DARK MATTER
BEING CRYPTO-
BARYONIC

THE WORK ABOUT THE DARK MATTER, MAINLY WITH

C.D. FROGGATT

& H.B.N (me)

BUT WE SHOULD ACKNOWLEDGE D. BENNETT.

BUT REALLY THE "DARK MAT-TER CRYPTOBARYONIC" IS ONLY THE LATEST NEW IDEA IN A SERIES PROPERLY CALLED: FINE TUNING COSMOLOGICAL CONSTANTS AND ALMOST PURE STANDARD MODEL GIVES EVERYTHING ALMOST!

ARIEL ZHITNITSKY

HAS A SERIES OF PAPERS OF DARK MATTER AS BEING IN A DIFFERENT PHASE OF Q.C.D.

THIS GIVES NATURALLY SAME ORDER OF MAGNITUDE FOR Ω_{DM} AND Ω_B BECAUSE THEY HAVE THE SAME ORIGIN.

DARK MATTER BEING CRYPTOBARYONIC IN MODEL THAT IS ONLY STANDARD MODEL - AT LEAST TO SEE-SAW SCALE - EXCEPT FOR THE FINE TUNING POSTULATE THAT THERE BE MANY VACUA, ALL HAVING SMALL COSMOLOGICAL CONSTANTS (ONLY OF ORDER OF SAY 73% OF CRITICAL COSMOLOGICAL DENSITY, AS IT IS IN "OUR" VACUUM.)

THE PRINCIPLE OF MANY VACUA DEVELOPPED GRADUALLY IN VARIOUS VERSIONS FROM WORKS WITH D. BENNETT (SEE HIS THESIS) - AND I. PICEK,..., IN ITS FINAL FORM BENNETT & C.D. FROGGATT & me

AN IMPORTANT INGRE-
DIENT IN OUR MODEL
- A BIT EARLIER THAN THE
IDEA OF USING IT FOR DARK
MATTER, AND MOST RECENTLY
SOME THOUGHT ON INFLATION
RELATED TO GRAHAM ROSS'S
TALK AT PLANCK CONFERENCE-
IS:

A BOUND STATE OF
$6A + 6\bar{A}$ SO STRONGLY
BOUND AS TO BECOME
TACHYON AND CONDENS
SOLVES "HIERARCHY-
PROBLEM RELATED SCALE-
PROBLEM"!

L. V. LAPERASHVILI, C. D. FROGGATT
AND H. B. N.

COMPARING OUR MAIN ASSUMPTION

$$\forall_{VACUA} \; i \; [\Lambda_{cosmo \, i} \approx 0]$$

TO THE "LANDSCAPES" WITH ANTROPIC PRINCIPLE?

OUR M.P.P. (= MULTIPLE POINT PRINCIPLE)

PARAMETERS (REALLY COUPLING CONSTANTS AND MASSES, ALTHOUGH INFLUENCED BY MILD NON-LOCAL EFFECTS, LIKE IN BABY UNIVERSE THEORY) GET TUNED IN TO MAKE EQUALY DEEP VACUA. ALSO THE ONES WE ARE NOT IN.

LANDSCAPE PICTURE

THE PARAMETERS THAT GET TUNED TO GET THE MINIMUM IS RATHER SCALAR FIELDS OR MODULI, THAN TRUE COUPLINGS CONSTANTS.

RATHER HUMANS FOUND A VACUUM WITH SMALL Λ_{cosmo} THAN THERE BEING MADE ANY.

ANTROPIC PRINCIPLES CAN ONLY INFLUENCE OUR VACUUM, NOT OTHERS

DARK MATTER AS KRYPTO-BARYONIC:

THE COLD DARK MATTER CON-SISTS OF SMALL BAGS OF AN ALTERNATIVE VACUUM (FALSE OR THE LOWEST DENSI-TY ONE NOT SO CRUCIAL, SINCE WE ASSUME IT ON THE BORDER) CONTAINING SQUEEZED BA-RYONS OR EVEN ATOMS.

