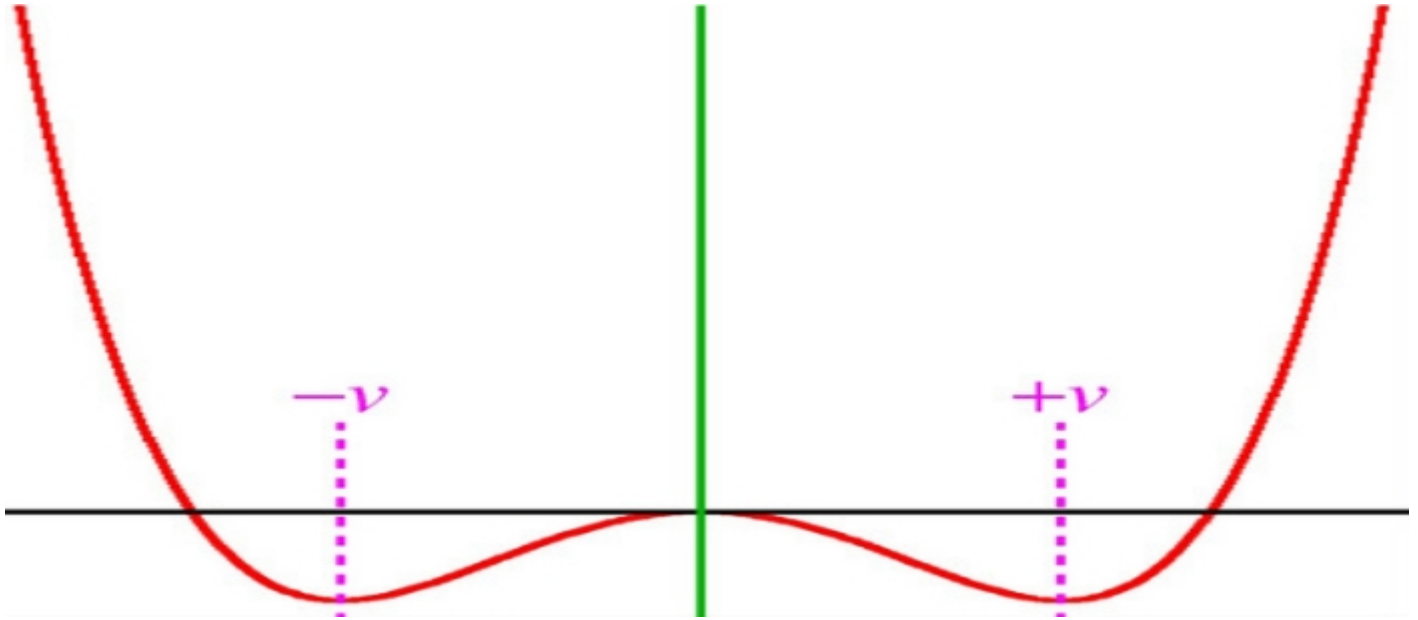
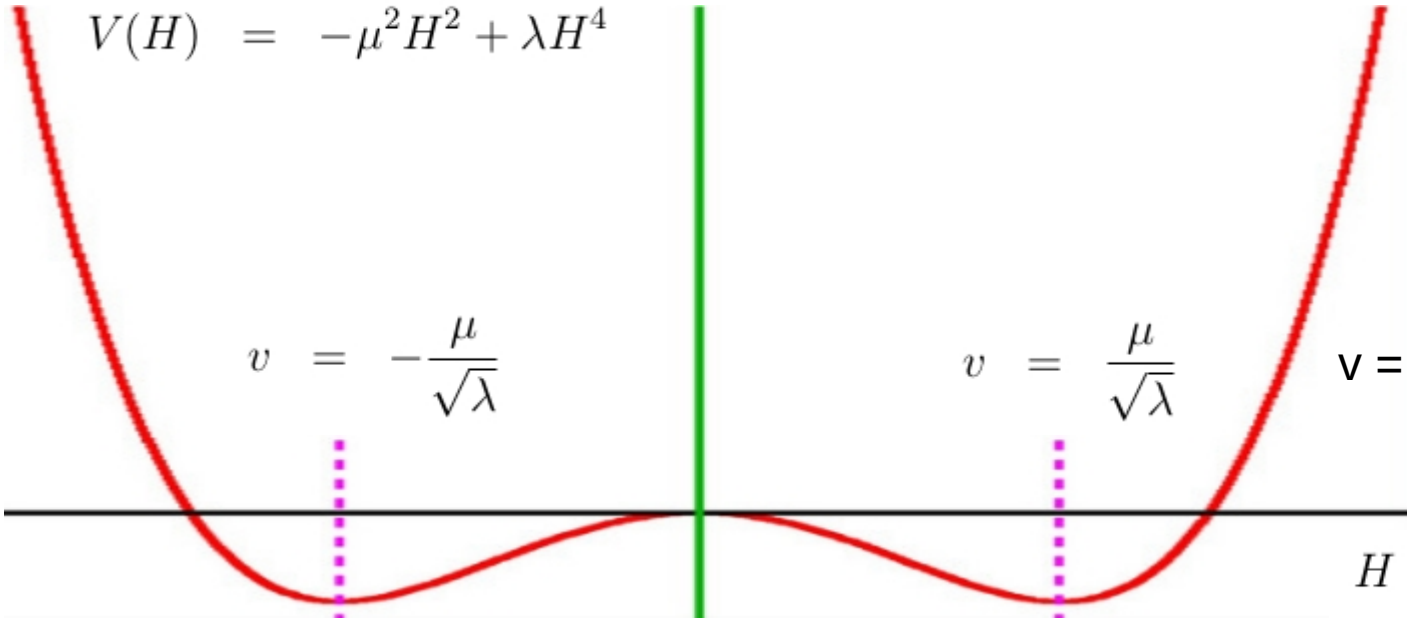
New scalar era



