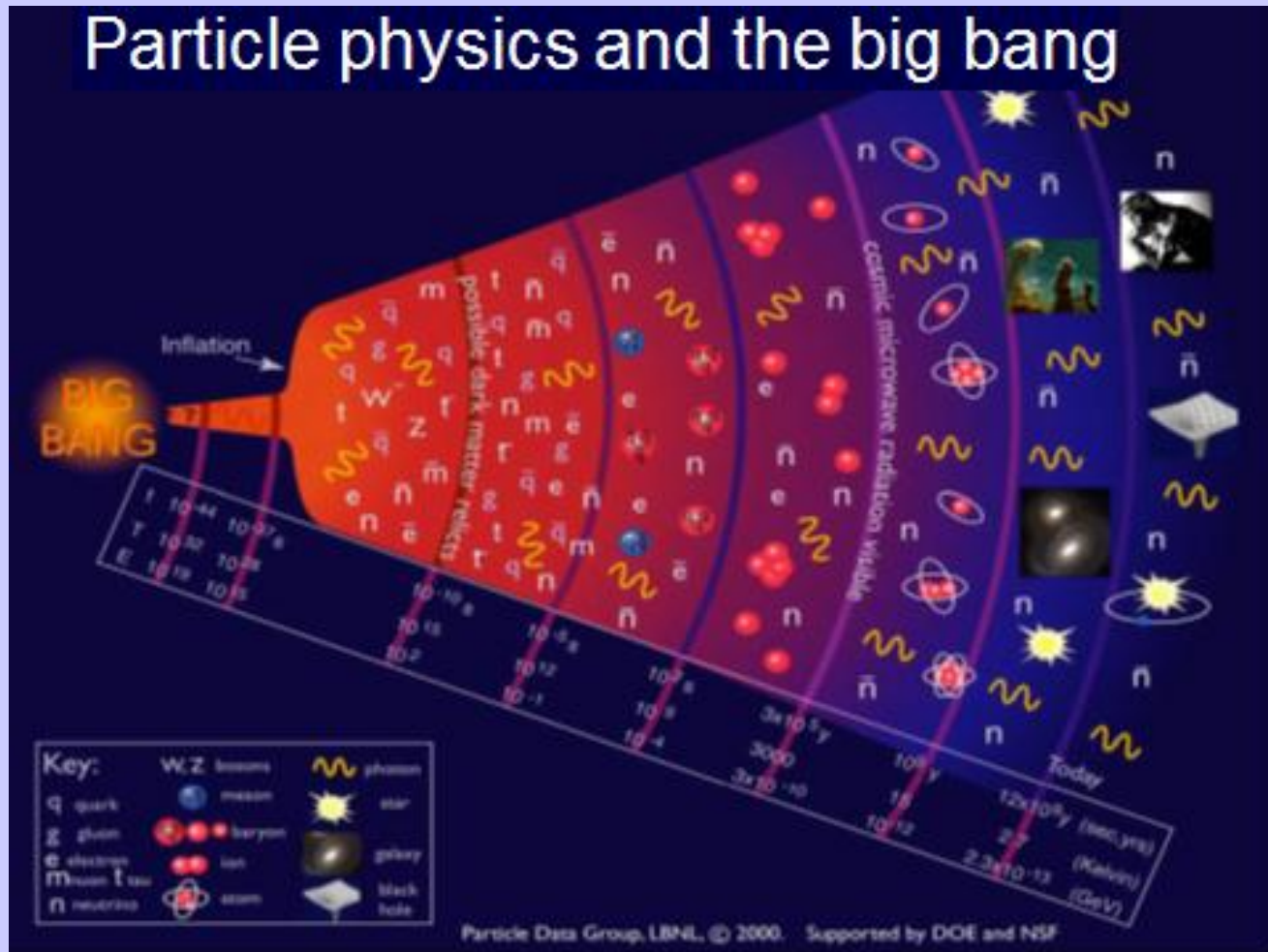


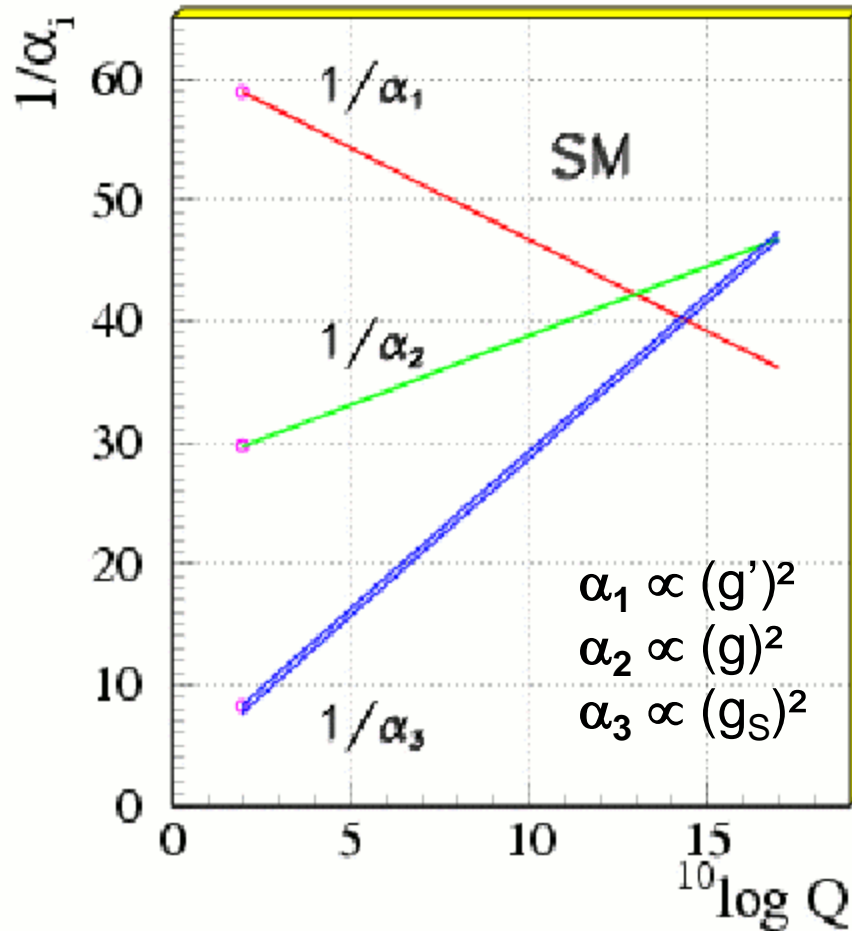
# Beyond the Standard Model



# Tuning the higgs couplings example

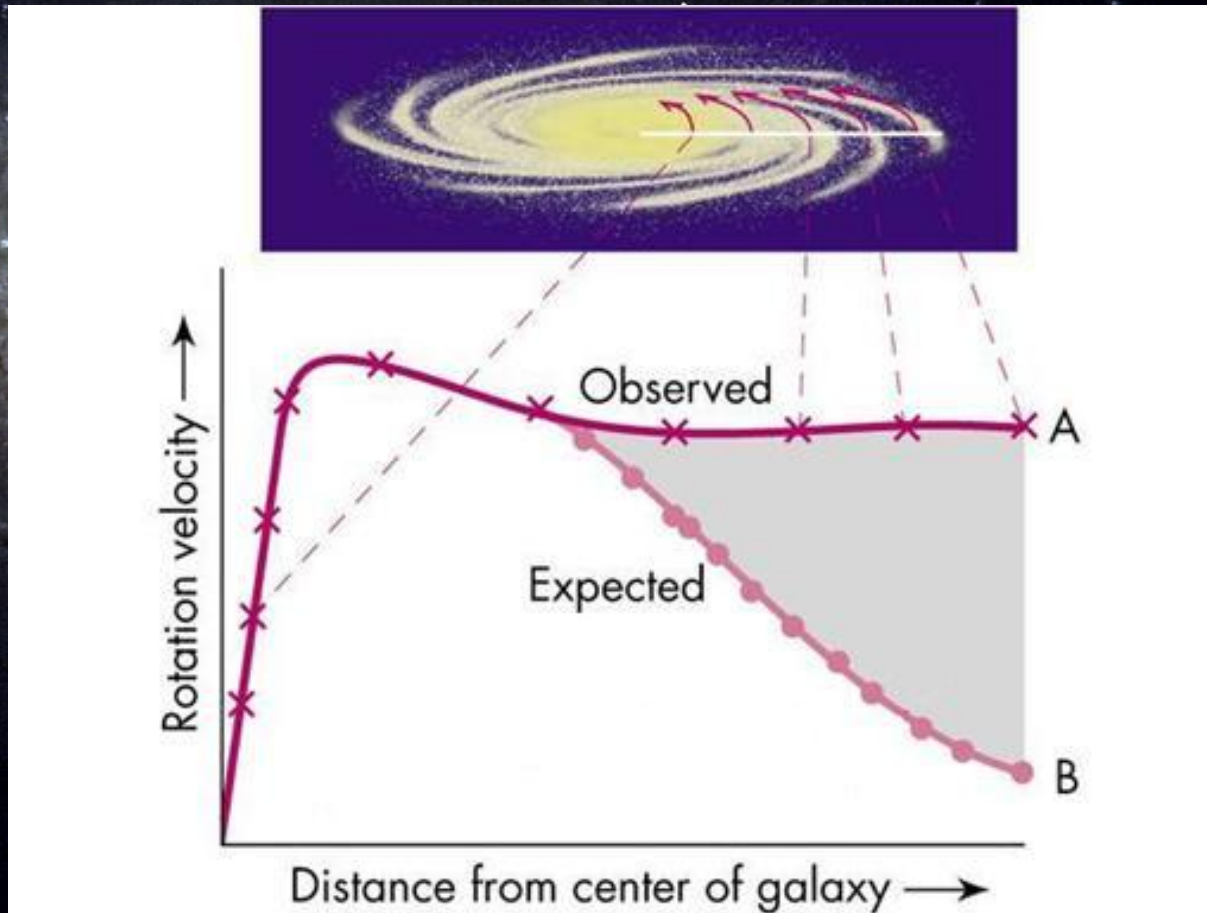
$$\begin{aligned} 100^2 &= 16419971512763993607881093447038089115 \\ &\quad - 19402031160008016677277886179991476752 \\ &\quad + 2441281099066559954943818225739637142 \\ &\quad + 540778548177463114452974507213751495 \end{aligned}$$