MULTIPLE POINT PRIN-CIPLE: OUR ASSUMPTION THAT THERE MANY POS-SIBLE VACUA, ALL WITH ZERO (ALMOST) COSMOLOGICAL CONSTANTS

$$\forall i \left[\Lambda_{COSMO_i} \approx 0 \right].$$

HIGGS ALREADY FOUND AT L.E.P.: WE PREDICT THE HIGGS
MASS COMPATIBLE WITH 115 GeN AS
FOUND AT L.E.P

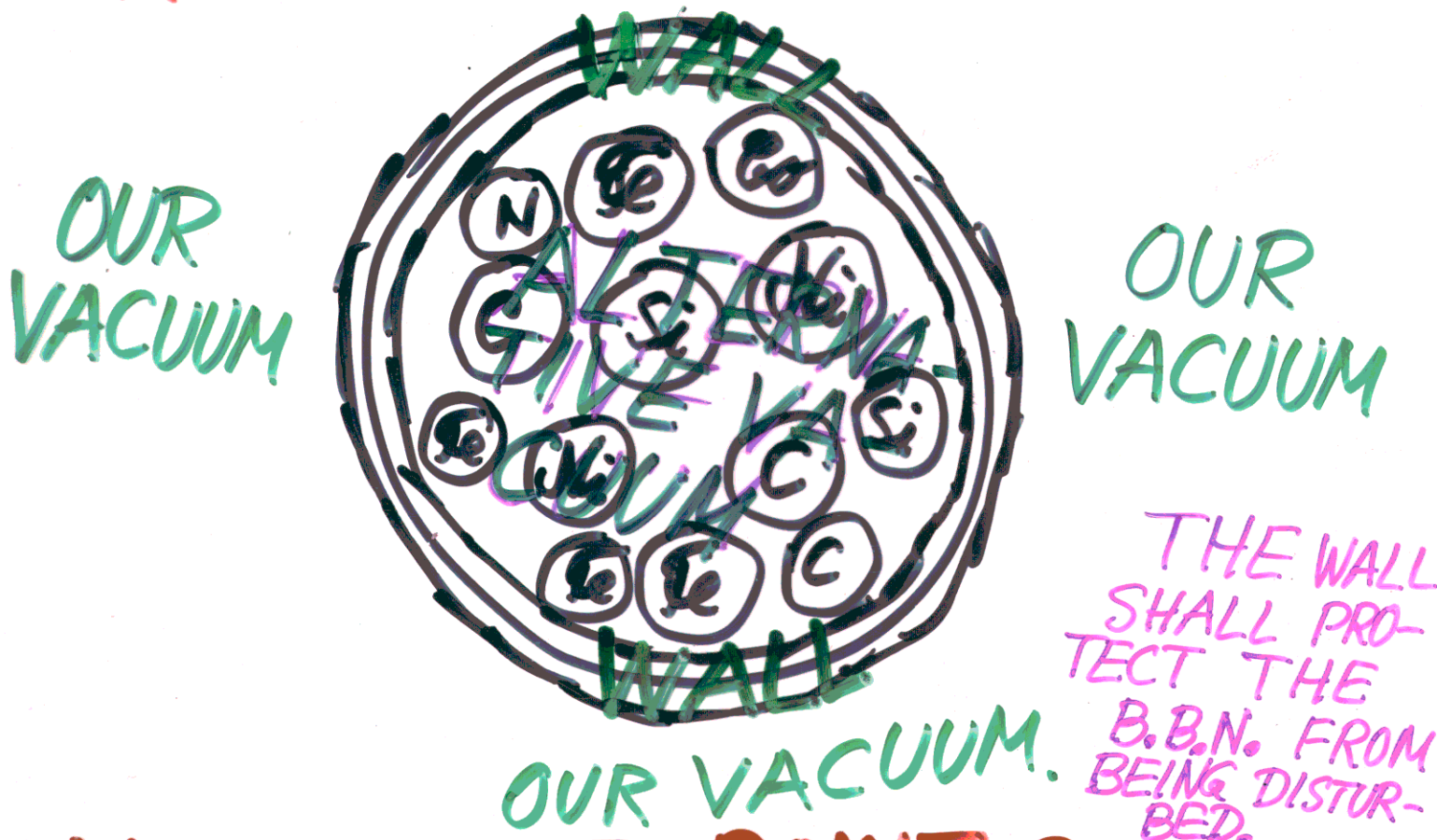# DARK MATTER
CRYPTO-BARYONIC

C.D. FROGGATT

H.B.N

COULD SOME BARYONS - OR EVEN ATOM - BE PACKED SO WELL INTO A SEPERATE TYPE OF VACUUM AS TO PREVENT THEM FROM PARTICIPATING IN BBN(= BIG BANG NUCLEAR SYNTHESIS)?

DARK MATTER AS KRYPTOBARYONIC:

WALL

OUR VACUUM

OUR VACUUM

ALTERNATIVE VACUUM

WALL

OUR VACUUM.

THE WALL SHALL PROTECT THE B.B.N. FROM BEING DISTURBED.

MULTIPLE POINT PRINCIPLE:

NATURE HAS CHOSEN COUPLINGS TO BE AT THE MULTIPLE POINT.

VAPOR
ICE
WATER

$\Rightarrow$ TRIPLE POINT (T, μ)

HIGGS ALREADY FOUND ATLEP.

$V_{eff}(\varphi_{WS})$ TWO DEGERATE MINIMA FOR $m_{HIGGS} = 135\,GeV$

φ_{WS}

CORR.

OUR MODEL IS AL-MOST THE $\overset{MOST}{\vee}$ CONSERVATIVE OR DULL, YOU CAN IMAGINE:

1) USE $_{ONLY}$ STANDARD MODEL — NO SUSY, NOTHING (EXCEPT $_{THAT}$ WE $\overset{MAY}{\vee}$ HAVE MORE NEW PHYSICS, SAY SEE-SAW SCALE ETC $\overset{IF\ NOT\ TOO\ DISTURBING}{\vee}$ CHITTA DAS WILL TALK ABOUT LOOKING FOR SUCH EFFECTS, AND OLD TIME D. BENNETT AND I STARTED WITH A $SMG \times SMG \times$... .. $\times SMG$ (N_{gen} FACTORS)).