Higgs mechanism … where is the explanation?

Particle, field, symmetry breaking,...



$m_H = \mu$ = 125 GeV

Symmetry of Lagrangian H → -H is not symmetry of vacuum (lowest E state)

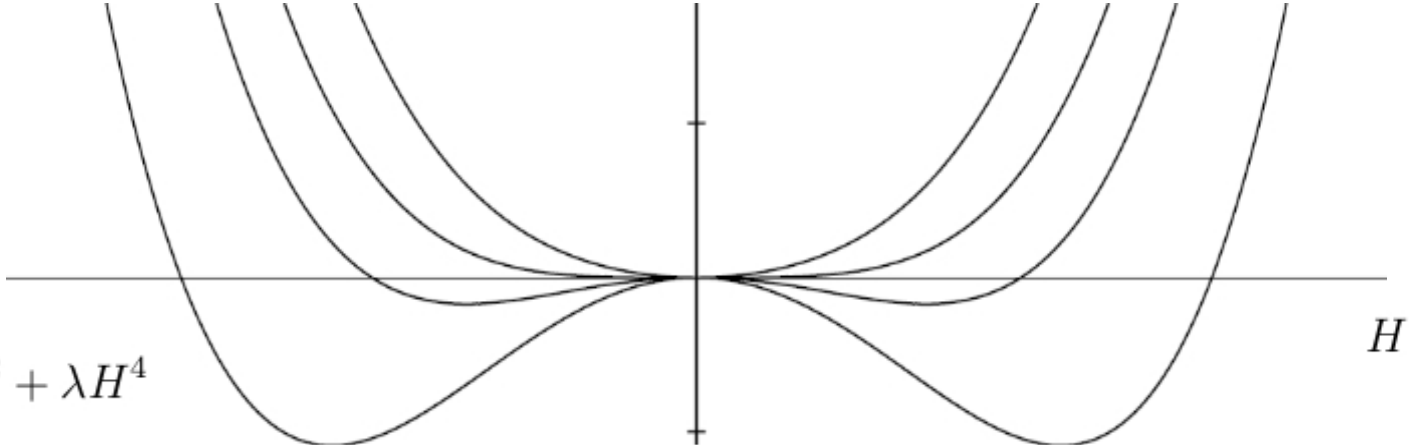
Spontaneous symmetry breaking

When did particles become massive?

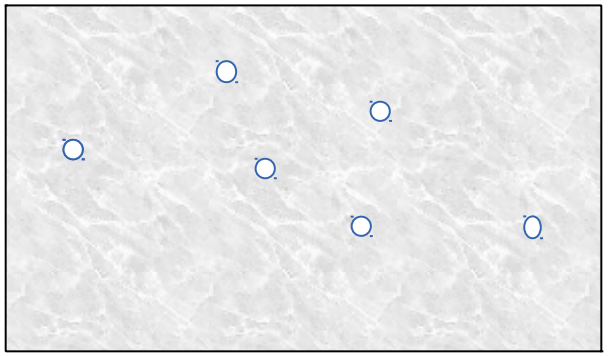
Electroweak phase transition 10^{-12} s after Big Bang

