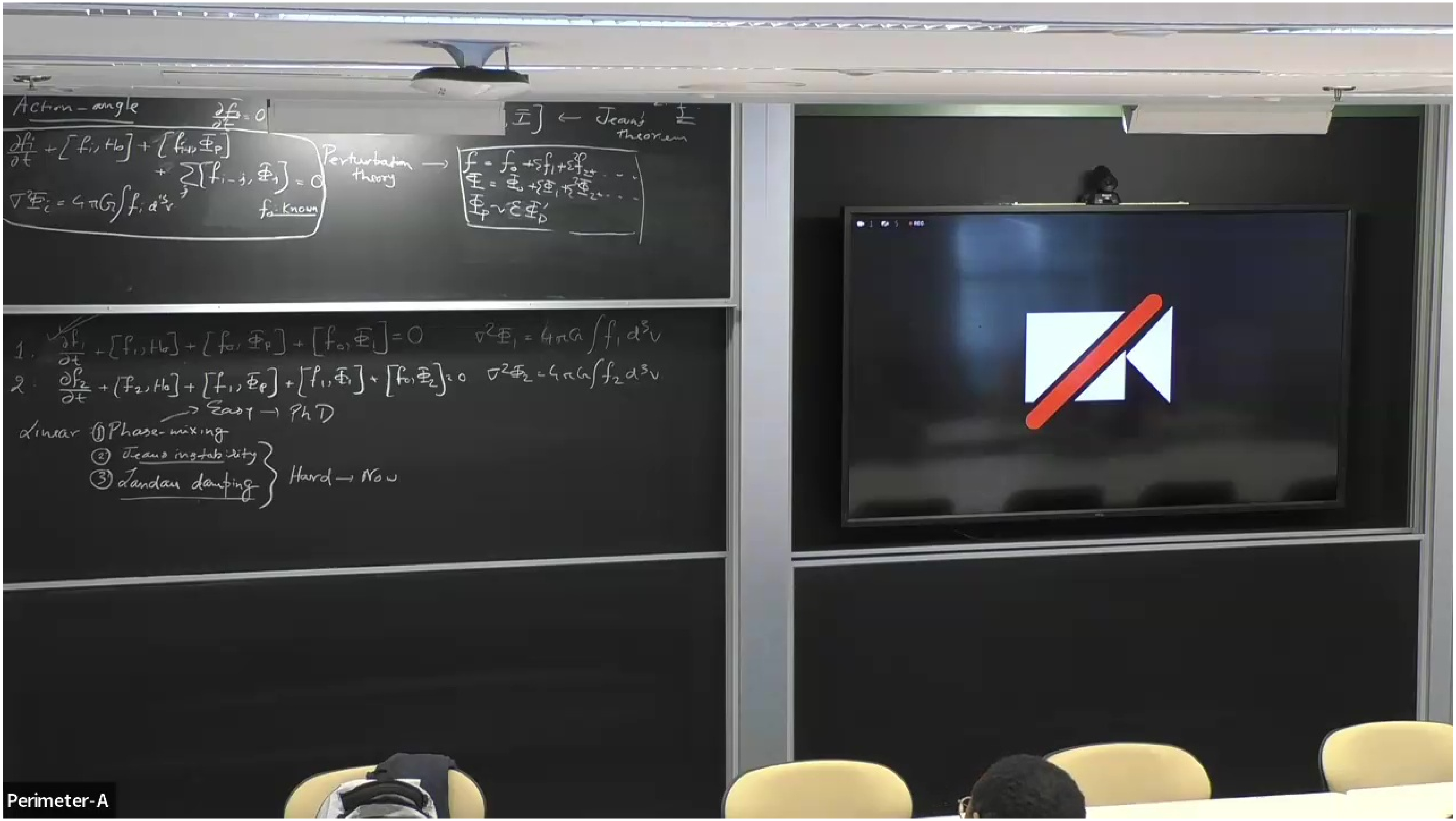

Kinetic Theory of Self-gravitating collisionless systems
Collisionless Boltzmann Eqn
Poisson Eqn
Poisson bracket
Galaxies
CDM halos
Action-angle
Jeans theorem
Perimeter-A