2) WE MAKE THE CHOICE IN ASSUMING "THE" COSMOLOGICAL CONSTANT TO BE SMALL OF SAYING MORE PRECISELY — PRE-SUPPOSING THAT THERE SEVERAL POSSIBLE VACUA —: ALL THE DIFFERENT VACUA HAVE VERY SMALL COSMOLOGICAL CONSTANTS Λ_{cosmo}: ~ PRESENT ENERGY DEN

PLAN: Ap.4.1.

1) INTRODUCTION:
MENTIONING OUR MANY COSMOLOGICAL CONSTANTS BEING ZERO,- MODEL. NOW TO GIVE DARK MATTER.

2) WHAT DO WE NEED TO HIDE BARYONIC MATTER, SO THAT IT DOES NOT "DISTURB" THE BIG-BANG-NUCLEAR SYNTHESIS?

3) ATTEMT TO CONSTRUCT THE SCENARIO OF THE STEPS GOING ON IN THE EARLY UNIVERSE.

4) THE SPECULATION OF THE "INTERNAL FUSION" CAUSING THE OUTBURST OF THE TO BE NORMAL MATTER. A GREAT FORMULA!

5) EXPLOSIVE DARK MATTER. 6) CONCLUSION.

THE NICE RELA- TION HOPEFULLY TO BE EXPLAINED BY OUR DARK MATTER BE- ING BAGS HIDING BA- RYONS INSIDE:

$$\frac{\Omega_{MATTER}}{\Omega_{ORDINARY\ (OPEN)\ BARYON\ MATTER}} = \frac{\overbrace{23\%}^{\Omega_{LCDM}} + \overbrace{4\%}^{\Omega_{ORDINARY\ BARYONIC\ MATTER}}}{\underbrace{4\%}_{\Omega_{ORDINARY\ BARYONIC\ MATTER.}}} \quad \begin{matrix} \text{HOPE} \\ \text{FULLY} \\ \text{OUR} \\ \text{MODEL.} \end{matrix}$$

$$= \frac{BINDING\ OF\ NUCLEON\ IN\ HEAVY\ N.}{(-BINDING\ OF\ NUCLEON\ IN\ {}^{4}He + B.O.N.\ IN\ HEAVY\ N.)}$$

$$= \frac{8.5\ MeV}{(8.5 - 7.1)MeV}$$

BASIC IDEA:

DARK MATTER CONSISTS OF PIECES OF "ALTERNATIVE VA-CUUM" — *PRESUMABLY THE ONE* <u>WITH</u> *THE CON-DENSATE OF $(6A + 6\bar{A})$-BOUND STATES* — CONTAINING NU-CLEI AND ELECTRONS KEPT INSIDE THE PIECE OF "ALTERNATIVE VACU-UM" DUE TO:

THE WEINBERG-SALAM HIGGS V.E.V. BEING SOMEWHAT SMALLER IN THE ALTERNATIVE VACUUM $\langle \varphi_{WS} \rangle_{WITH} < \langle \varphi_{WS} \rangle_{WITHOUT}$

$$\Longrightarrow_{THUS} \begin{cases} \pi^+, \pi^-, \pi^0 \text{ LIGHTER IN "ALTERNATIVE"} \cong \text{"WITH STRONGER NUCLEAR BINDING.} \\ e^- \text{ LIGHTER IN "ALTERNATIVE"} \end{cases}$$

IF THERE SHALL BE TIME
WE CAN HAVE A LONG SEMINAR
ABOUT OTHER APPLICATIONS THAN
DARM MATTER OF OUR HYPO-
THESIS OF:

"MULTIPLE POINT PRINCIPLE":

