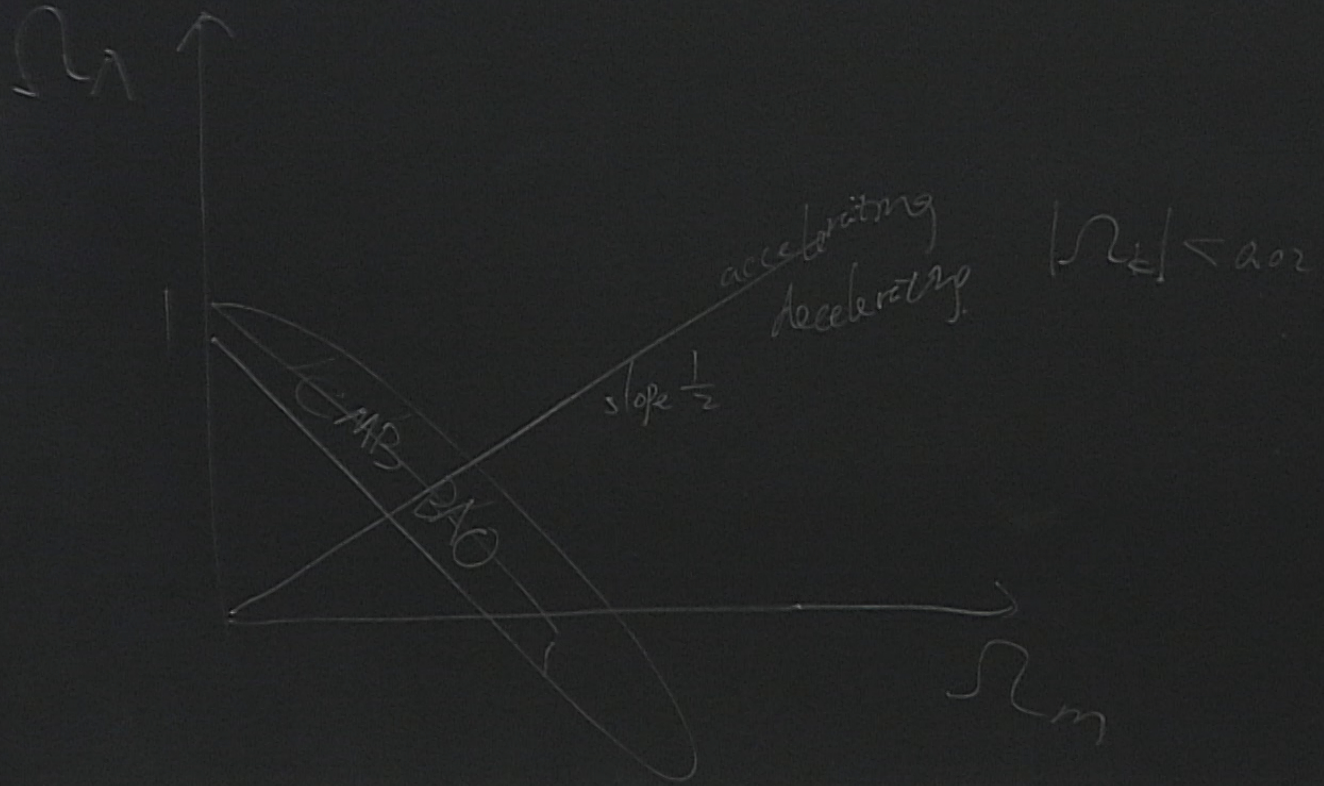
Title: PSI 2018/2019 - Cosmology Review - Lecture 10

Date: Jan 18, 2019 09:00 AM

URL: http://pirsa.org/19010011

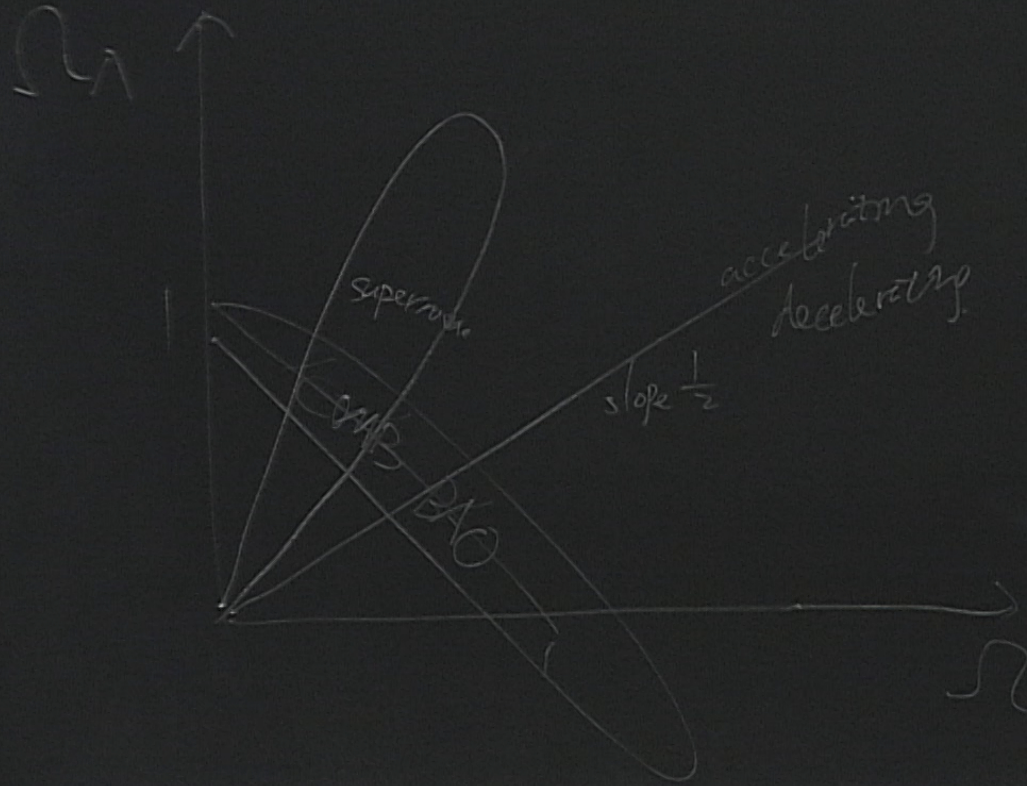
Abstract:

