Title: Classical and Quantum Chaos 2021/2022 - Lecture 6

Speakers: Meenu Kumari

Collection: Classical and Quantum Chaos 2021/2022

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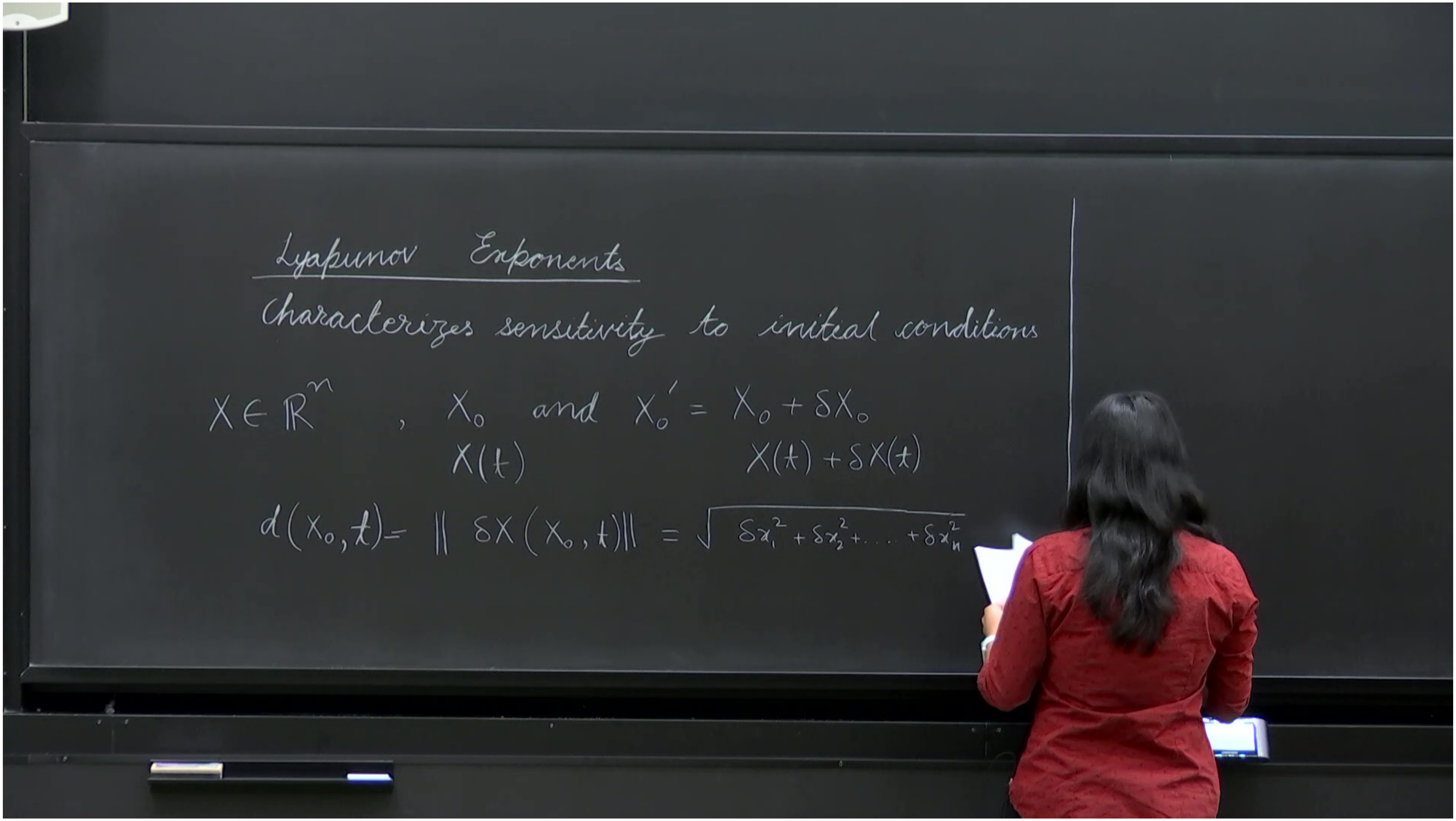
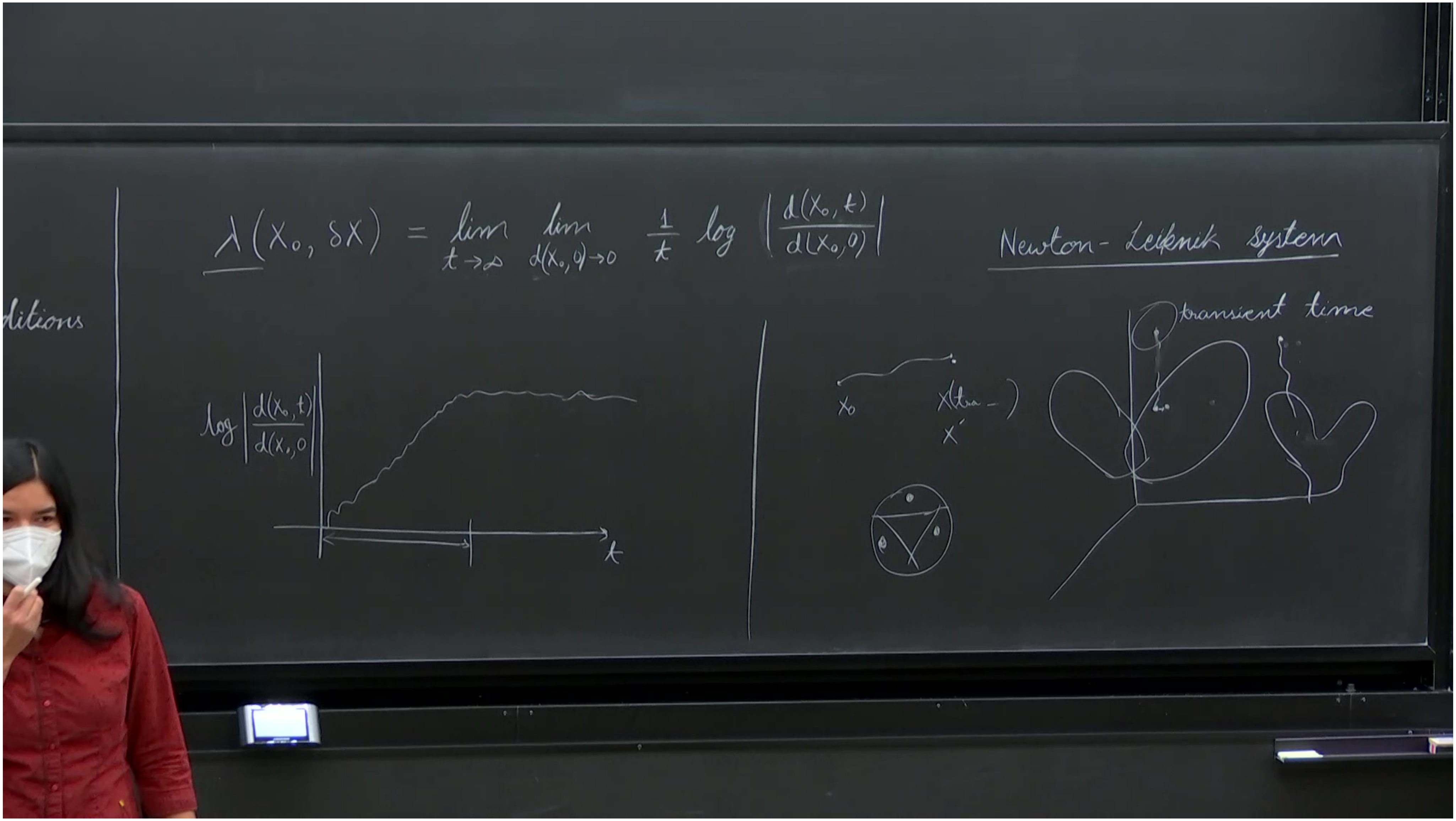
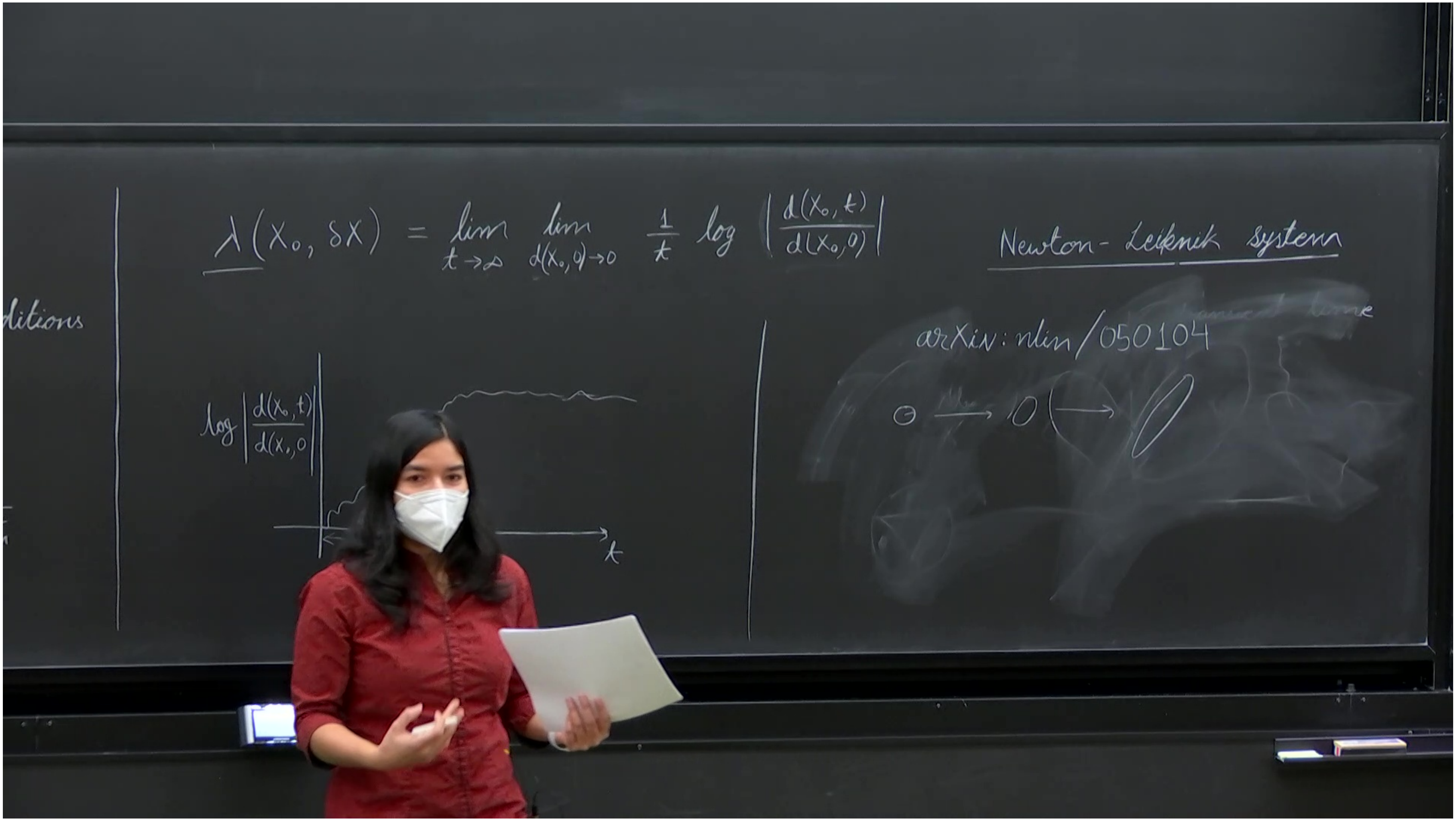
URL: https://pirsa.org/22030051