$V_{eff}(\varphi)$ = "ENERGY DENSITY FOR THE GIVEN FIELD VALUE φ."
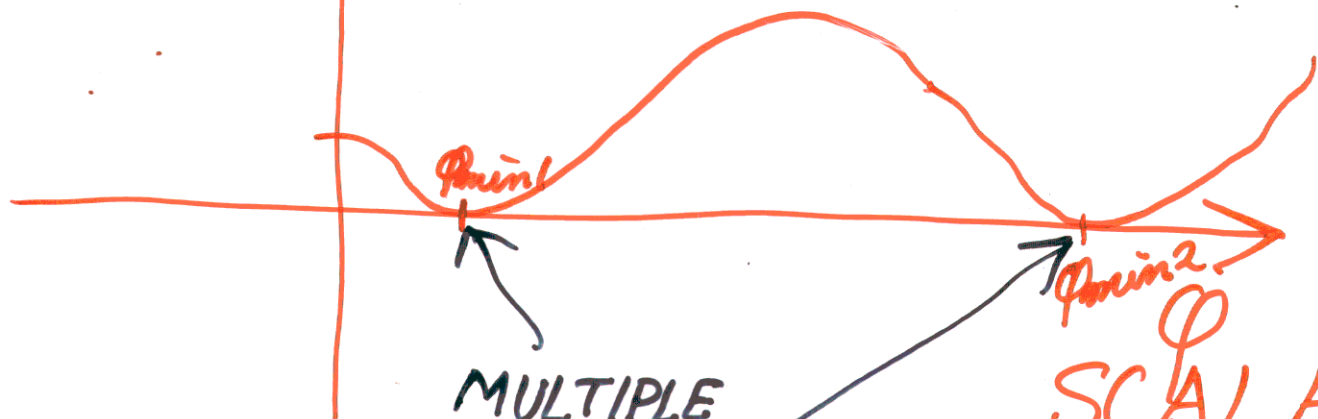
MULTIPLE
POINT
PRINCIPLE
POSTULATES
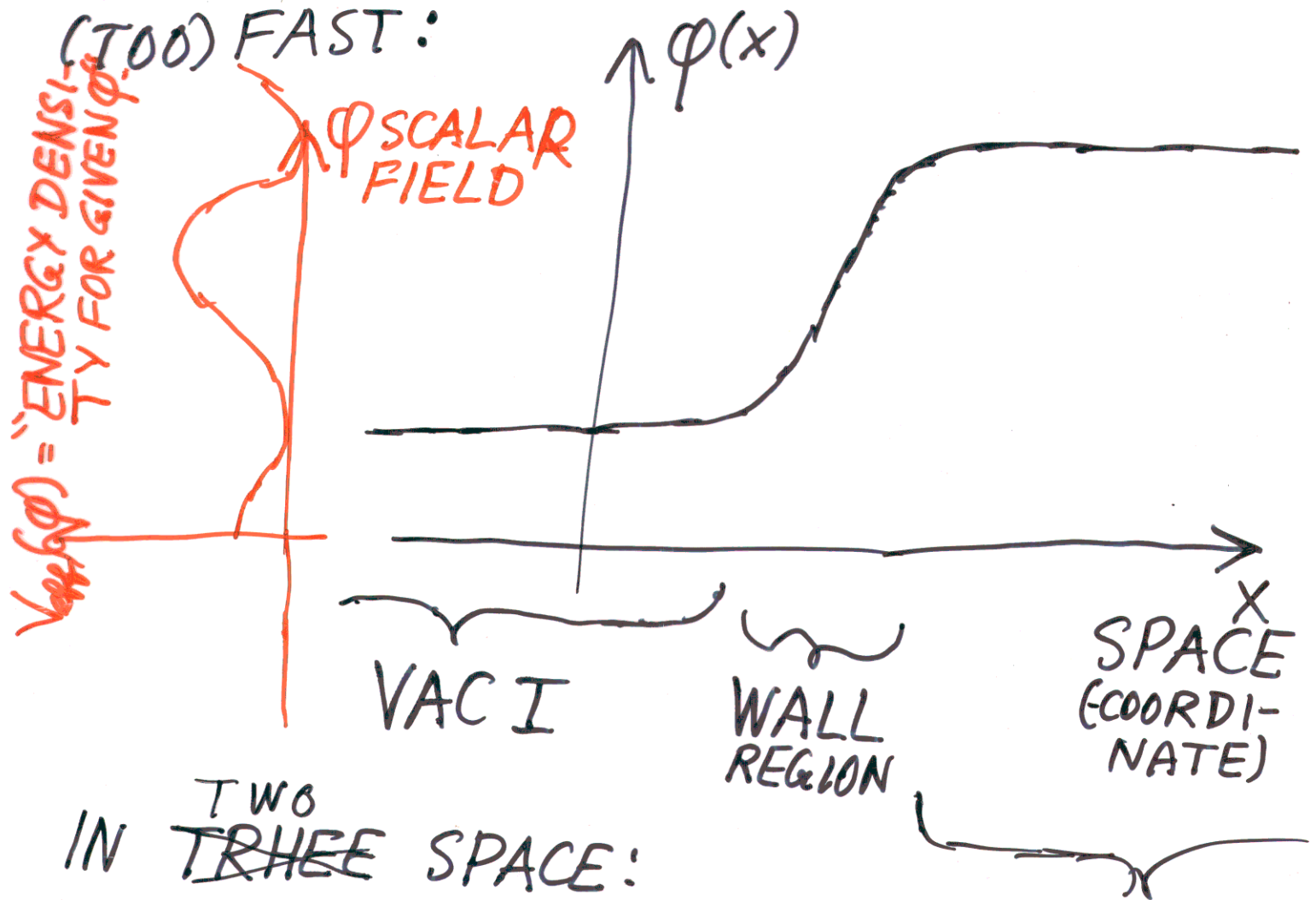SEVERAL MINI-
MA OF <u>SAME</u>
<u>DEPTH</u>