$T_k \sim 200$ GeV

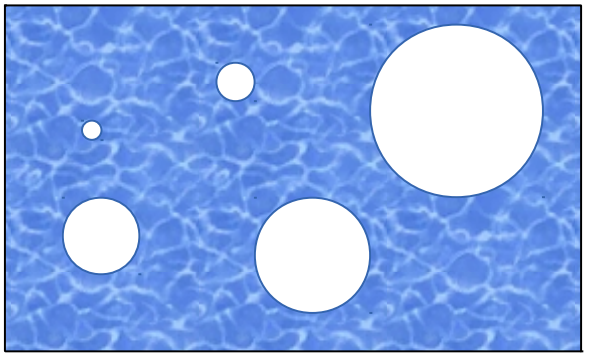
$T > T_k$ $T \sim T_k$ $T = 0$



$$V(H) = -\mu^2 H^2 + \lambda H^4$$



Phase transition

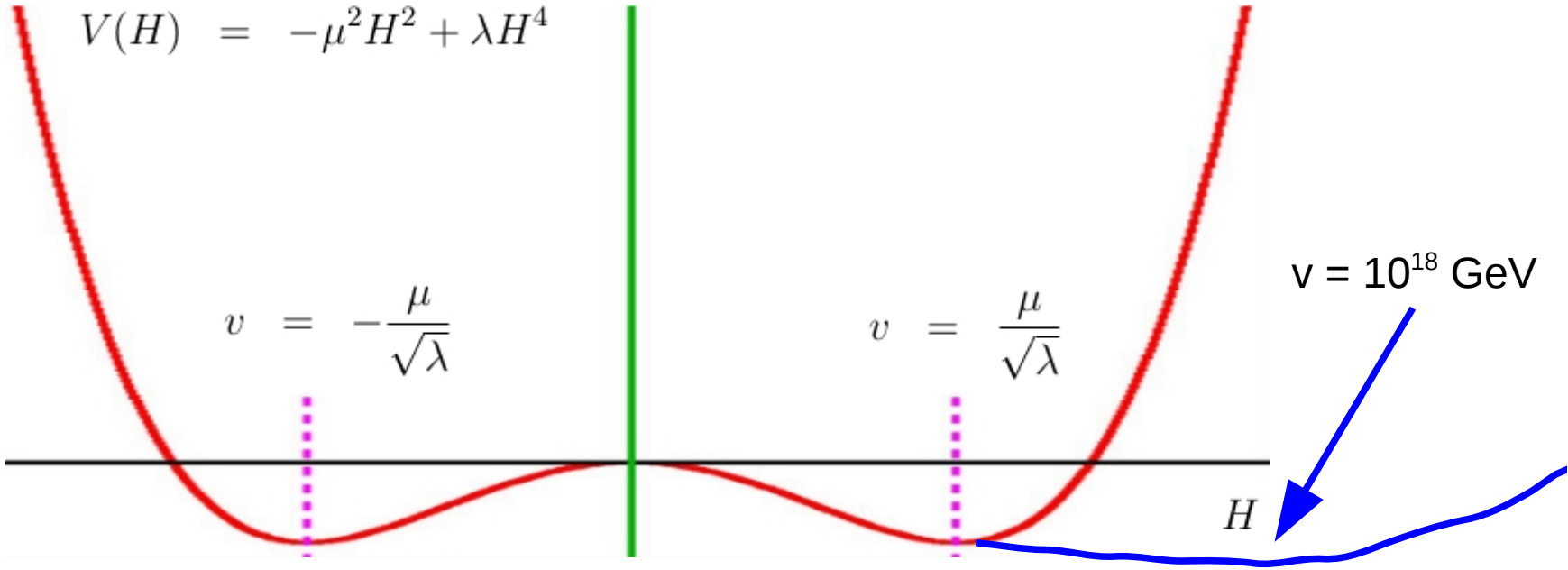


$T > T_k$

$T = 0$

Naturalness problem … supersymetry...

Particle, field, symmetry breaking,...



$H = h + v$

$m_H = \mu$ = 125 GeV

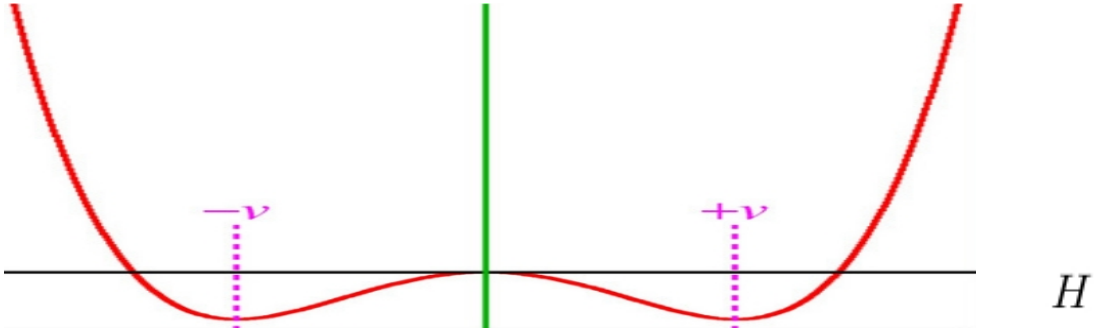
Symmetry of Lagrangian H → -H is not symmetry of vacuum (lowest E state)