Dark Matter



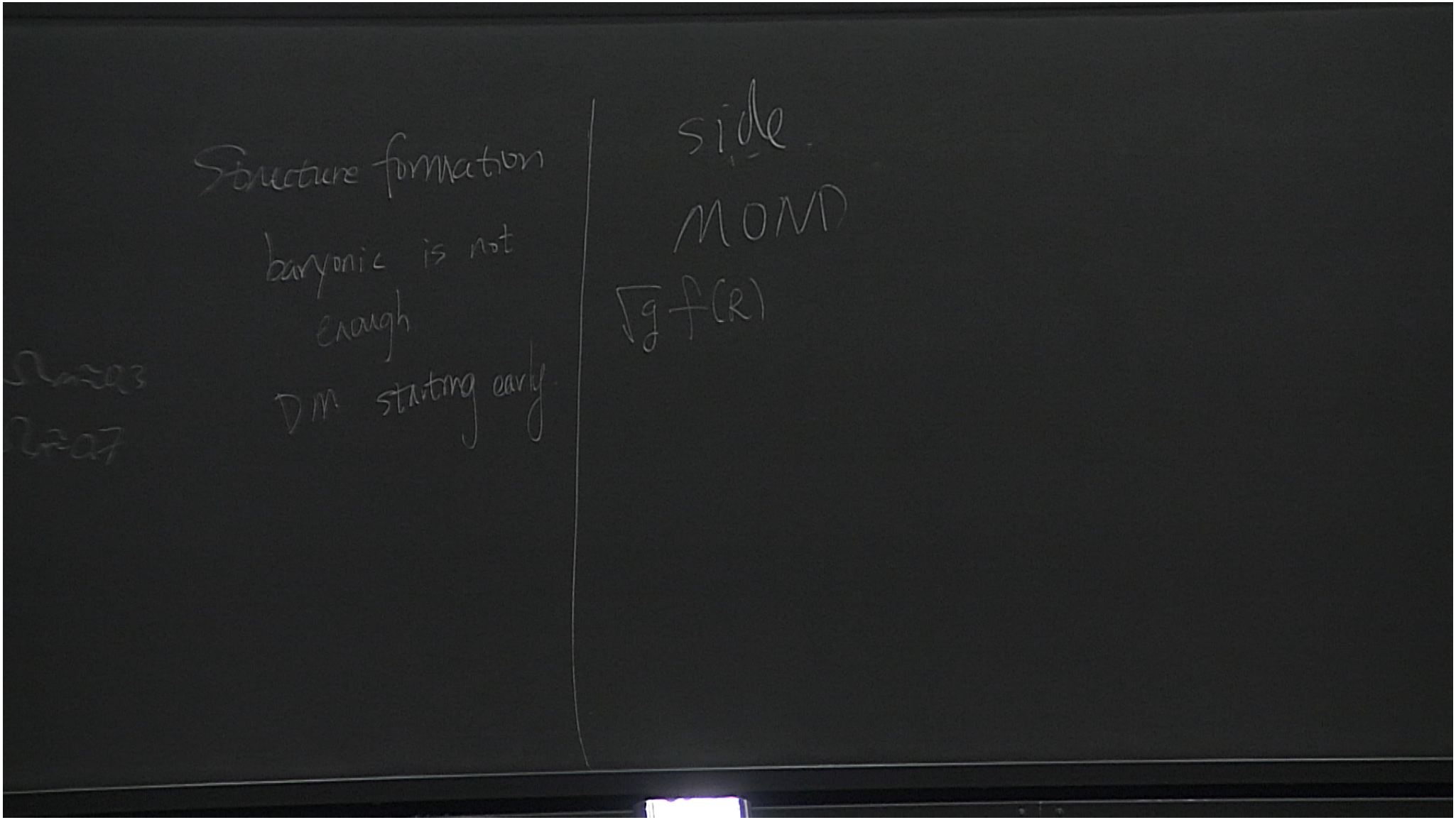
$|\Omega_k| < 0.02$