# Unification of coupling constants?



Extrapolating the Standard Model coupling constants to higher energies

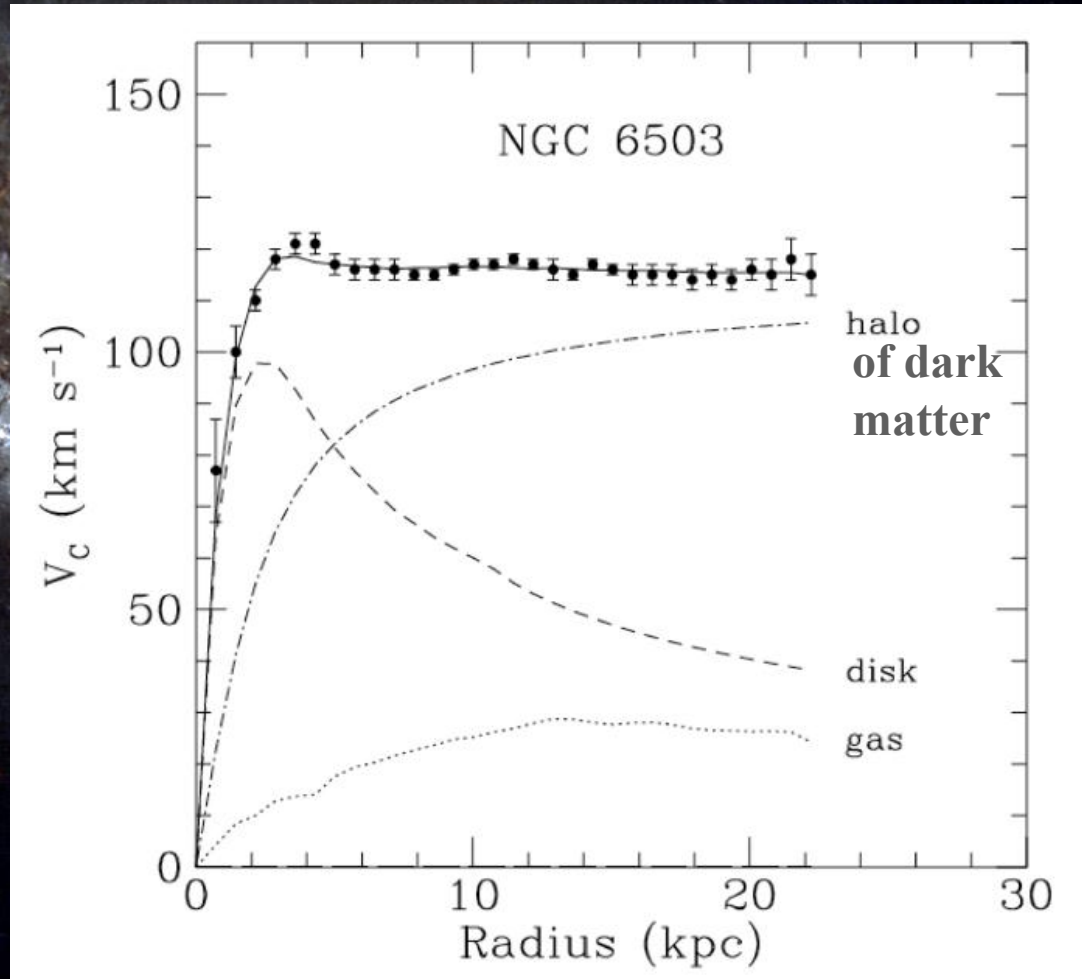
# Galaxy rotation curves



**Standard