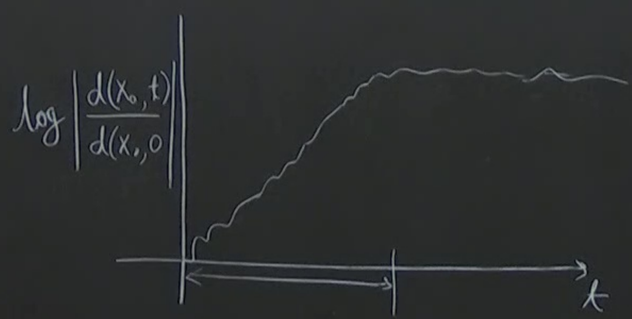

Lyapunov Exponents
Characterizes sensitivity to initial conditions
$X \in \mathbb{R}^n$, X_0 and $X_0' = X_0 + \delta X_0$
$X(t)$ $X(t) + \delta X(t)$
$d(X_0, t) = \| \delta X(X_0, t) \| = \sqrt{\delta x_1^2 + \delta x_2^2 + \ldots + \delta x_n^2}$


$\lambda(X_0, \delta X) = \lim_{t\to\infty} \lim_{d(X_0,0)\to 0} \frac{1}{t} \log \left| \frac{d(X_0,t)}{d(X_0,0)} \right|$
Newton- Leibnik system
transient time
ditions
$\log \left| \frac{d(X_0,t)}{d(X_0,0)} \right|$
t
X_0
X'


ditions
λ(X₀, δX) = lim lim 1/t log |d(X₀,t)/d(X₀,0)|
log |d(X₀,t)/d(X₀,0)|
t
Newton- Leipnik system
arXiv: nlin/050104

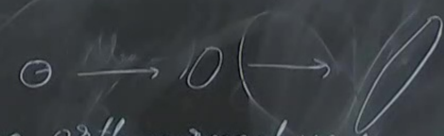
ditions

$$\lambda(X_0, \delta X) = \lim_{t\to\infty} \lim_{d(X_0,0)\to 0} \frac{1}{t} \log \left| \frac{d(X_0,t)}{d(X_0,0)} \right|$$