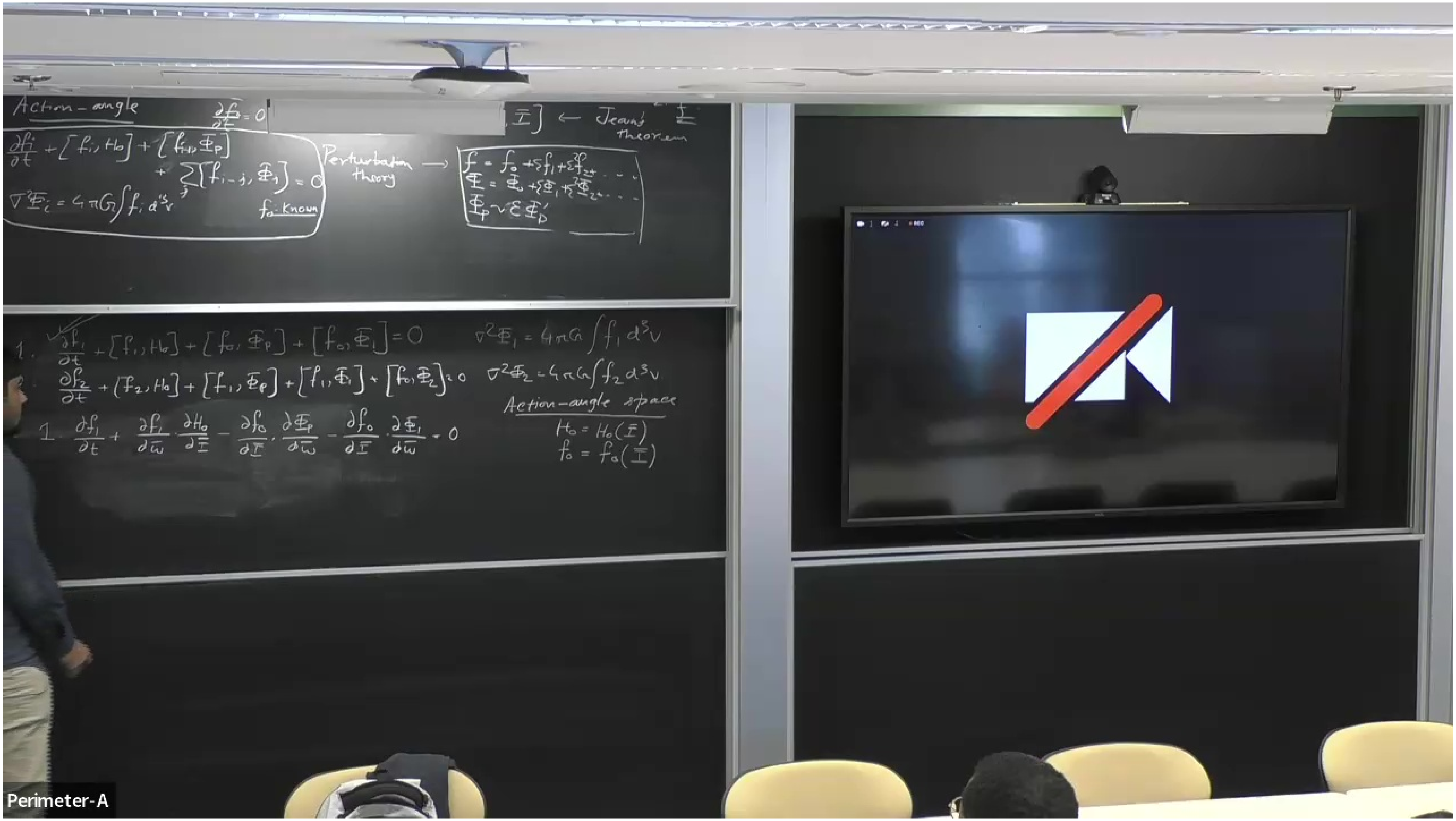

Kinetic Theory of Self-gravitating collisionless systems
Collisionless Boltzmann Eqⁿ
Poisson bracket
Poisson Eqⁿ
Galaxies
CDM halos
Action - angle
Jean's theorem
Sph
Isotropy
Perimeter-A