Model only accounts for  
~20% of the matter of the Universe!!!**

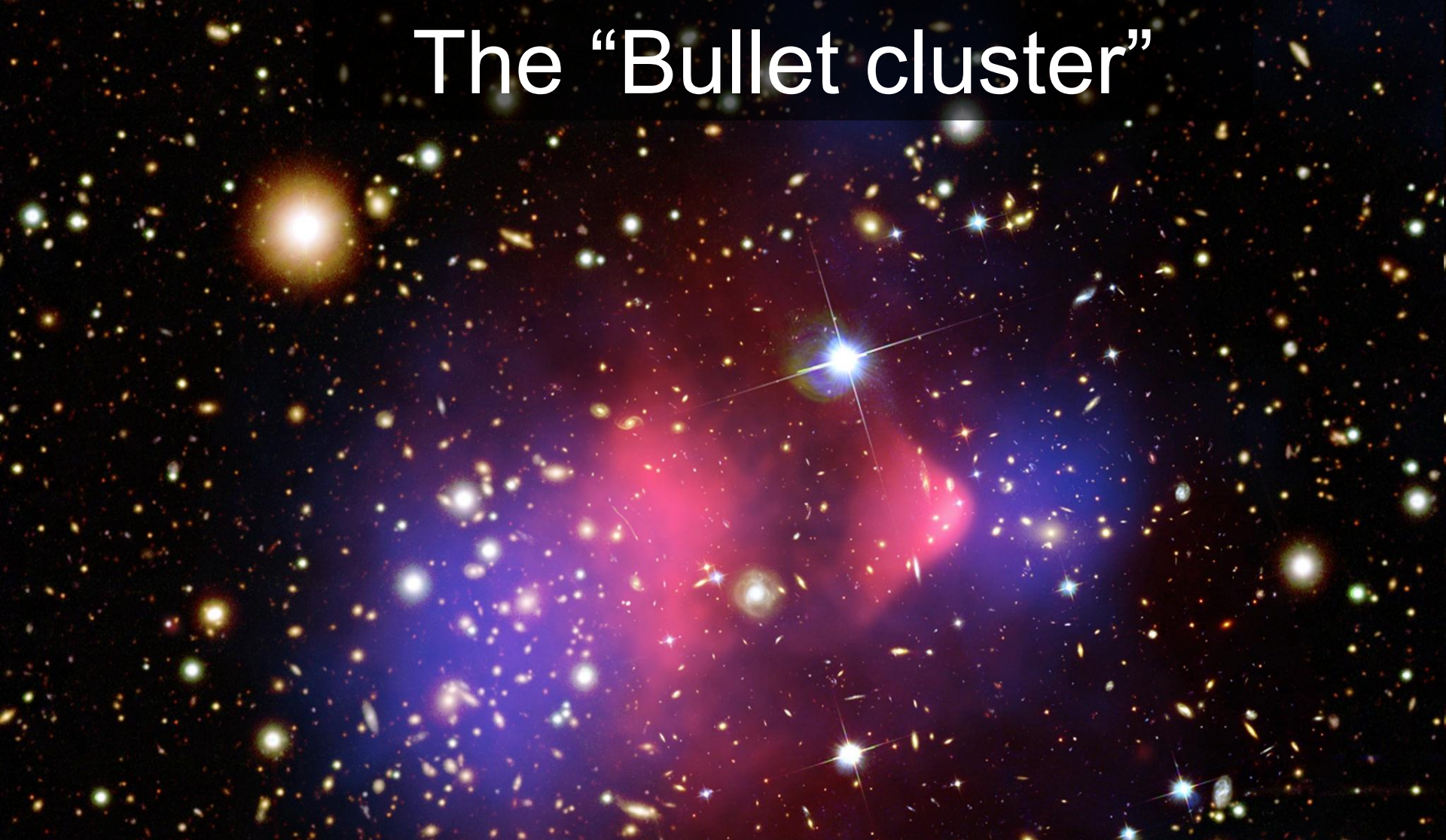
# Galaxy rotation curves

Kamionkowski 1998, astro-ph/9809214



Dark matter?