Spontaneous symmetry breaking

New scalar era

Scalar fields in other systems:

$$V(H) = -\mu^2 H^2 + \lambda H^4$$



composite

Landau – Ginzburg theory of superconductivity

Condensate of electron pairs

Chiral symmetry breaking in phase transition from quarks to hadrons

Condensate of quark-antiquark

elementary

Inflaton field *elementary scalar field*

Field responsible for accelarating expansion of the Universe

elementary scalar field

When did hadrons become massive?

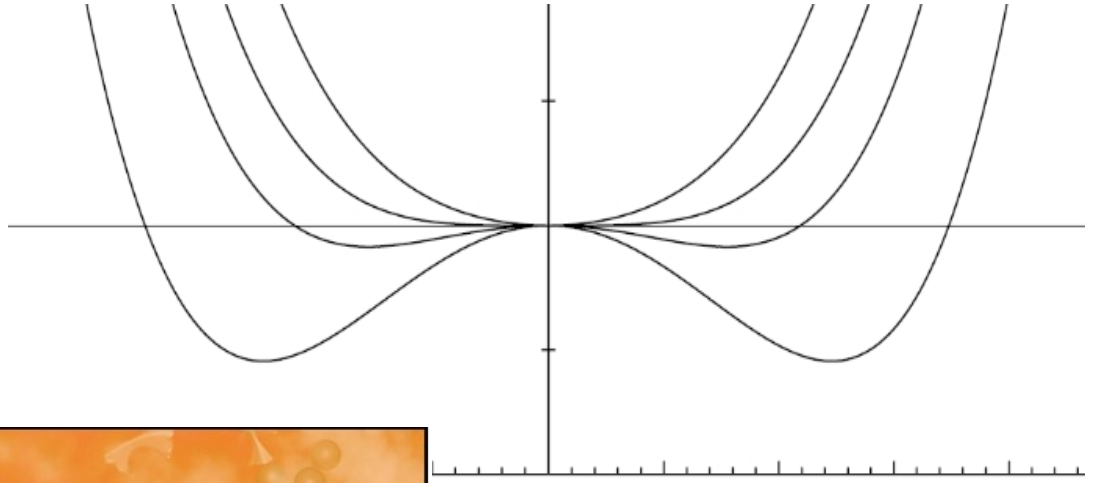
Chiral symmetry breaking 10^{-6} s after Big Bang

$M_p = 938$ MeV

$m_u + m_u + m_d = 9$ MeV

99% proton and neutron mass is not from Higgs mechanism

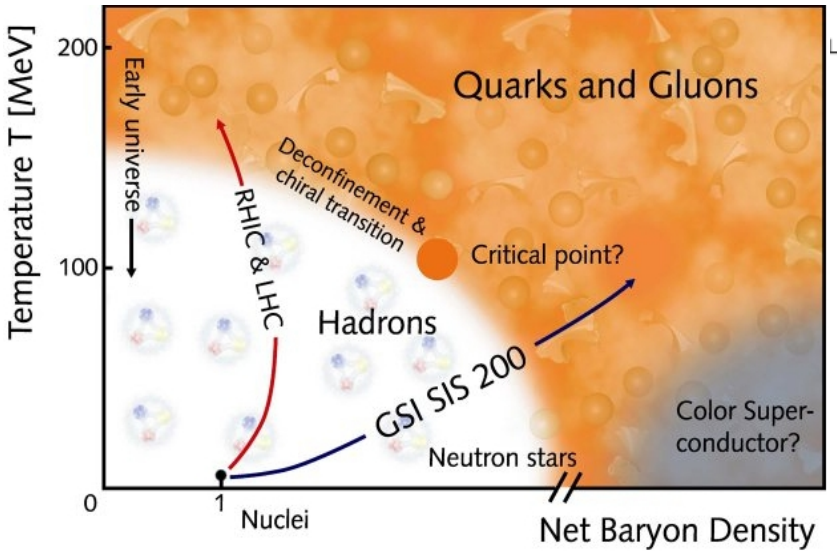
$T > T_k$ $T \sim T_k$ $T > T_k$



$v = 246$ GeV

$T_k \sim 175$ MeV

$v = 90$ MeV



u d gluons ...

σ π^- π^+ π^0 ρ p n ...

Universe in a metastable phase?