SCALAR
FIELD, e.g.
HIGGS FIELD,
OR AN EFFECT
FIELD FOR SO
BOUND STATE, e.
OUR DREAMT 6NO
6 TOP-QUARKS + 6 ANTI-

$V_{eff}(\varphi_{min\,1}) = V_{eff}(\varphi_{min\,2}) = \cdots$

WILL LOVE TO TELL THAT WE
FIT A LOT WITH OUR "MULTIPLE
POINT PRINCIPLE" BUT FOR DARK MAT-
TER MOST IMPORTANT THAT ONE CAN
HAVE WALLS WITHOUT ASSOCIATED
VOLUME ENERGY-DENSITIES, THAT WOULD
CAUSE THE WALLS TO CONTRACT
(TOO) FAST:

$\varphi(x)$

$V_{eff}(\varphi)$ = "ENERGY DENSI-
TY FOR GIVEN φ"

φ SCALAR FIELD

VAC I   WALL REGION   SPACE (COORDI-NATE) X

VAC II

IN TRHEE TWO SPACE:

WALL
VAC II
WALL
WALL

VAC I

"VAC" = VACUUM

MULTIPLE POINT PRINCIPLE
ENSURE SAME ENERGY DENSITY
IN VAC I AND IN VAC II.

IF SOME NUCLEAR
MATTER — POSSIBLY IN-
CLUDING ELECTRONS — WERE
VERY HARD PACKED
INTO CLUSTERS OF MANY
NUCLEI ALREADY BEFORE
THE BBN(= BIG BANG NUCLEO-
SYNTHESIS), AN APPRE-
CIABLE AMOUNT OF SUCH
MATTER COULD BE BROUGHT
THROUGH THE BBN-ERA
WITHOUT MIXING UP AND
THUS NOT DISTURBING THE
BBN.
THE IDEA IS TO SPECULATE
A —NEW PHYSICS?— WAY OF PACKING
PART OF ORDINARY MATTER EARLY
AND STRONGLY ENOUGH TO BE ALL THROUGH
FUNCTIONING AS DARK MATTER

CAN WE PACK OR-DINARY MATTER SO AS TO MAKE IT

BECOME WHAT WE "SEE" AS COLD DARK MATTER?

THE PROBLEM IS TO MAKE EFFECTIVELY IN-VISIBLE — "DARK" — IN THE VARIOUS EPOKES:

1) IN THE BIG-BANG-NU-CLEO SYNTHESIS ERA: IN THIS PERIDE SO HOT THAT NEW PHY-SICS WOULD BE NEEDET TO KEEP IT FROM BEING DISSOLVED TO THERMAL NUCLEONS AS THE REST OF THE BARYONS

2) LATER, TO DAY: SUITABLE CLUSTERS, STONES NEEDED; BUT HOW TO MAKE "STONES" OF HYDROGEN?

TO SIMULATE DARK
MATTER AND NOT GET
IN THE NORMAL MATTER
DURING BBN, THE BARYONS,
THAT SHALL SIMULATE, MUST
BE SO STRONGLY BOUND THAT THEY
ARE ALREADY CONFINED TO
THEIR PACKS IN THIS ERA.

⇓

THE "NEW PHYSICS" KEEPING
THE BARYONS CONFINED MUST
INTERACT STRONGLY ENOUGH
THAT AT TEMPERATURES
OF MeV ORDER THE BARYO-
NIC MATTER IS KEPT INSIDE
THE "FENCE"

⇓

WE NEED "NEW PHYSICS" FORCES
PROVIDING MeV-SCALE POTENTIALS
FOR NUCLEONS OR NUCLEI.

A WAY TO HAVE SOMETIMES AN EXTRA

BINDING OF NUCLEONS COULD BE TO HAVE TWO (OR MORE) VACUA.