# The “Bullet cluster”



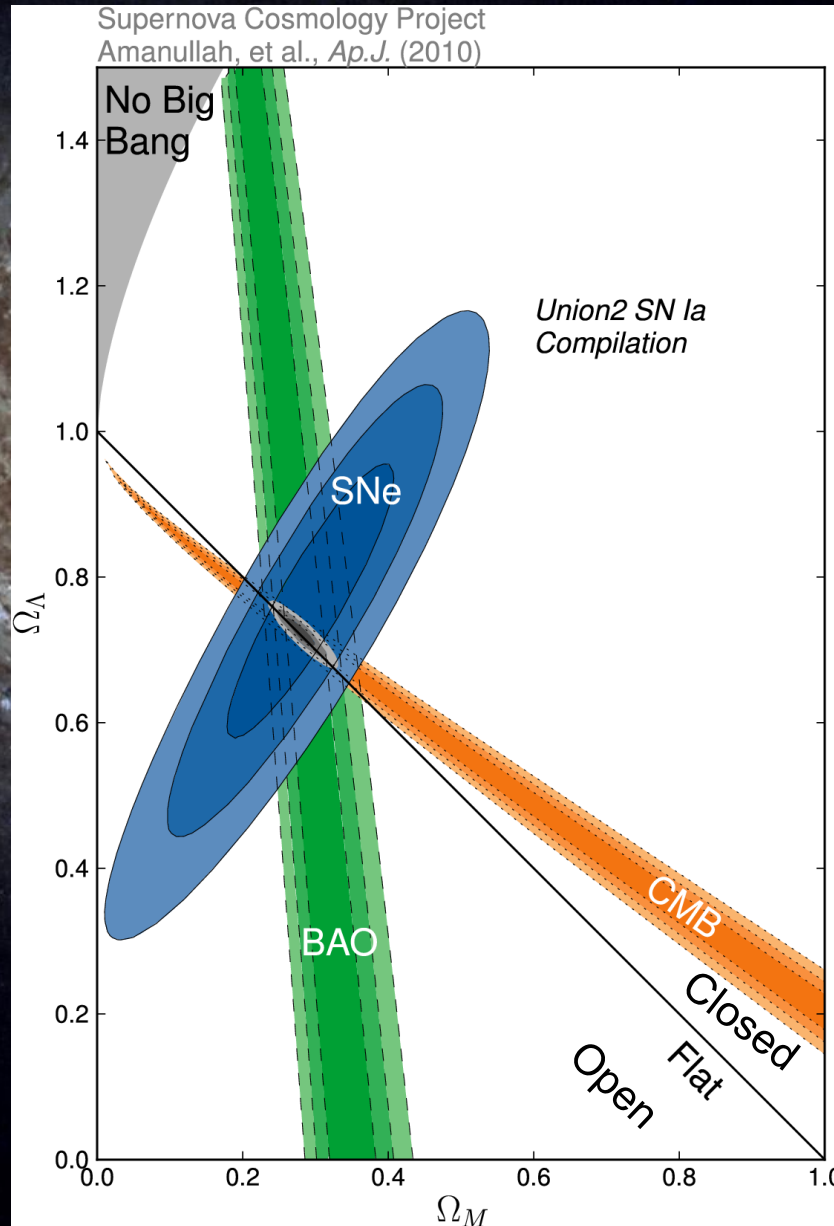
Gas: pink

Dark mass: (from gravitational lensing) blue

Credit: X-ray: NASA/CXC/CfA/ [M.Markevitch](#) et al.;

# Supernovae data

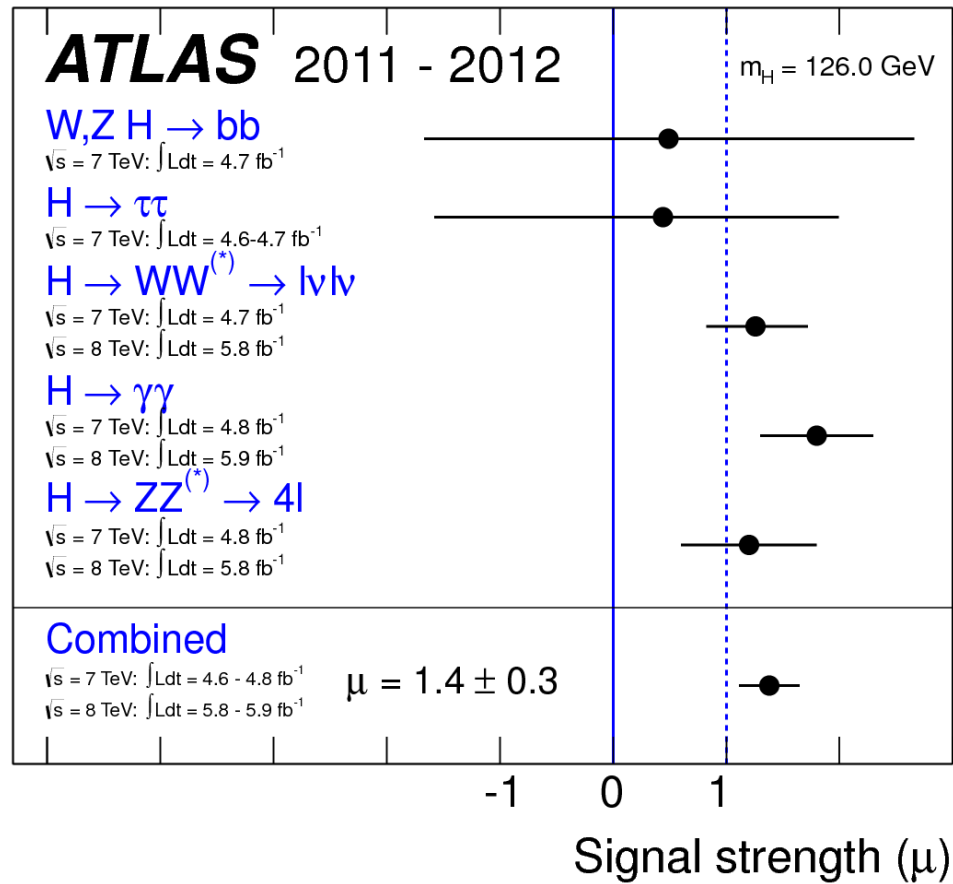
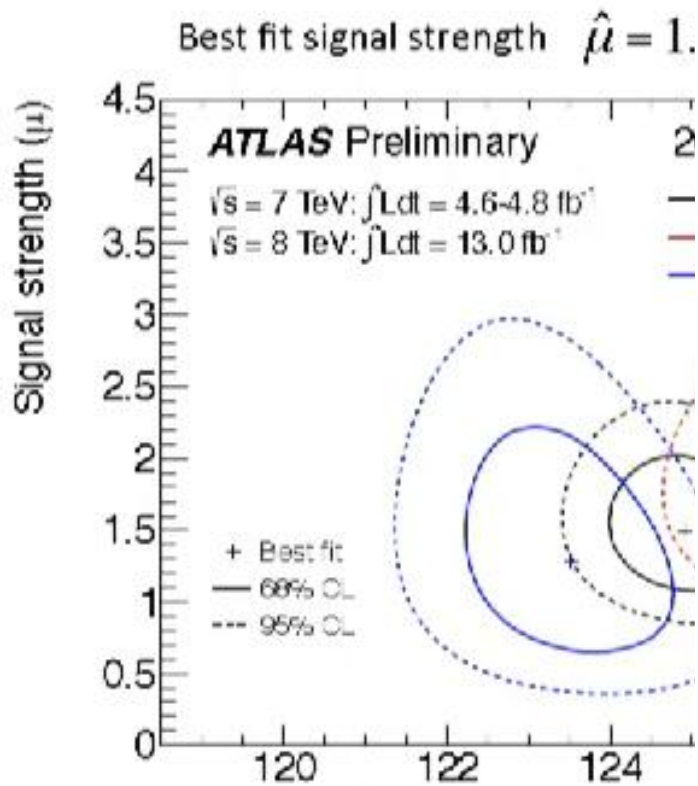
“Cosmological constant” term