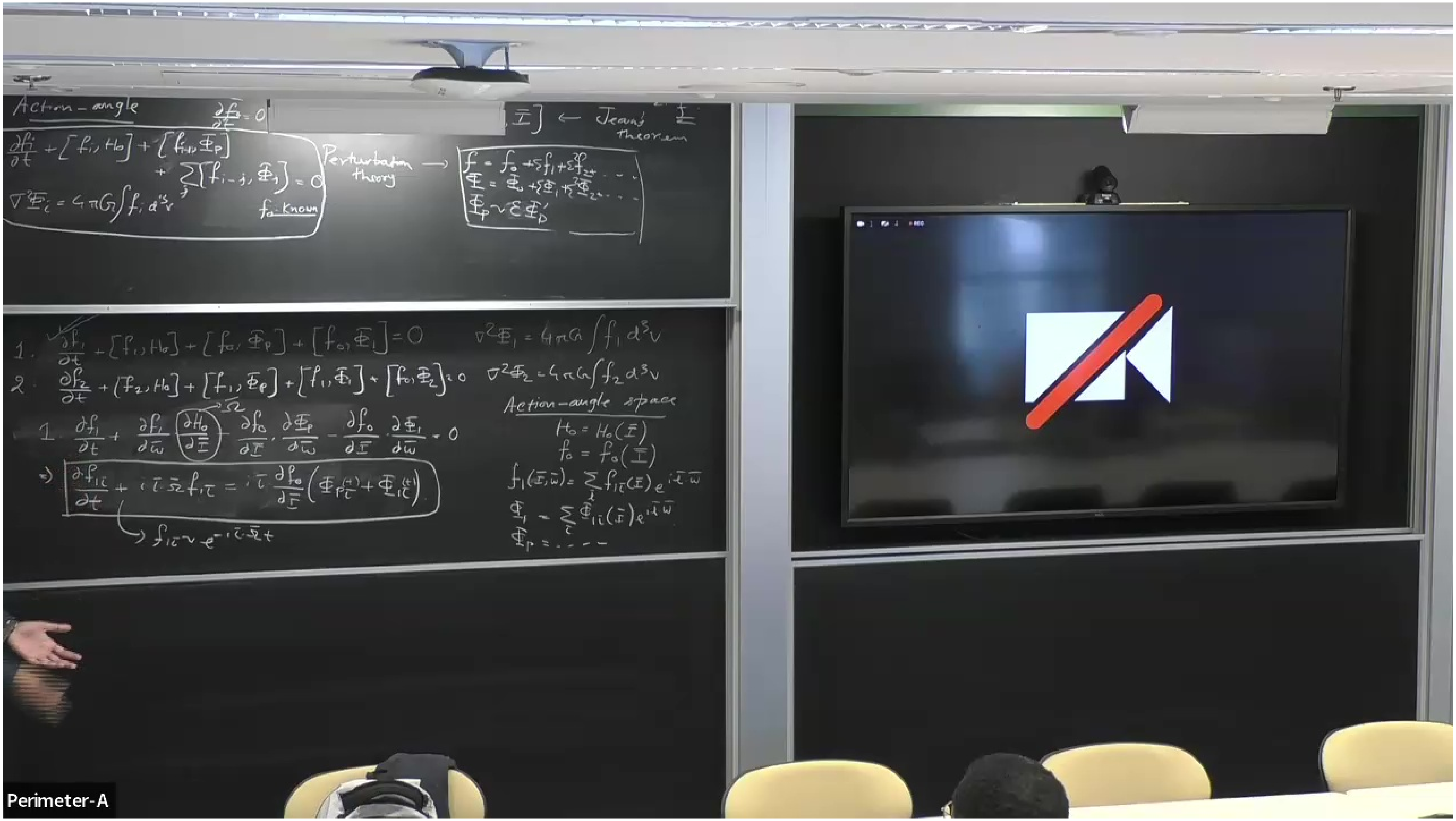

Kinetic Theory of Self-gravitating collisionless systems
Collisionless Boltzmann Eqn
Poisson Eqn
Poisson bracket
Ext perturber
due to galaxy response
Galaxies
CDM halos
Action-angle
Jeans theorem
Perturbation theory
Perimeter-A

