

Strings
M2-Branes

String Theory

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 ? Grand Unified Theory ?
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10⁻³² meters

10⁻²⁸ meters

10⁻¹⁹ meters

10⁻¹⁷ meters

10⁻¹⁵ meters

10⁻¹³ meters

Grand Unified Theory

????????????????
 ?????????????????
 ????????? SUSY ?????
 ?????????????????
 ?????????????????

The Standard Model

$$\mathcal{L}_{SM} \sim \sum_{S,W,Y} -\frac{1}{4g_S^2} F_S^2 + \sum_{i=1}^3 \sum_{q,u,d,l,e} (\psi_i^\dagger i \not{D} \psi_i + y_i \psi_i^\dagger H \psi_i) + |D_\mu H|^2 - m_H^2 H^2 + \lambda H^4 + \text{h.c.}$$

$e^+ e^- \rightarrow \langle H \rangle$
 $H \rightarrow \langle H \rangle \sim M_{\text{weak}}$
 $e^+ e^- \rightarrow \langle H \rangle e^-$
 $q\bar{q} \rightarrow \langle q\bar{q} \rangle \sim \Lambda_{QCD}$

$W^+ W^- \rightarrow \text{tt}$
 $W^+ W^- \rightarrow \text{W}^-$

10^{-15} m
 Electroweak Theory
 Quantum Electromagnetism

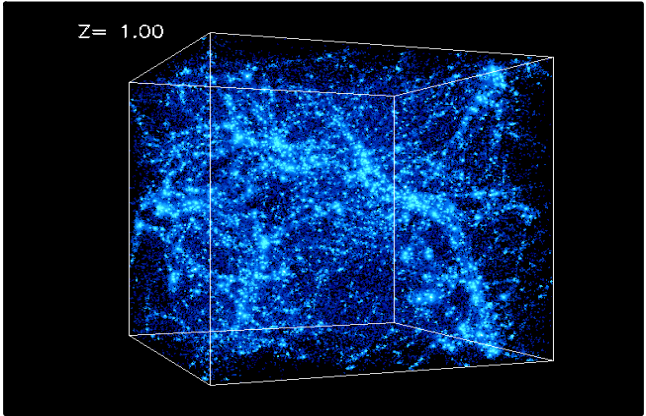
Diagrams showing particle interactions: $W \rightarrow \pi$, $W \rightarrow K$, $W \rightarrow p^+$, $W \rightarrow n^0$.



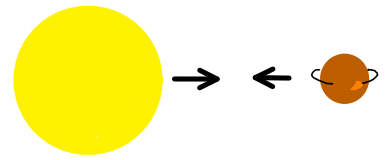
10⁸ meters



10¹⁶ meters

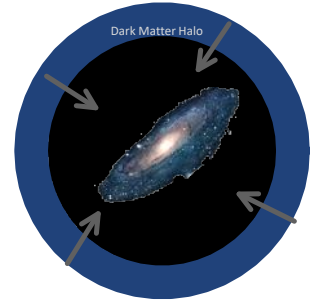


10²⁴ meters



Classical Gravity

$$V(r) = \sum_i \frac{G_N m_i}{r-r_i}$$



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