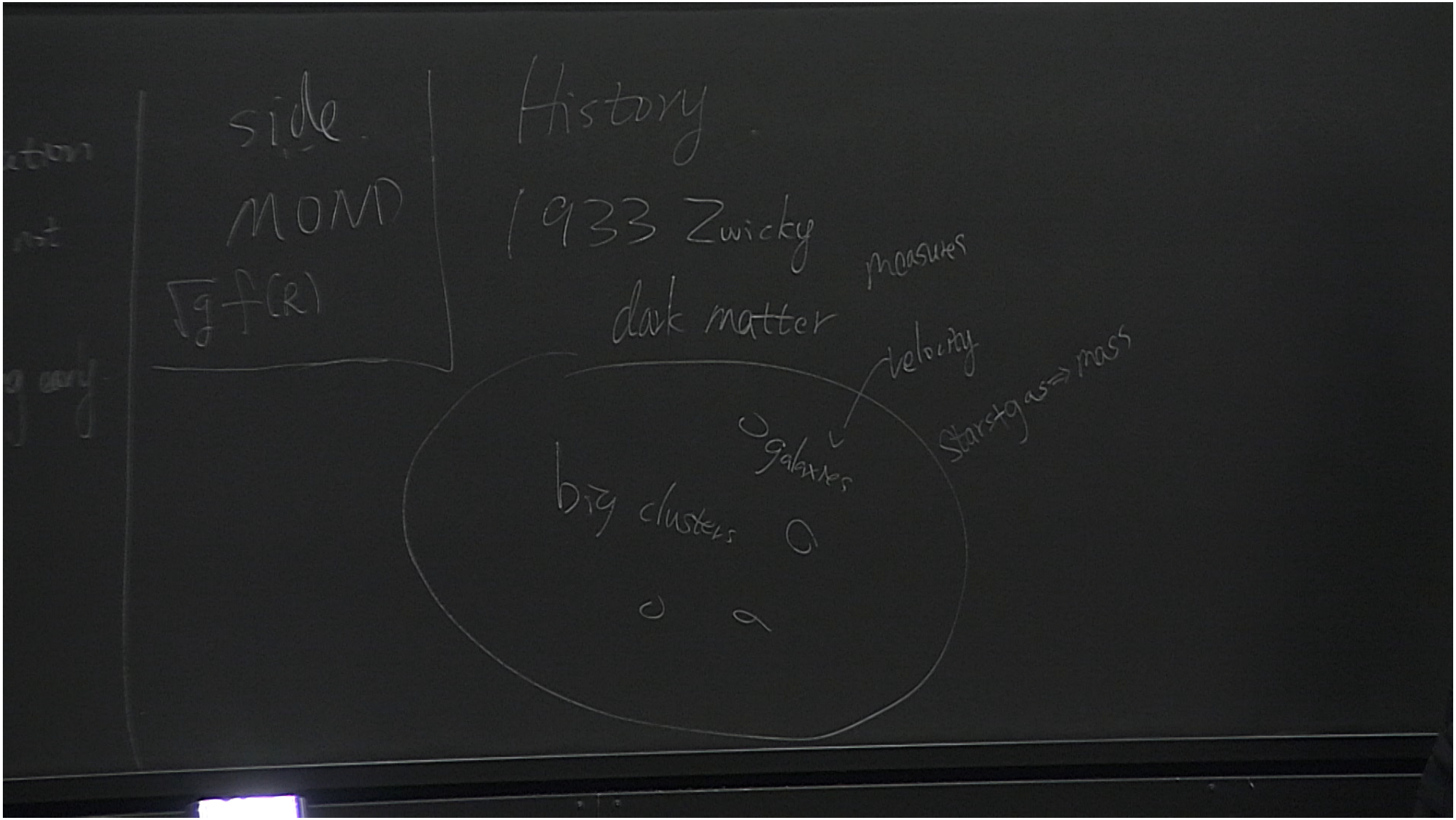
Dark Matter

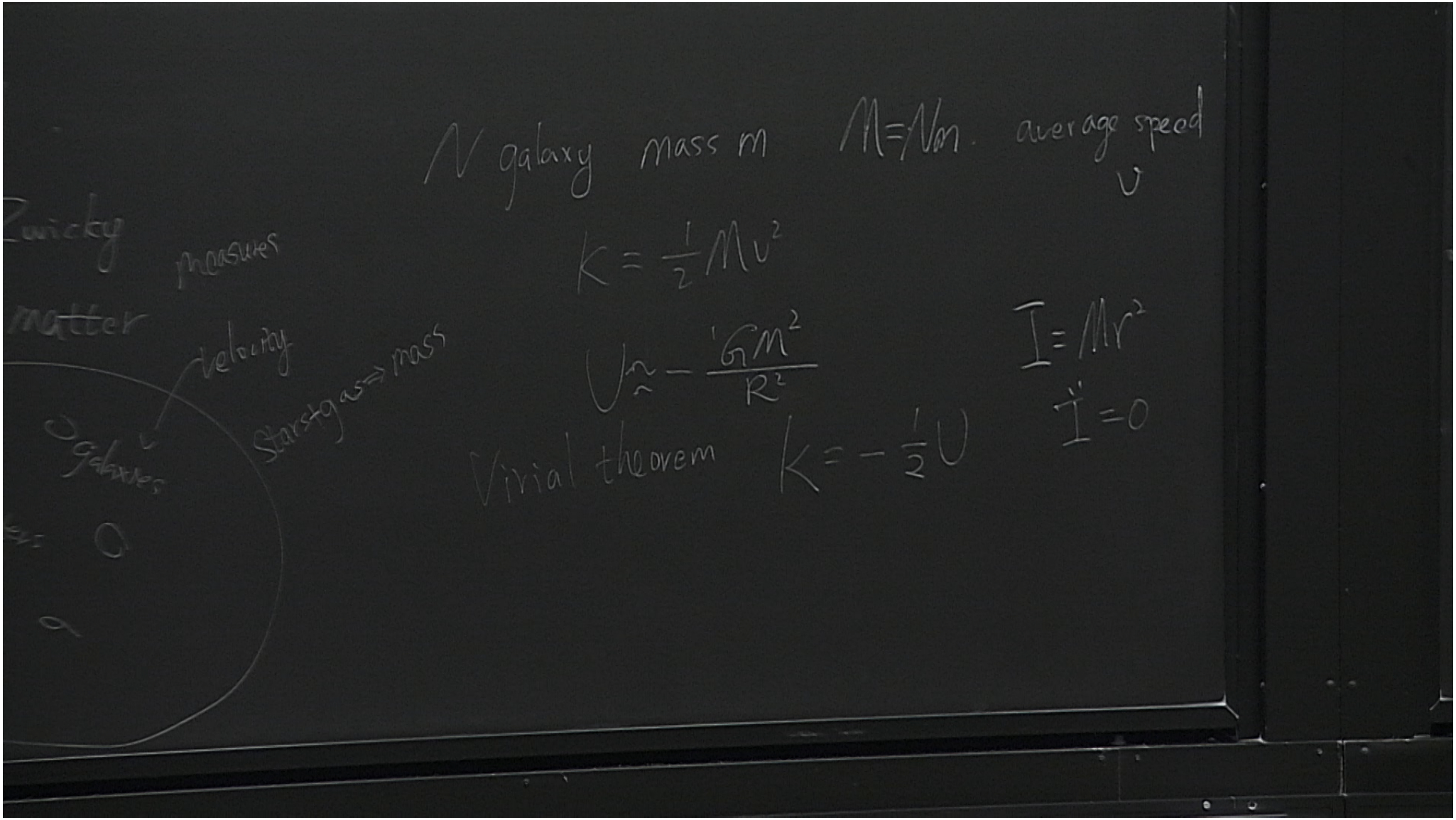