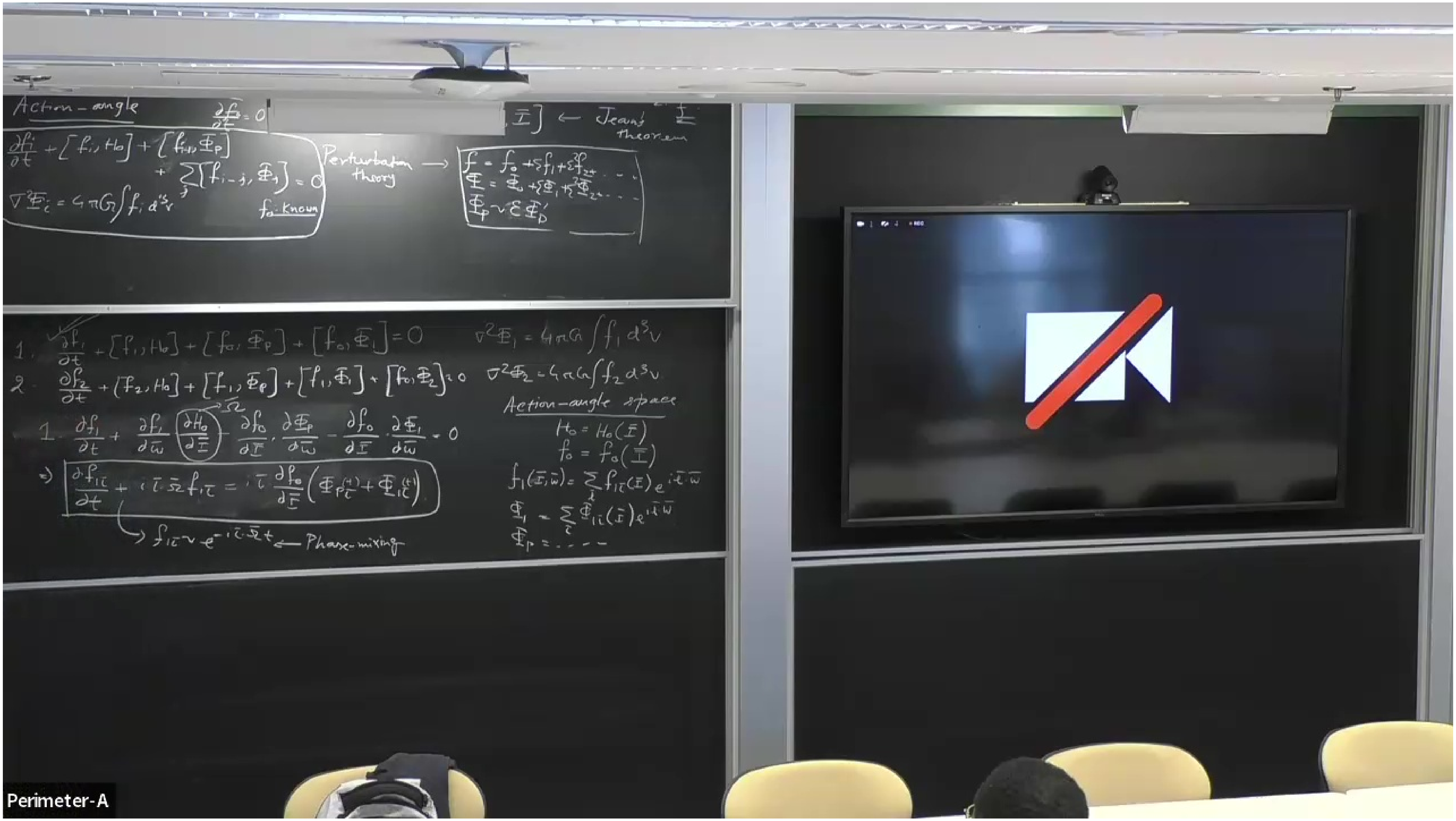


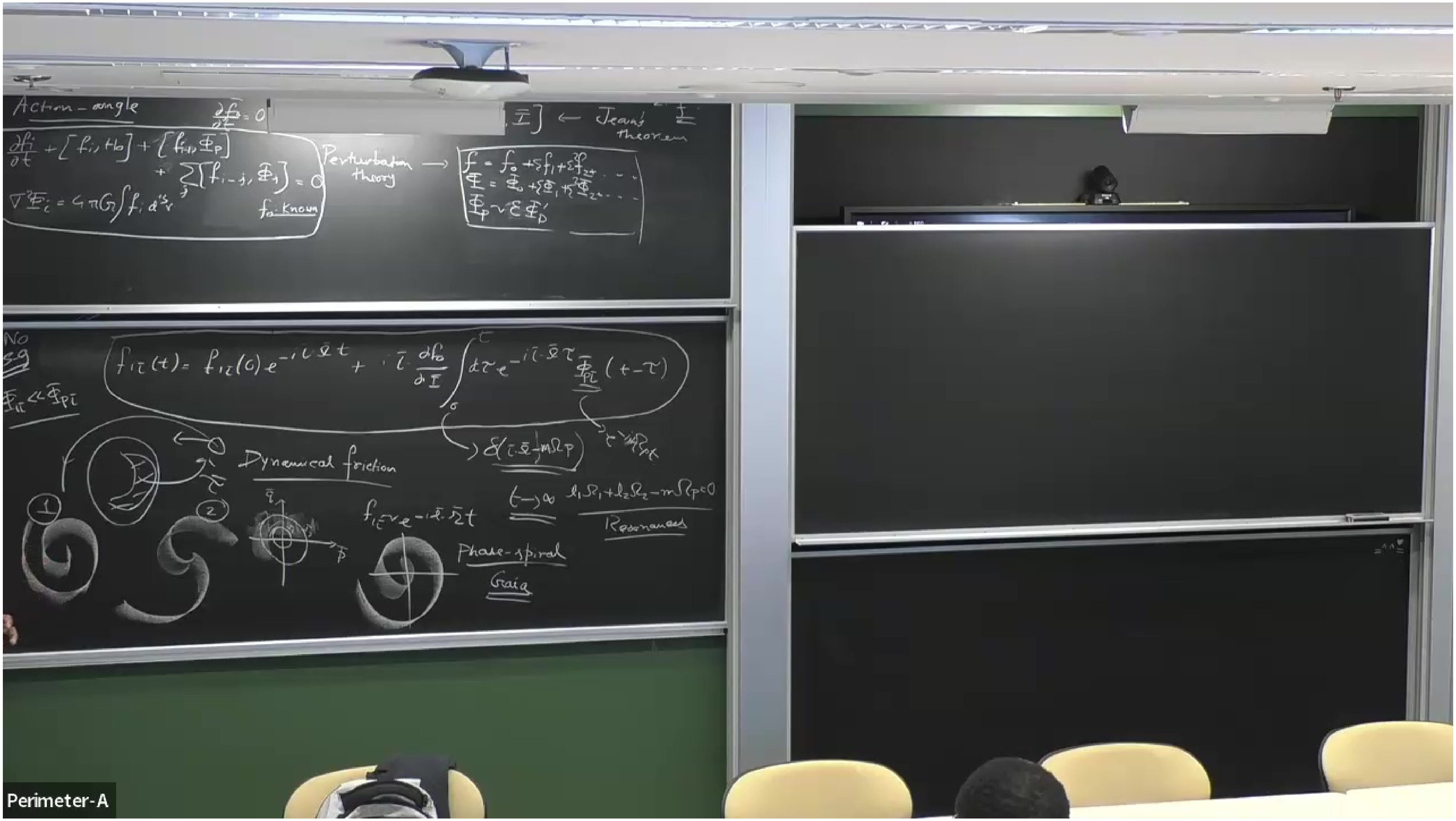
Kinetic Theory of Self-gravitating collisionless systems
Collisionless Boltzmann Eqn: ∂f/∂t + [f, H] = 0
Poisson Eqn: ∇²Φ = 4πG ∫ f d³v
H = H₀ + Φp + Φ
Ext perturber
Due to galaxy response
Poisson bracket
Galaxies
CDM halos
Action - angle
Jean's theorem
Perturbation theory
f₀ known
Perimeter-A