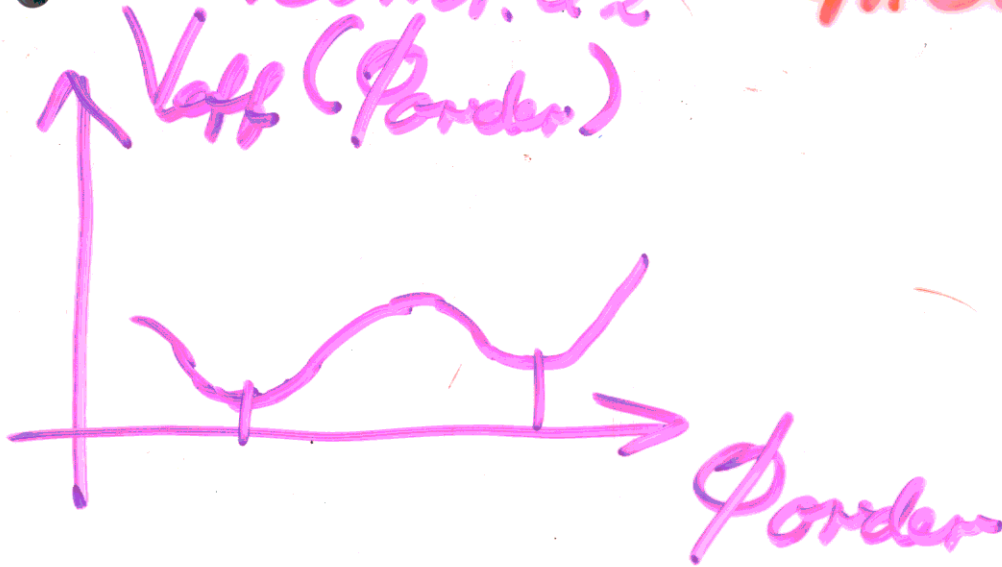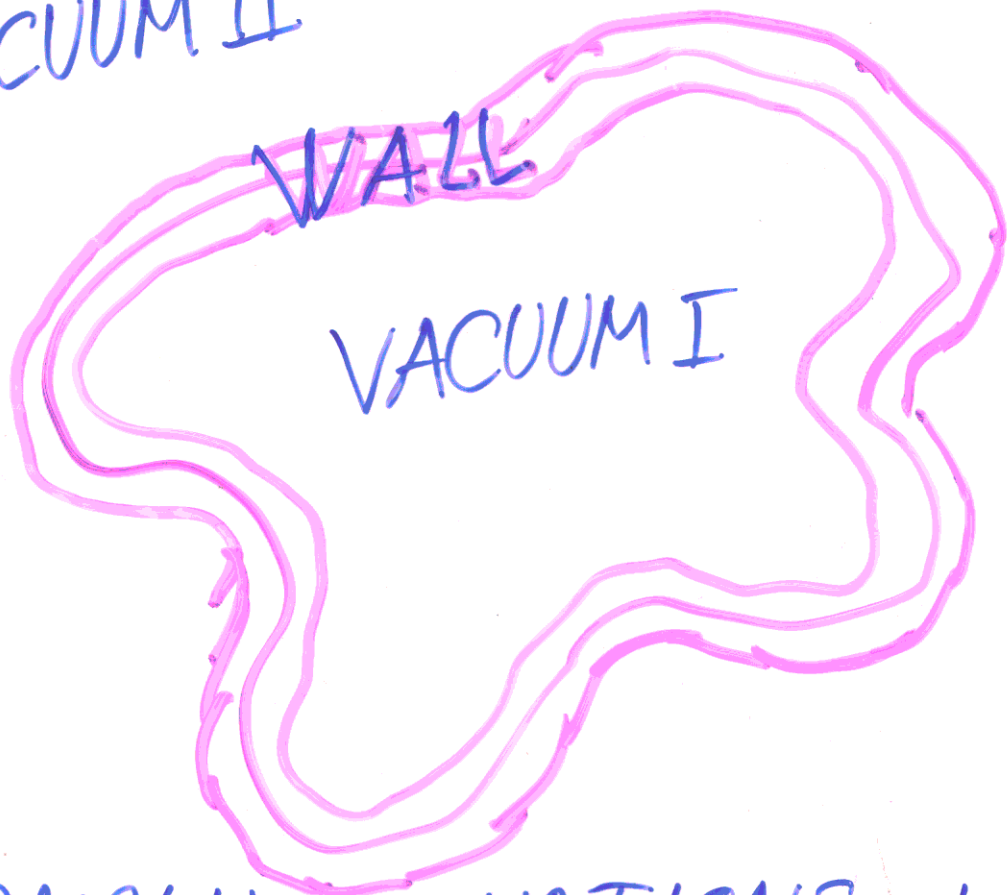E.g. SOME ORDER PARAMETER THAT CAN TAKE TWO DIF-FERENT (META) STABLE VALUES GIVING TWO VACUA.