Newton-Leibnik system

arXiv: nlin/050104

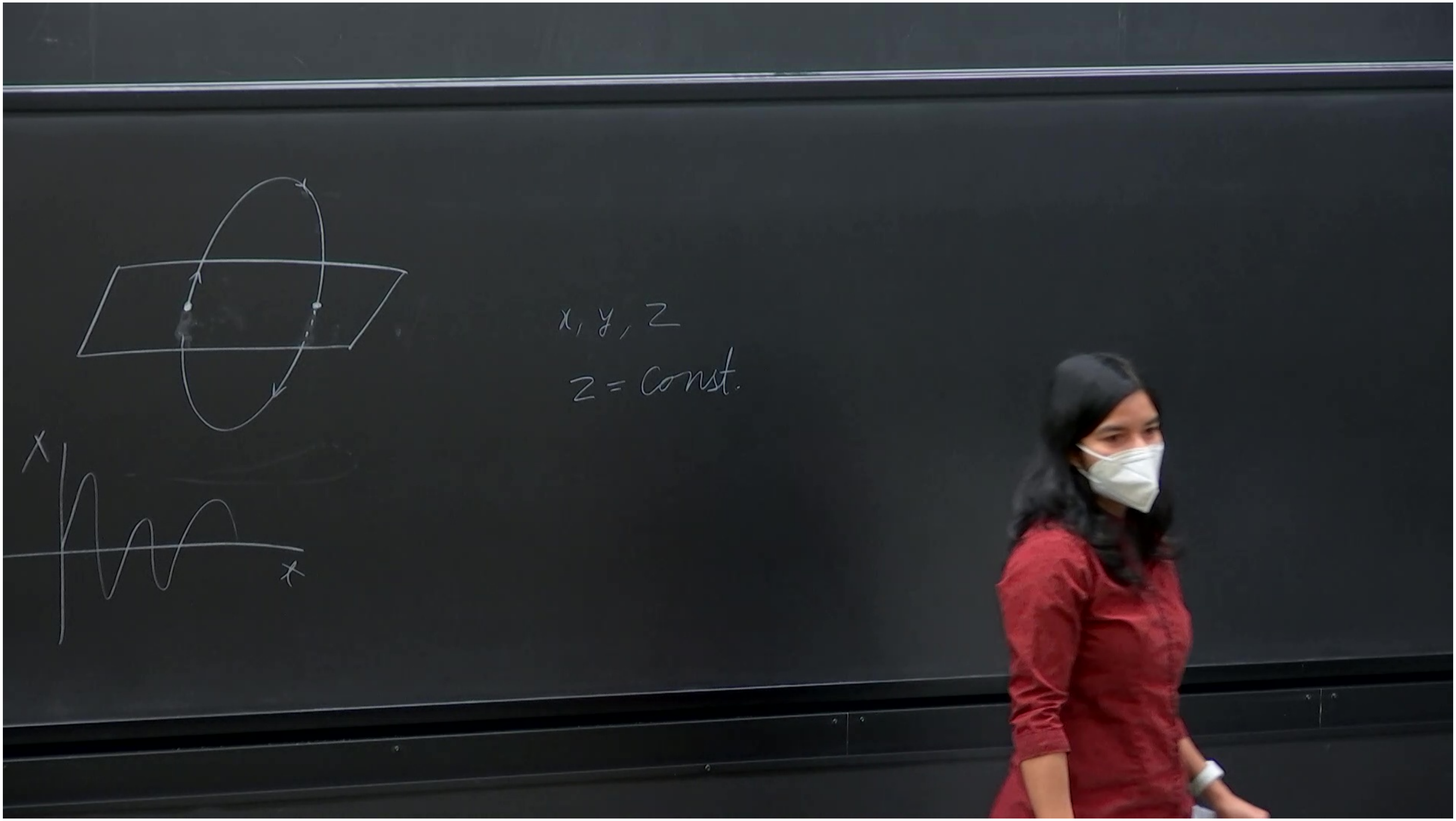