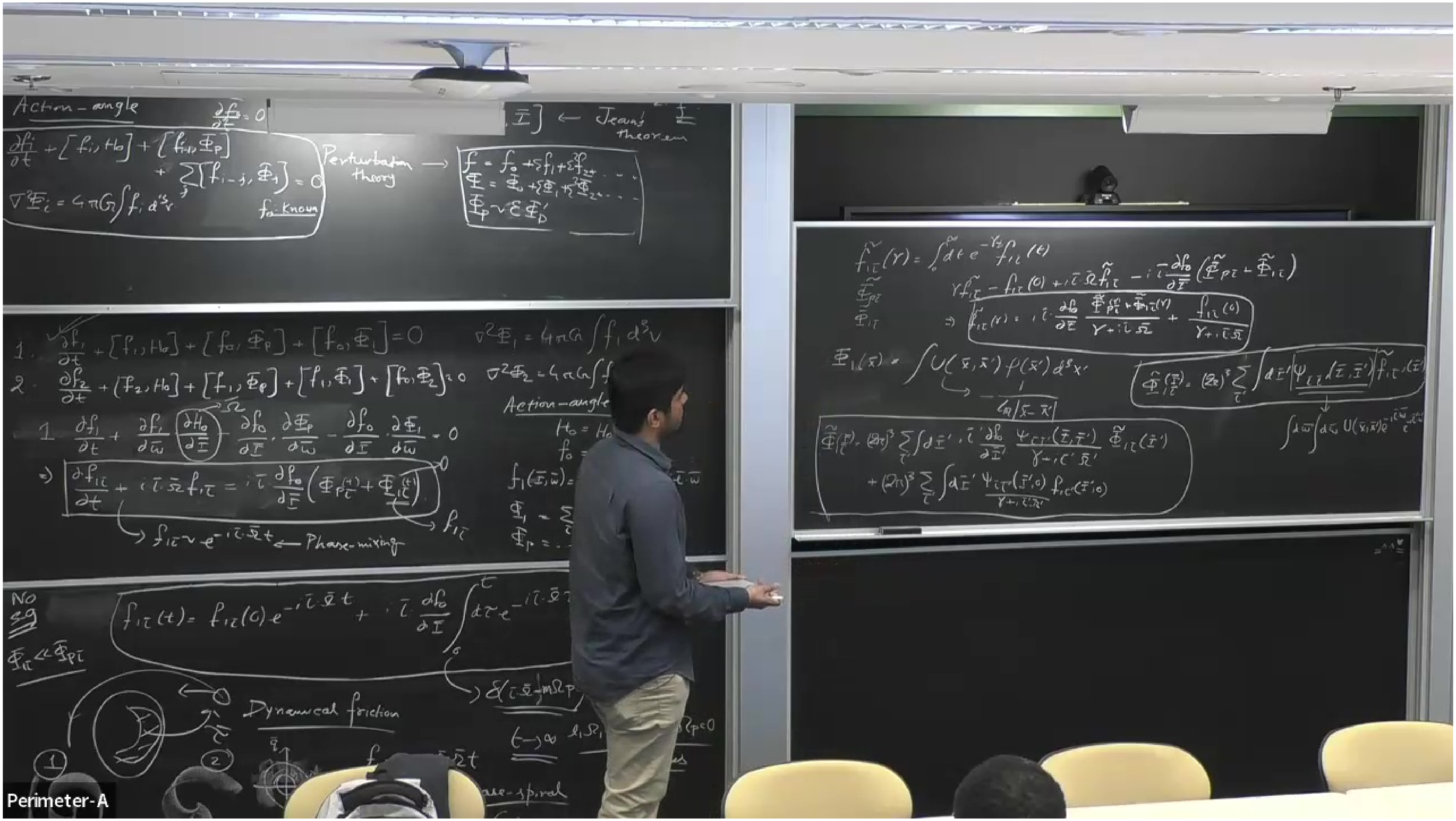

Action - angle
Jeans' theorem
Perturbation theory
f₀ known
Easy → PhD
Linear ① Phase-mixing
② Jeans instability
③ Landau damping
Hard → Now
Perimeter-A

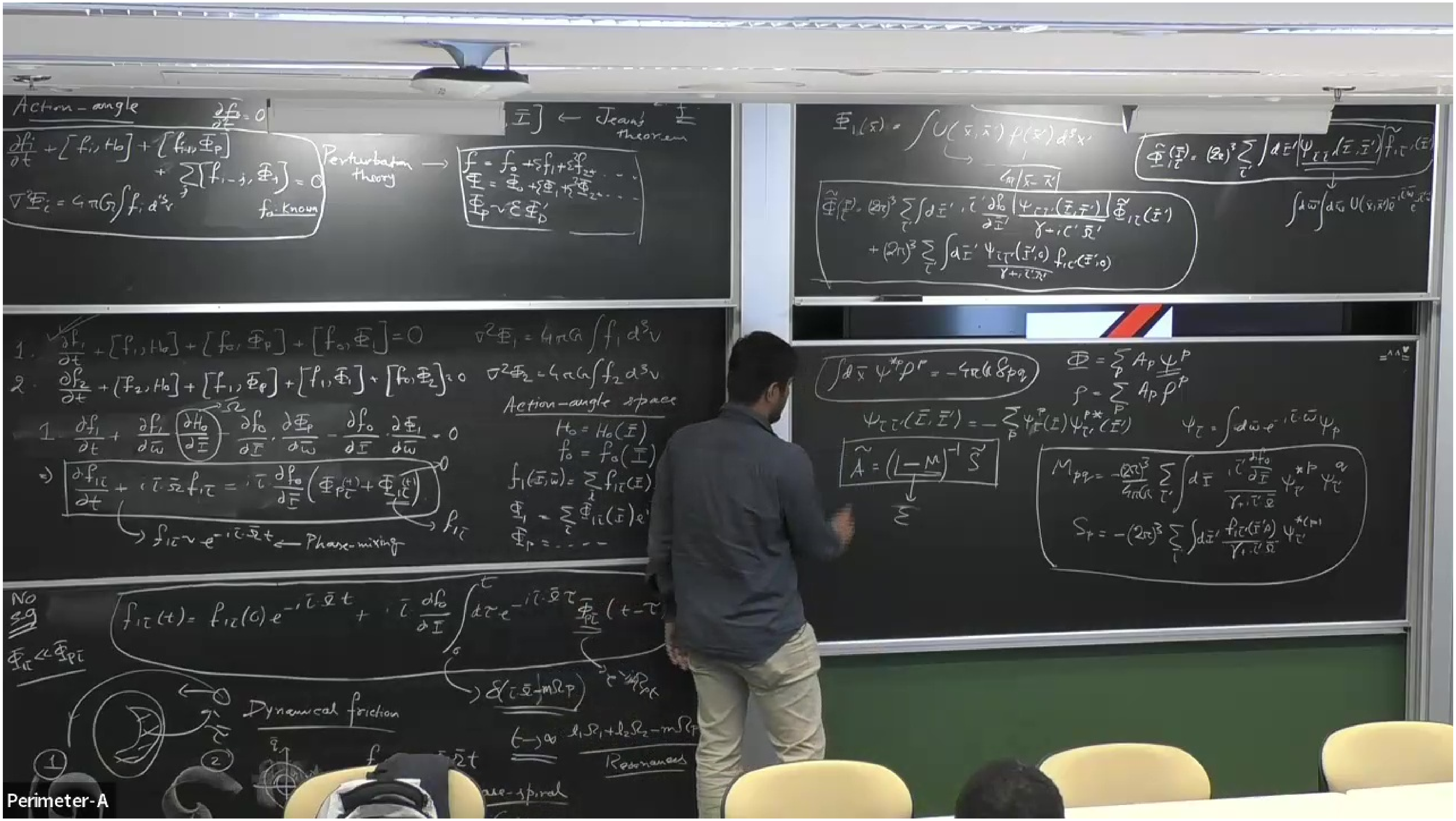

Action - angle
Perturbation theory
Jeans' theorem
f_0 known
Action-angle space
$H_0 = H_0(\bar{I})$
$f_0 = f_0(\bar{I})$
Perimeter-A