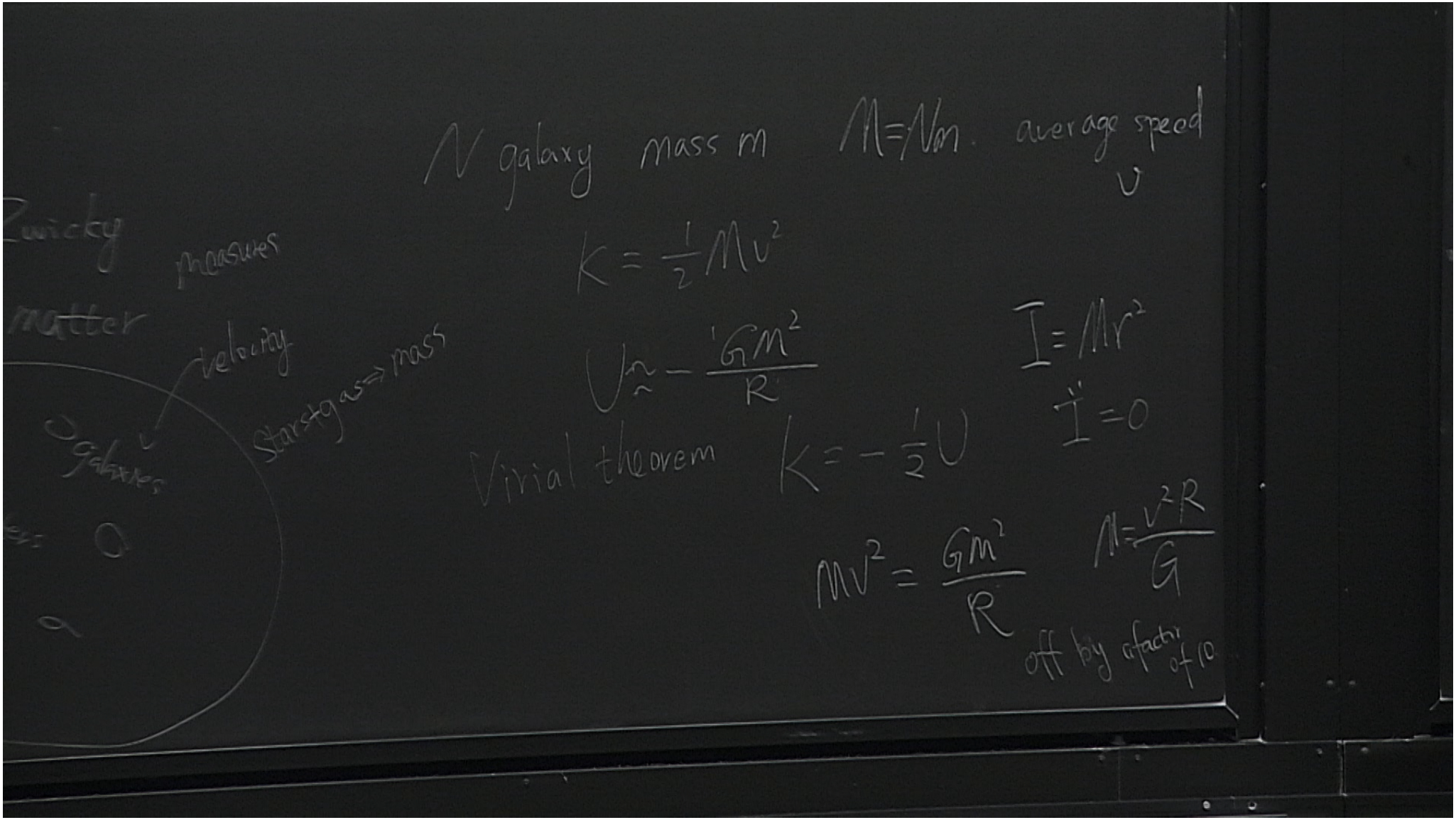
$|\Omega_k| < 0.02$ $\Omega_m \approx 0.3$