Matter only  
accounts for  
~30% of the  
Universe!

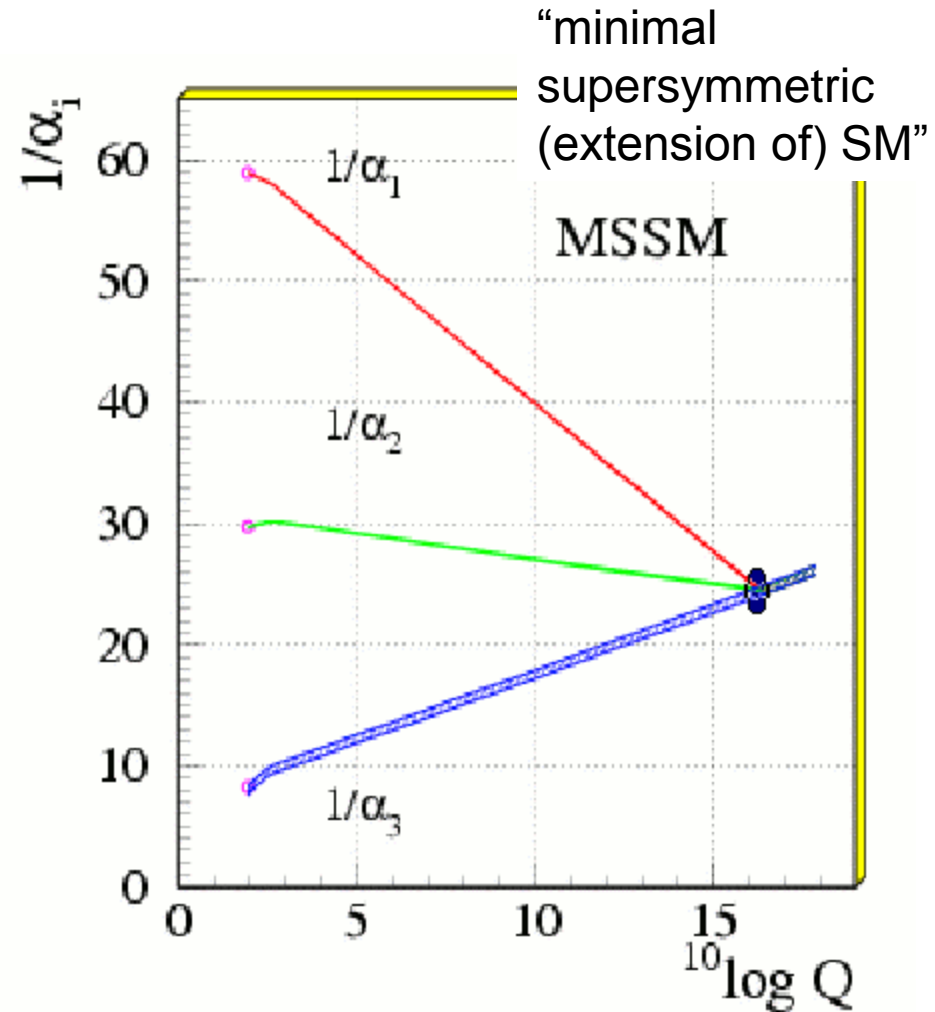
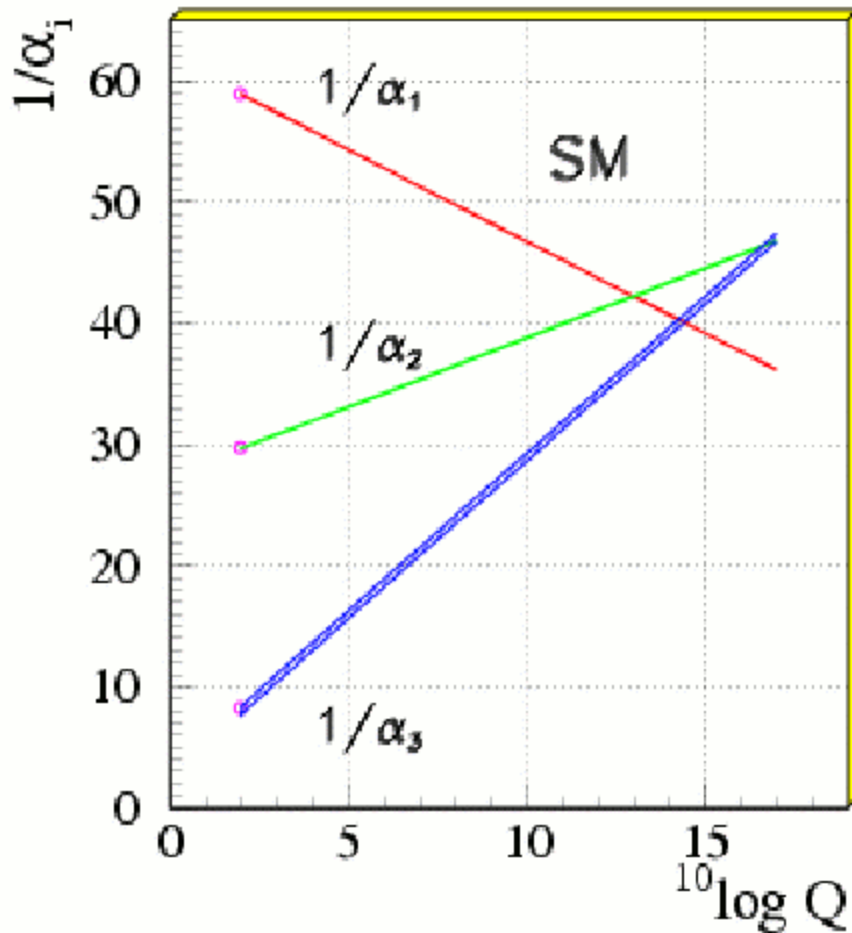
“Matter density” term