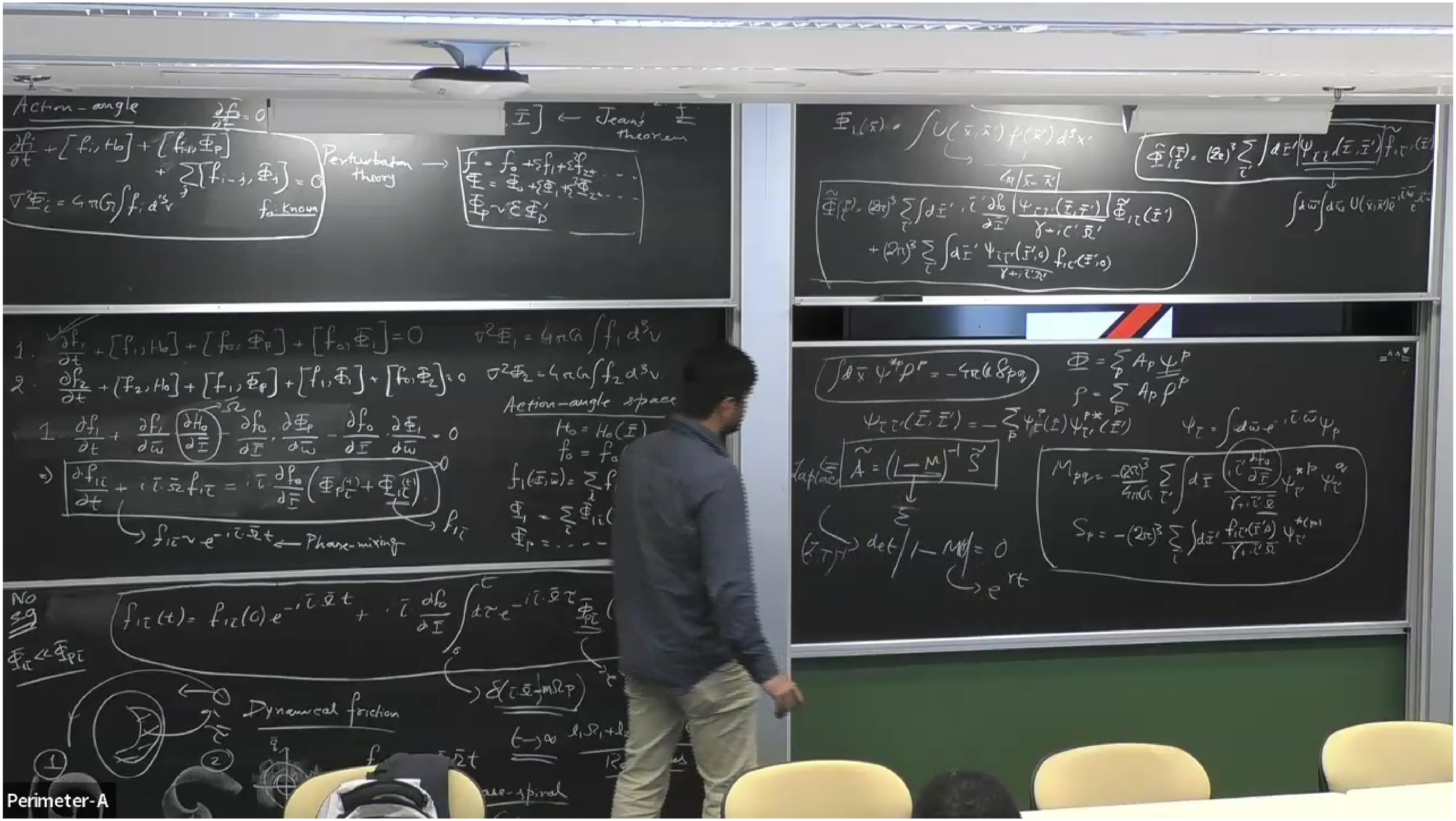

Action-angle
Jeans' theorem
Perturbation theory
Action-angle space
Perimeter-A

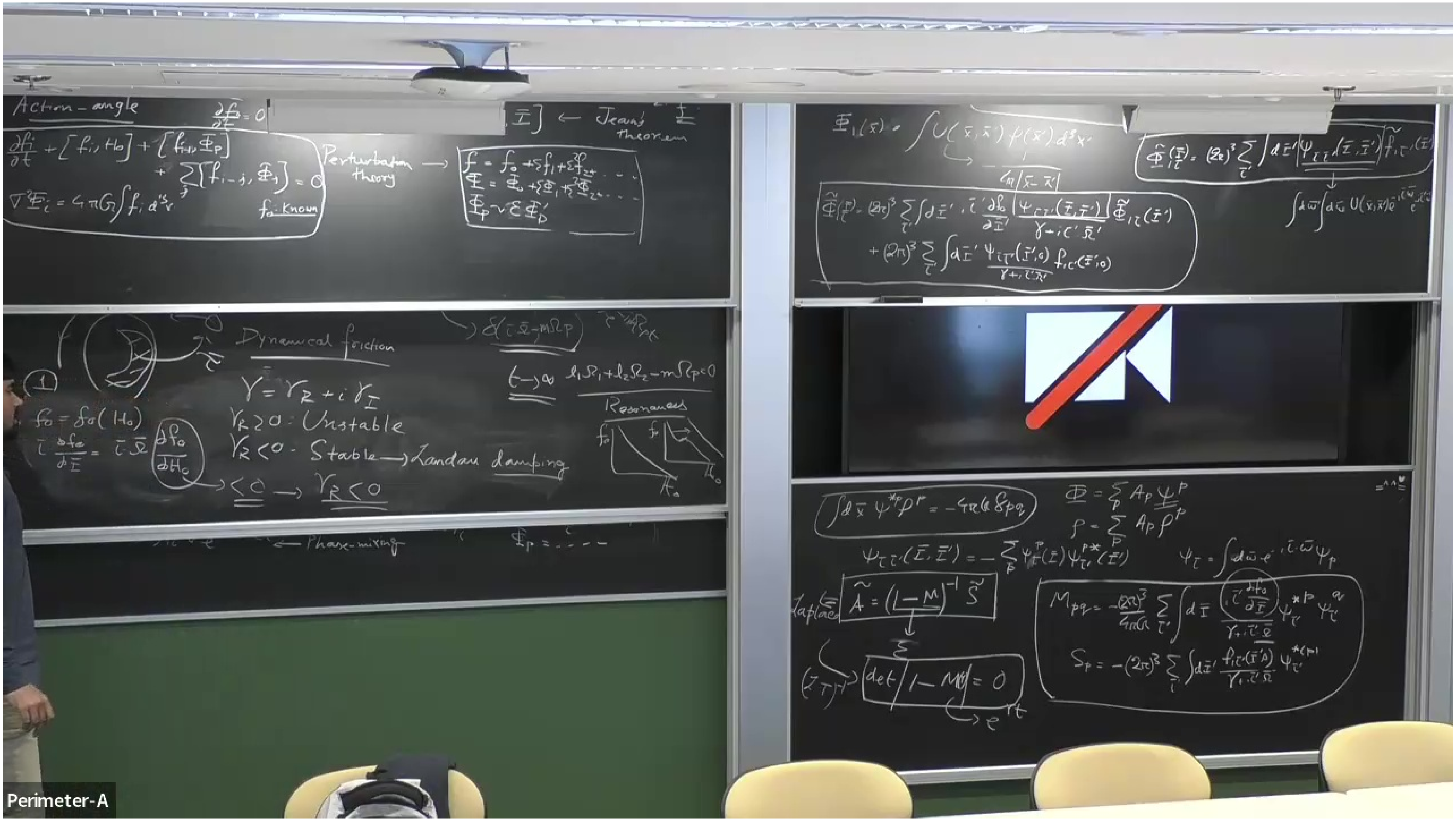

Action-angle
Jeans' theorem
Perturbation theory
f₀ known
Action-angle space
Phase-mixing
Perimeter-A


Action - angle
Jeans theorem
Perturbation theory
Dynamical friction
Resonances
Phase-spiral
Gaia
Perimeter-A


Action-angle
Jeans' theorem
Perturbation theory
Phase-mixing
Action-angle
Dynamical friction
Perimeter-A


Action - angle
Perturbation theory
Jeans' theorem
Action-angle space
Phase-mixing
Dynamical friction
Resonances
Perimeter-A


Action-angle
Jeans' theorem
Perturbation theory
Phase-mixing
Action-angle space
Dynamical friction
Perimeter-A


Action - angle
Jeans' theorem
Perturbation theory
Dynamical friction
Unstable
Stable
Landau damping
Resonances
Phase-mixing
Perimeter-A