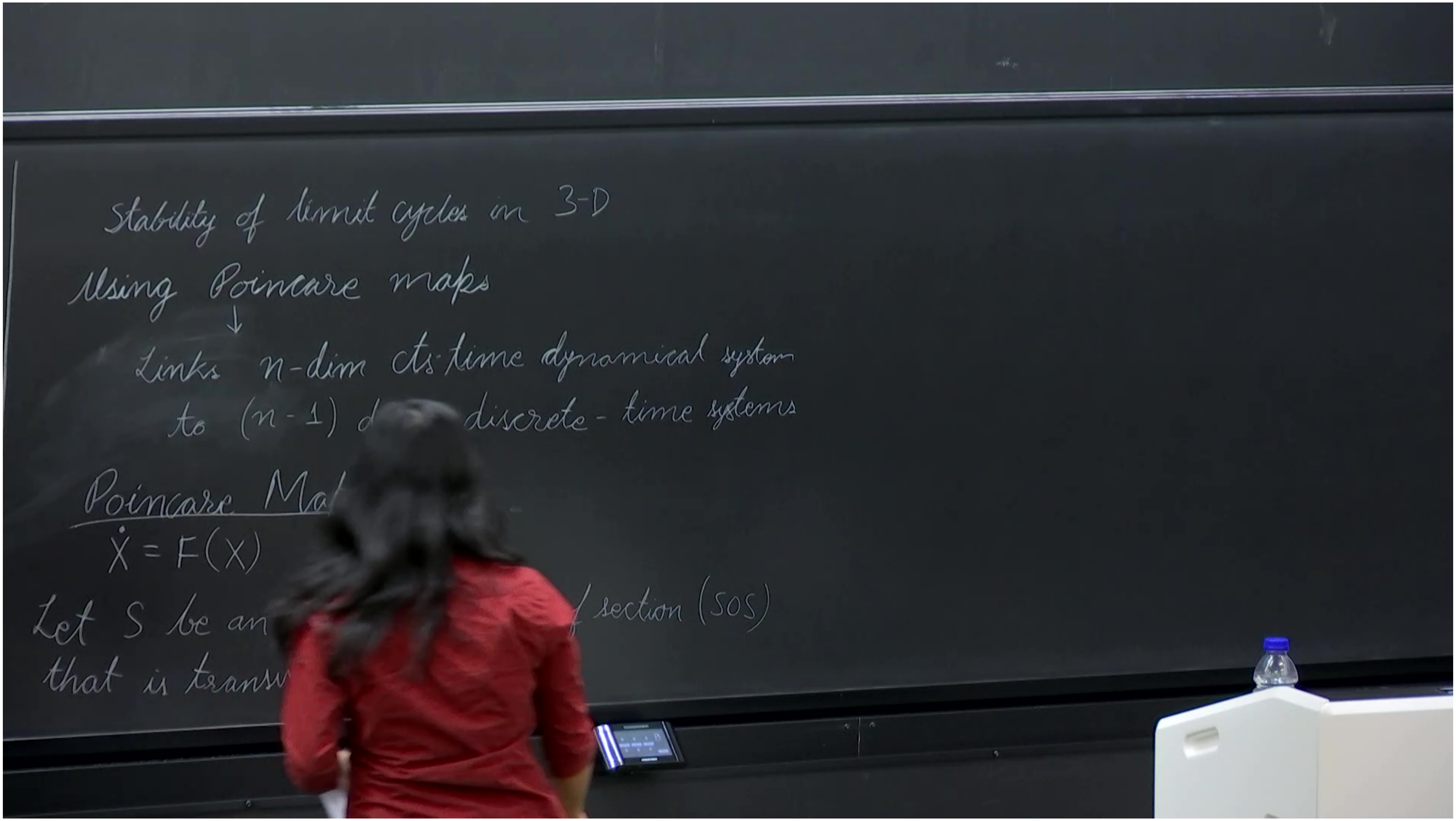
$\hat{e}_i$ - n-orthonormal vectors of δX, $i = 1,2 \dots n$