$\Omega_\Lambda \approx 0.7$


Structure formation
baryonic is not
enough
DM starting early
side
MOND
√g f(R)


side
MOND
$\sqrt{g}f(R)$
History
1933 Zwicky
dark matter
measures
velocity
Starsstgas=>mass
galaxies
big clusters

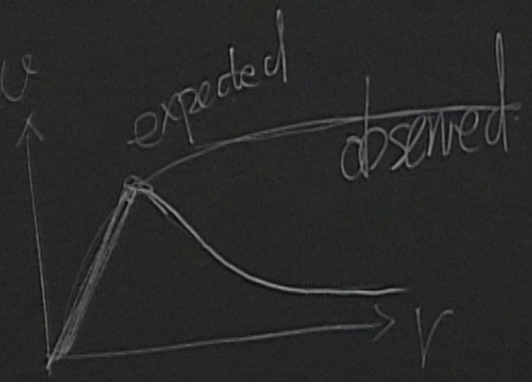

N galaxy mass m M=Nm average speed v
K = 1/2 Mv²
U ≈ − GM²/R²
I = Mr²
İ = 0
Virial theorem K = − 1/2 U
Density
matter
measures
velocity
Stars+gas ⇒ mass
galaxies

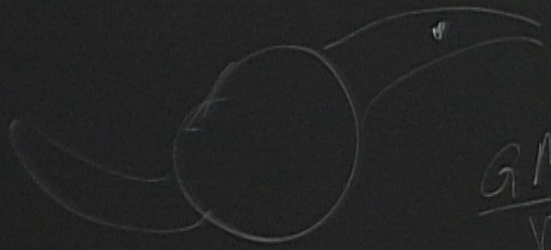

N galaxy mass m M=Nm average speed v
K = ½Mv²
U ≈ −GM²/R
Virial theorem K = −½U
I = Mr²
İ = 0
Mv² = GM²/R
M = v²R/G
off by a factor of 10
Lucky
matter
measures
velocity
stars+gas⇒mass
galaxies

$\Omega_{cluster,0} = 0.2$

$\Omega_m > 0.2$

1973 Vera Rubin





$\frac{GM}{r^2} = \frac{V^2}{r}$

$V \propto \frac{1}{\sqrt{r}}$

$\rho \propto r^{-x}$

$M \propto \int r^{-x} r^2 dr = \frac{r^{3-x}}{3-x}$

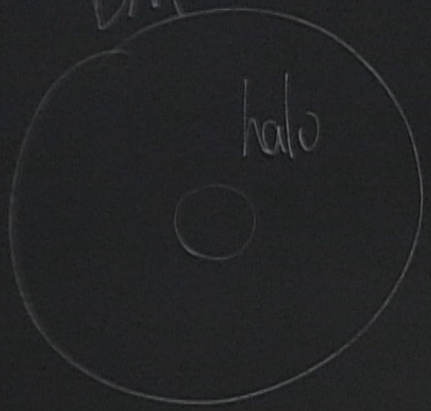
$V^2 \propto \frac{M}{r} \propto r^{2-x}$

$V \propto r^{1-\frac{x}{2}}$

$x = 2$

$\rho \propto r^{-2}$.

DM.