# Is it the SM higgs?

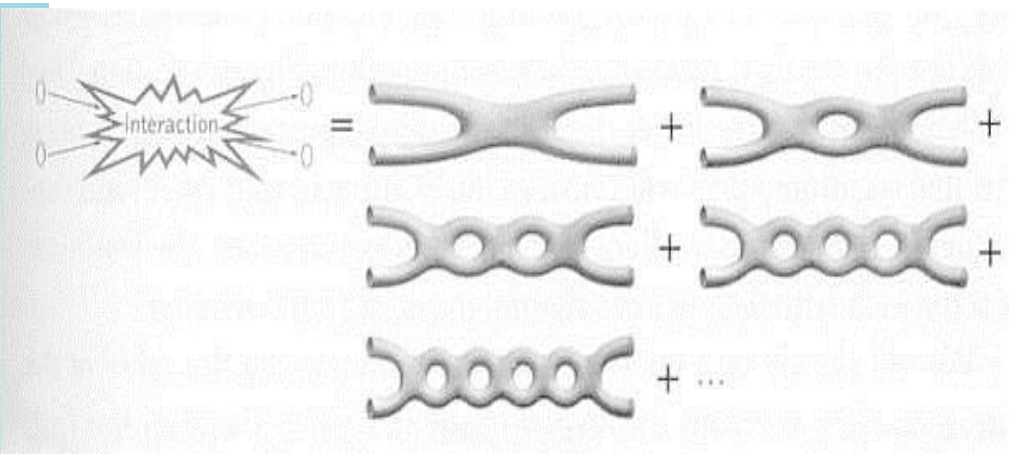
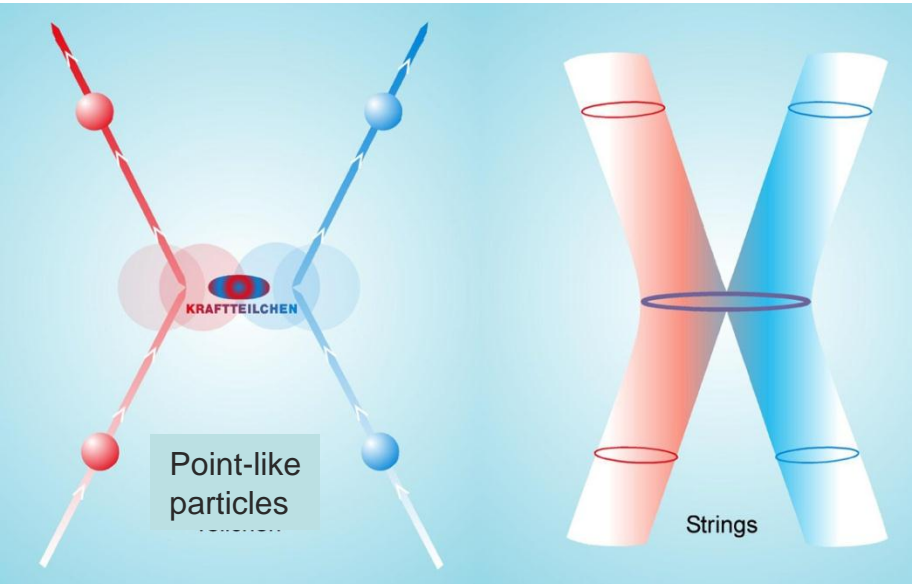
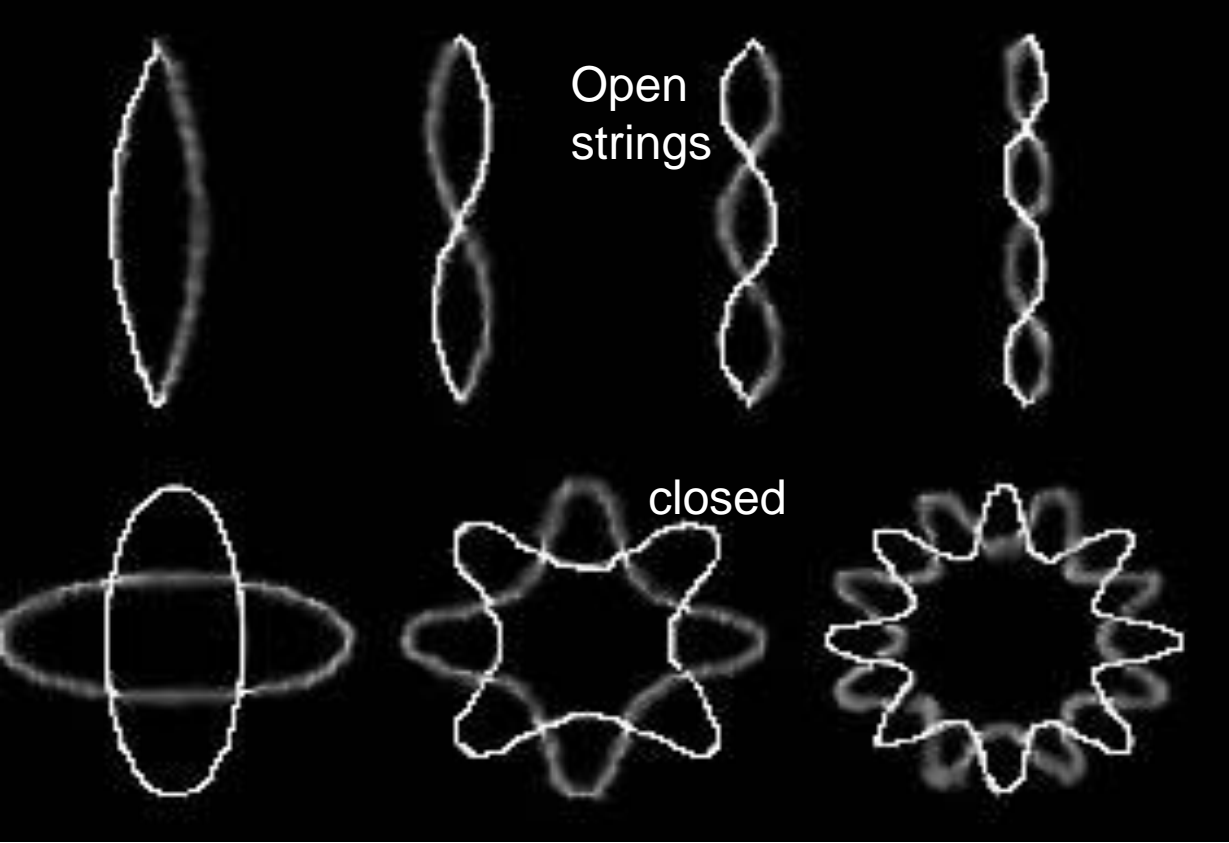




# Unification of coupling constants with supersymmetry



# Strings



# Randall-Sundrum Gravitons