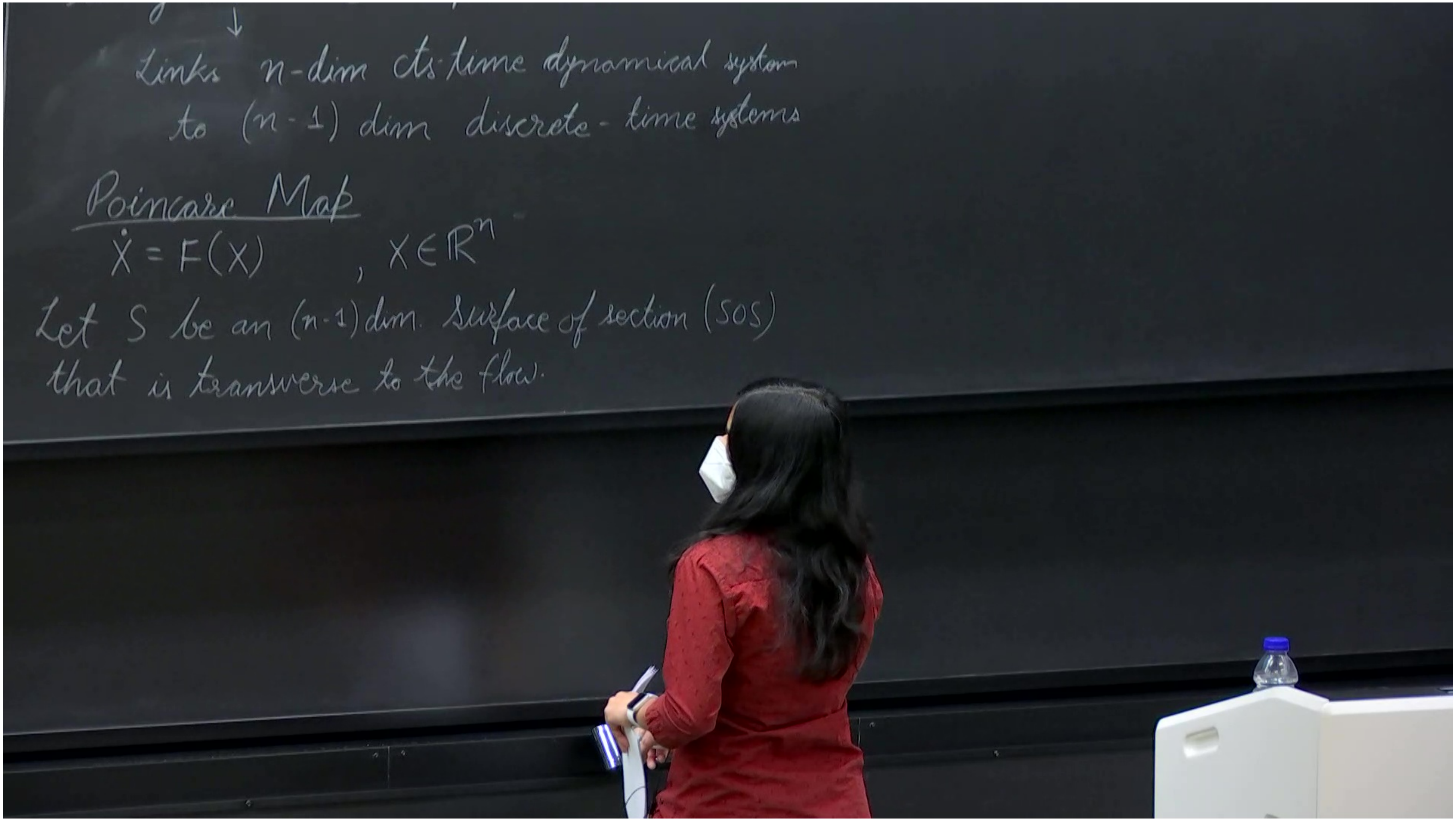
$\delta \dot{e}_i = M(X_0) e_i$

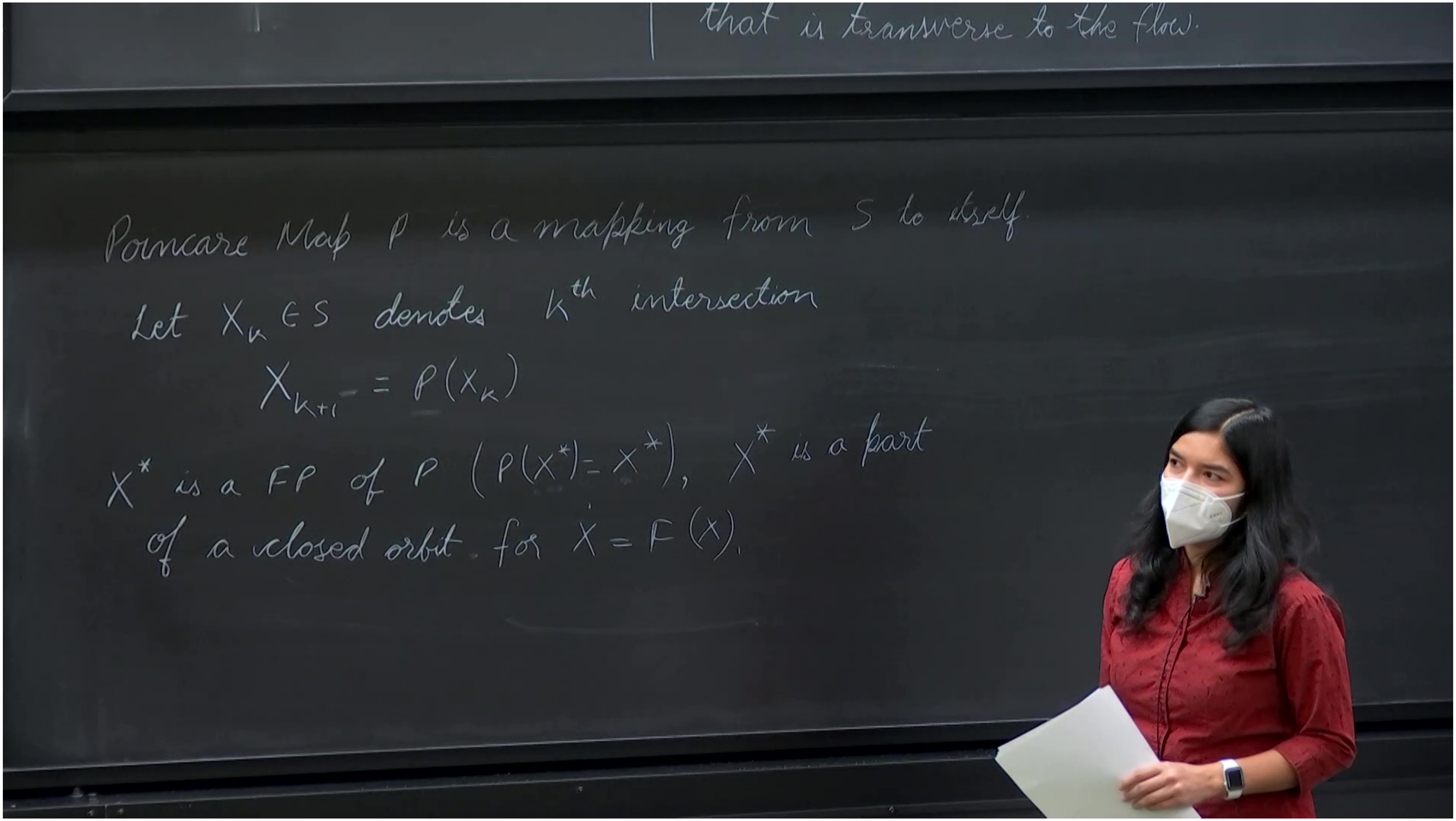
Jacobian evaluated at X_0

$\lambda_i(X_0) = \lambda_i(X_0, e_i)$ $\quad \left| \; d_i(X_0,t) \approx d_i(X_0,0) e^{\lambda_i t} \right.$, $i = 1,2, \dots n$