WALL

ORDER PARAMETER

VACUUM I

VACUUM II

POSITION X

$V_{eff}(\phi_{order})$
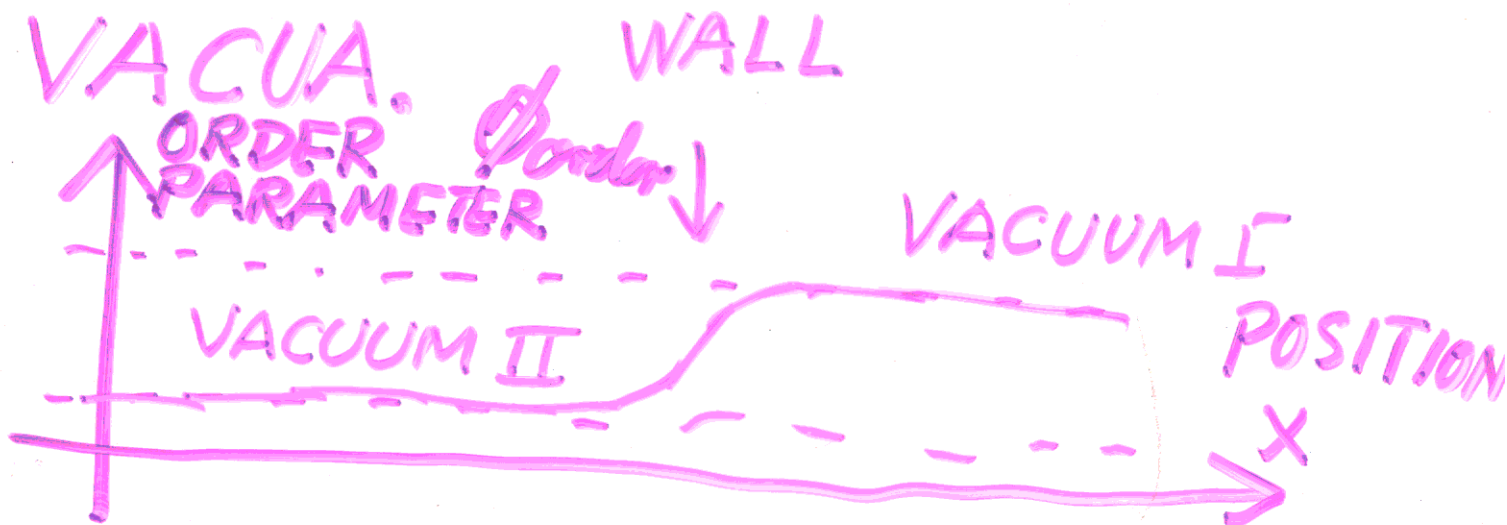
ϕ_{order}

THE VACUA HAVE LOCAL MINIMAL VALUES FOR $\langle\phi_{order}\rangle$

VACUUM II

WALL

VACUUM I
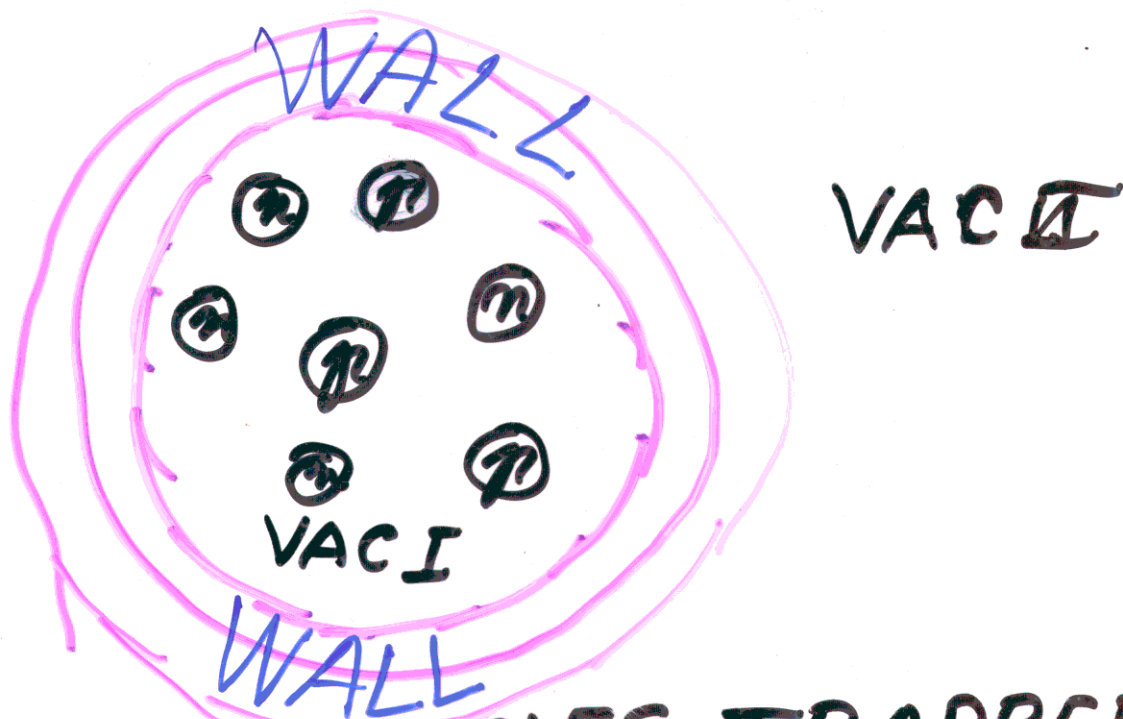

NORMALLY SITUATIONS LIKE THIS UNSTABLE. WALL WILL CONTRACT.

COULD A LIMITED PIECE OF VACUUM THAT WOULD OTHER-WISE CONTRACT BE STABILIZED BY ADDING SOME - e.g. BARYONIC - MATTER TO IT?

WALL

VAC Ⅱ

VAC I

WALL

IF THE PARTICLES TRAPPED IN VAC. I FEEL A LOWER POTENTIAL THAN IN VAC Ⅱ (LOWER MASS SAY, IT MIGHT STABILIZE WALL.

IF THE TWO PHASES
ONLY DEVIATE BY A
NOT TOO LARGE PHY-
SICAL DIFFERENCES,
WE EXPECT TO HAVE
THE STANDARD MODEL
WORKING IN EACH VA-
CUUM SEPERATELY BUT
WITH SOMEWHAT DIF-
FERENT (RENORMALIZED)
COUPLING CONSTANTS.