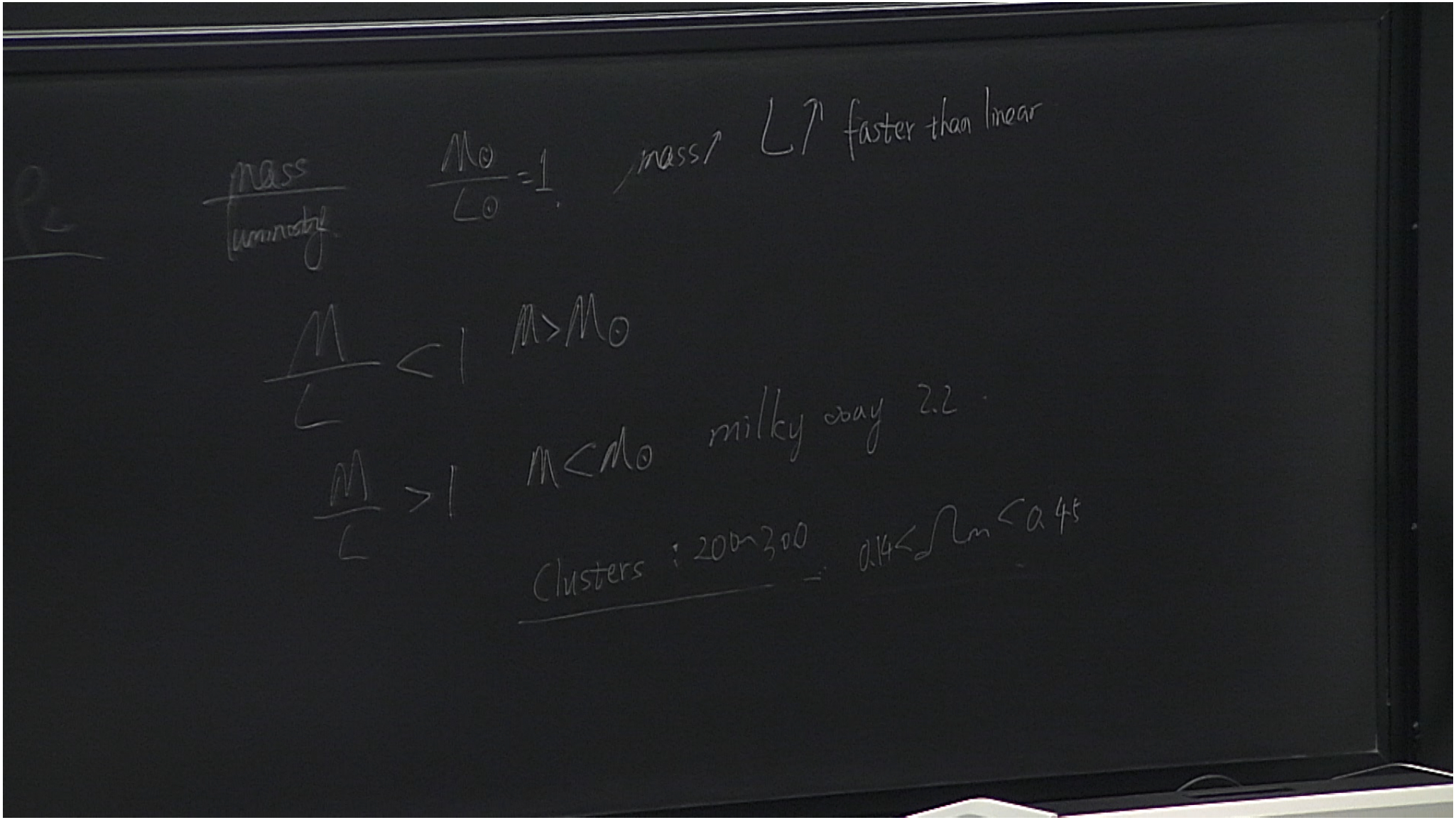
$\frac{\text{mass}}{\text{luminosity}}$ $\quad P_L$

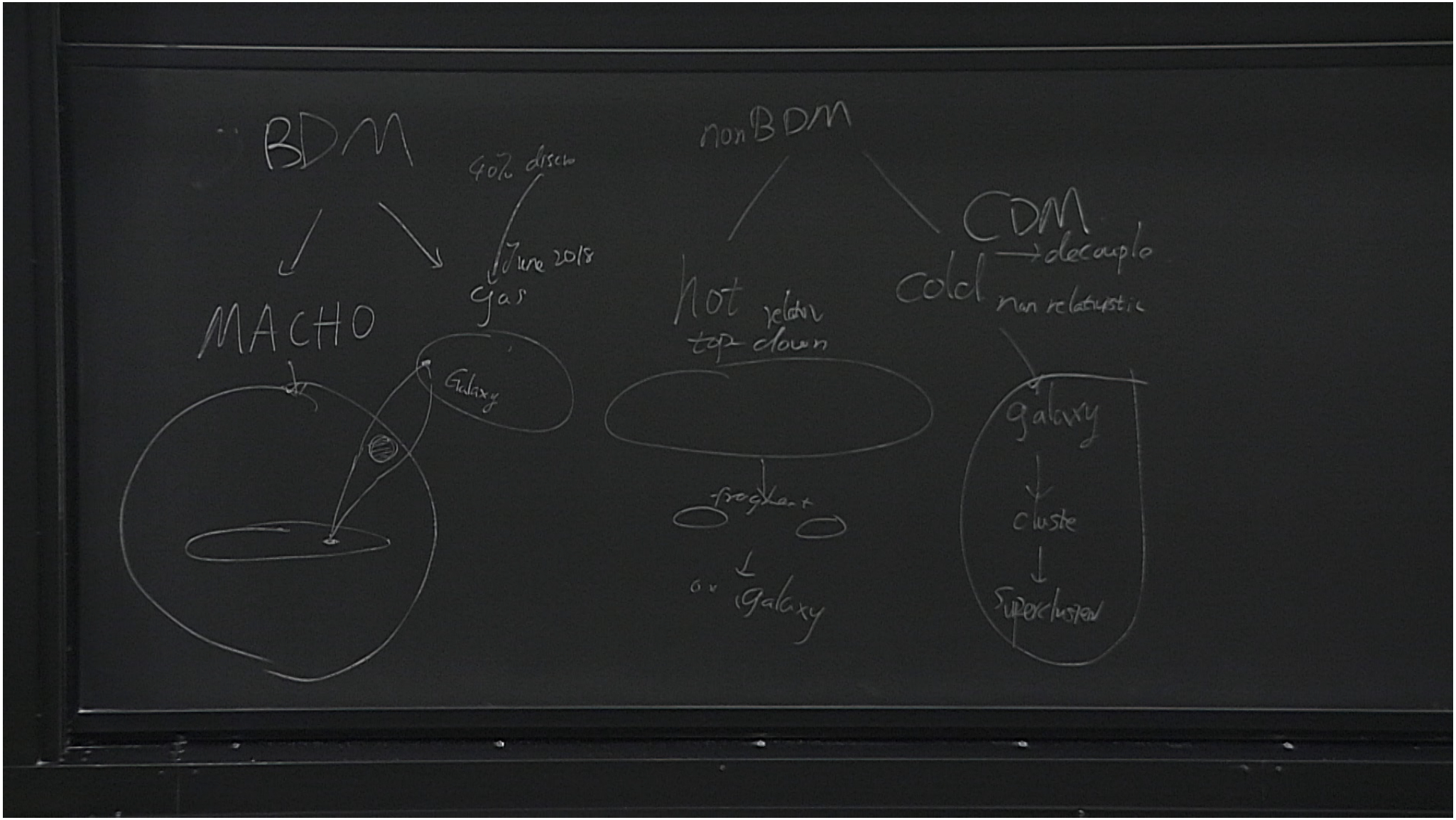
$\frac{M_\odot}{L_\odot} = 1$. mass↑ L↑ faster than linear