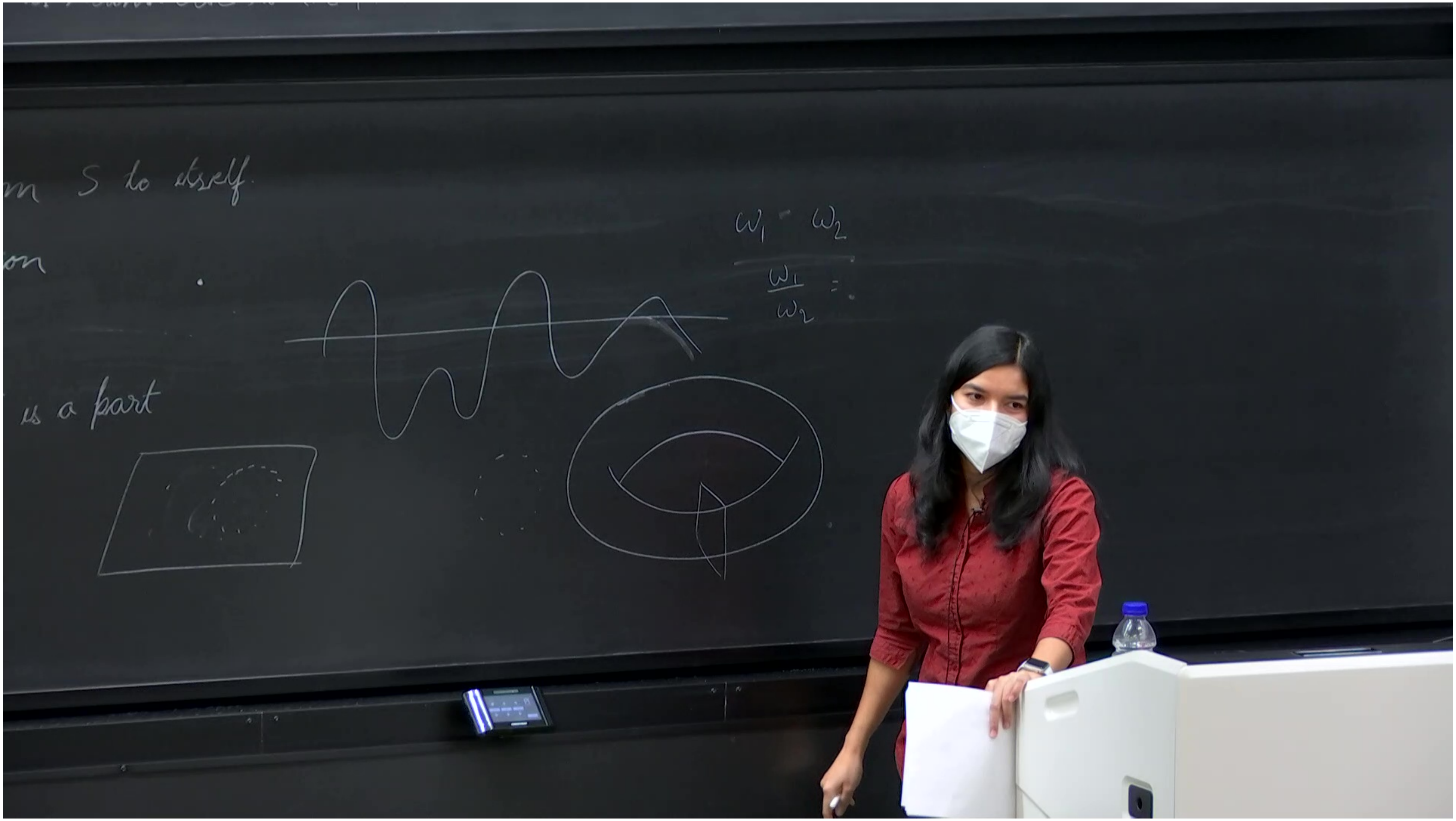

x, y, z
z = const.


Stability of limit cycles in 3-D
Using Poincare maps
Links n-dim cts-time dynamical system
to (n-1) d discrete-time systems
Poincare Ma
Ẋ = F(X)
Let S be an
section (SOS)
that is transv


Links n-dim cts time dynamical system
to (n-1) dim discrete-time systems
Poincare Map
$\dot{X} = F(X)$, $X \in \mathbb{R}^n$
Let S be an (n-1) dim. surface of section (SOS)
that is transverse to the flow.



that is transverse to the flow.
Poincare Map P is a mapping from S to itself.
Let $X_k \in S$ denotes k^{th} intersection
$X_{k+1} = P(X_k)$
X^* is a FP of P $(P(X^*) = X^*)$, X^* is a part
of a closed orbit for $\dot{X} = F(X)$.



m S to itself
on
is a part
$\omega_1 - \omega_2$
$\frac{\omega_1}{\omega_2}$ =