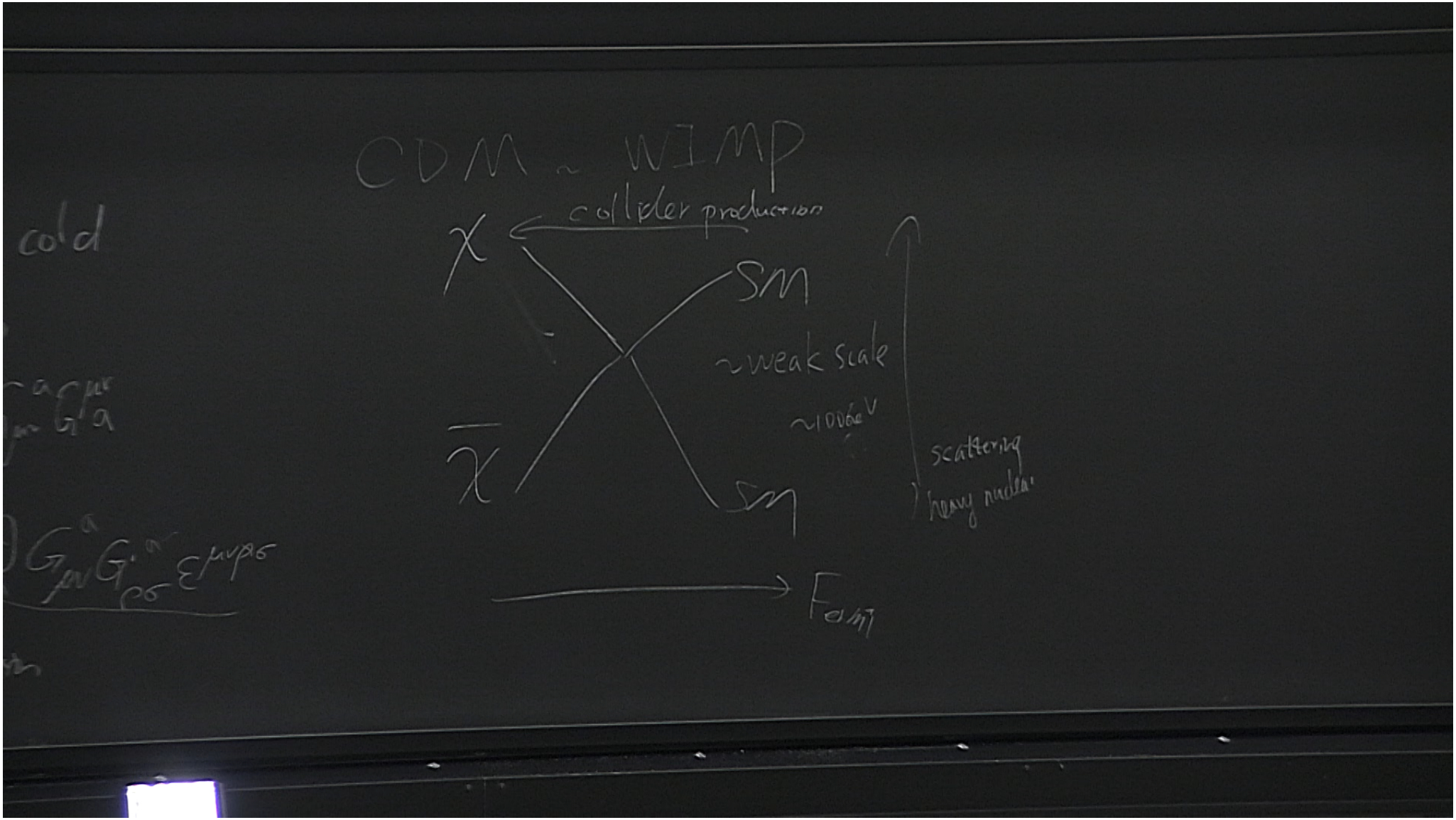
$\frac{M}{L} < 1$ $\quad M > M_\odot$

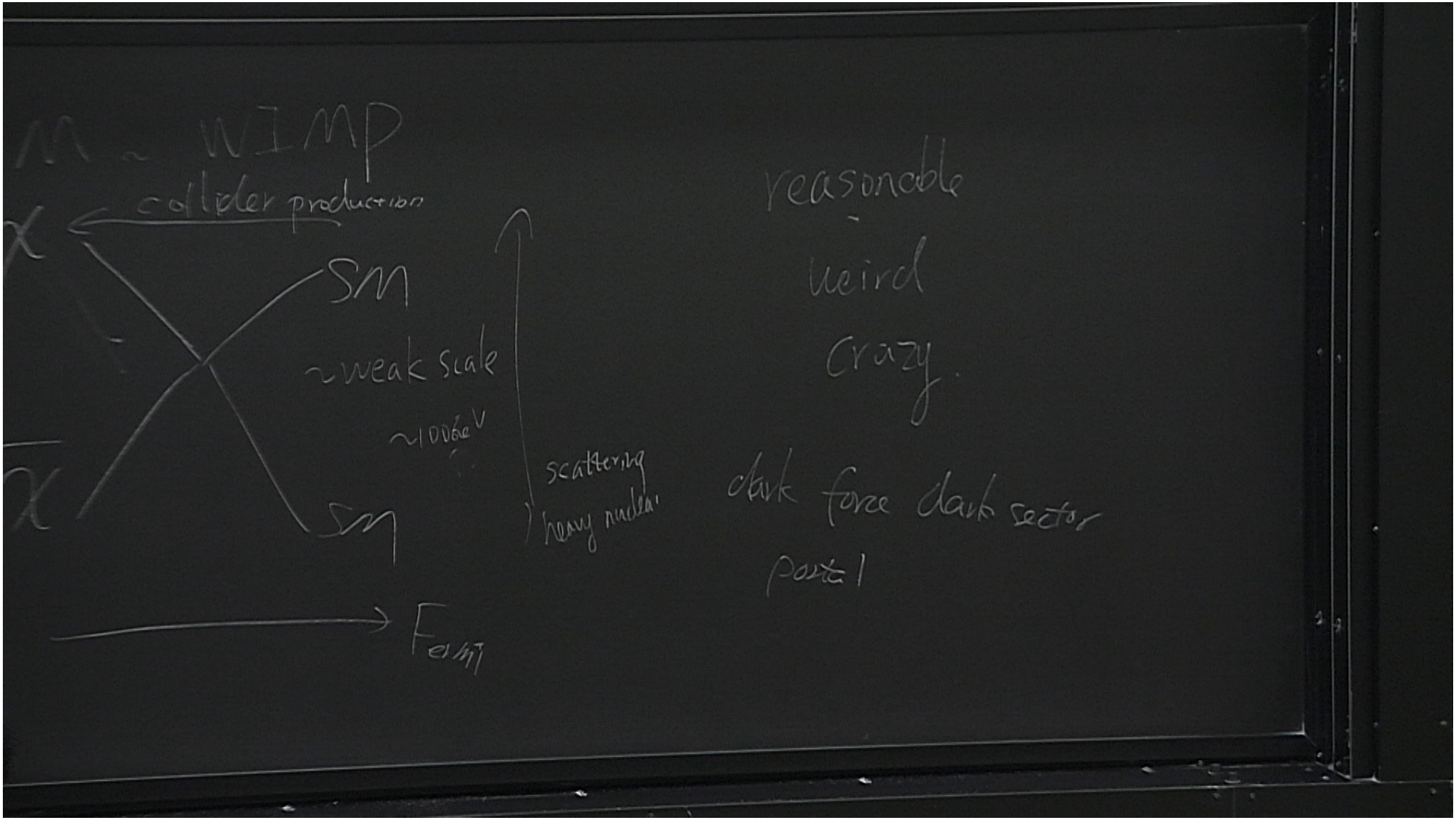
$\frac{M}{L} > 1$ $\quad M < M_\odot$ milky way 2.2.

Clusters : 200~300


mass / luminosity
$\frac{M_\odot}{L_\odot} = 1$
mass↑ L↑ faster than linear
$\frac{M}{L} < 1$ $M > M_\odot$
$\frac{M}{L} > 1$ $M < M_\odot$ milky way 2.2
Clusters : 200~300 $0.14 < \Omega_m < 0.45$


BDM
40% disco
June 2018
gas
MACHO
Galaxy
non BDM
hot
relativ
top down
fragment
or
galaxy
CDM
decouple
cold
non relativistic
galaxy
cluste
Superclusters


CDM ~ WIMP
collider production
χ
SM
~ weak scale
~ 100 GeV
χ̄
SM
scattering
heavy nuclei
Fermi


WIMP
collider production
SM
~weak scale
~100GeV
SM
scattering
heavy nuclei
Fermi
reasonable
weird
crazy
dark force dark sector
portal