SINCE THE HIGGS MASS
IS THE MOST FINE TUNED IT
WOULD BE A GOOD GUESS TO
THINK THAT THIS HIGGS MASS
WOULD VARY MOST FROM PHASE
/VACUUM TO PHASE/VACUUM.
WE HAVE CONDENSATION OF
6₂+6 Ī BOUNDSTATE MODEL GIVING THIS.

A CHANGE IN QUARK MASSES BY A FACTOR OF ORDER UNITY FROM ONE VACUUM TO THE OTHER ONE WOULD ONLY CHANGE THE HADRONS WITH UP AND DOWN QUARKS LITTLE IN MASS, EXCEPT THE PIONS WHICH WOULD HAVE THEIR MASSES CHANGED BY A FACTOR OF ORDER UNITY.

⇓

MAIN CHANGE BETWEEN SUCH PHASES, THE RANGE -YUKAWA RANGE- OF NUCLEAR FORCES.

BECAUSE OF OUR FINE-
TUNING ASSUMPTION (MPP)
OF SEVERAL VACUA WITH
SAME COSMOLOGICAL CON-
STANT (=ENERGY DENSITY)
THE WALLS/THE BORDERS
IN SPACE BETWEEN THEM
CAN BE MOVED FREELY EX-
CEPT FOR THE EFFECT
OF THEIR TENSION AND
CURVATURE-DEPENDENT POTEN-
TIAL.

IF ONE THUS TAKE A
LARGE ENOUGH BALOON WITH
THE WALL AS ITS SKIN
THE PRESSURE NEEDED TO
SPAN IT CAN ARBITRARILY
SMALL, JUST THE BALOON
IS BIG ENOUGH, EVEN SOFT
MATERIAL CAN PUMP UP A SUFFICIENT-
LY BIG BALOON WITH THE WALL AS SKIN.

EXPLOSIVE DARK MATTER, MAY ALSO BE USEFULL IN SUPERNOVAE:

IF DARK MATTER OF OUR KRYPTO-BARYONIC TYPE COMES INTO DENSE NUCLEAR MATTER AS IN SOME STRONGLY CON- TRACTED STAR,

OUR VACUUM   ALTER- NATIVE   OUR VACUUM

THE STABILITY OF THE WALL AS LEANING ON THE —AS IN DARK MATTER, THAT IS ISOLA- TED— WILL/CAN BE DISTURBED AND IT MAY EXPAND OR CON- TRACT. EXPLOSION LIKELY HAPPENS!

WHAT ARE THE MAIN EFFECTS ON NUCLEAR PHYSICS BY VARYING THE WEINBERG SALAM HIGGS V.E.V. ?

THE HIGGS MASS INFLUENCES THE HIGGS-VEV AND THERE-BY THE QUARK MASSES IN Q.C.D.

E.G. AN ORDER OF UNITY CHANGE OF THE QUARK-MASSES — BY COMMON FAC-TOR. IF DUE TO HIGGS VEV CHANGE — CHANGES THE $\pi^{\pm,0}$-MAS-SES BY ORDER UNITY.
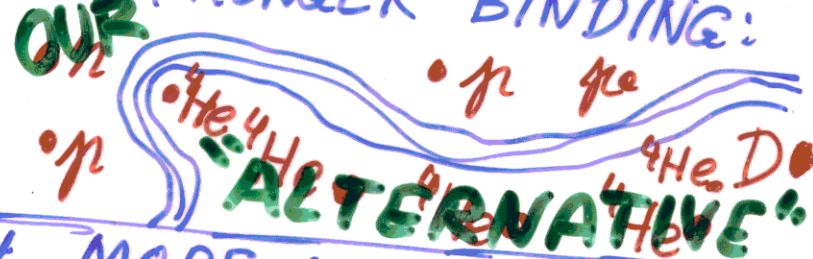
SCENARIO

1. $A \approx$ FRACTION OF Ω VOLUME-WISE COMPARABLE PHASES OF THE TWO VACUA:

OUR

ALTERNA-TIVE

2. NUCLEONS IN THE "ALTER-NATIVE VACUUM" FORM $D = {}^2H$, ${}^4He$ etc FIRST, BECAUSE OF STRONGER BINDING:

OUR

"ALTERNATIVE" ${}^4He$ ${}^4He$ D ${}^4He$

3. $A =$ STILL IN FIRST SECOND. NOW "ALTERNATIVE VA-CUUM" CONTRACT:

OUR ${}^4He$ A.T. ${}^4He$
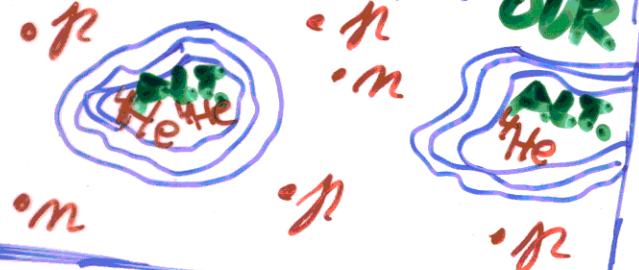
4. MORE AND MORE BARYONS GET BOUND INTO ${}^4He$ etc IN THE "ALTERNATIVE VACUUM":

OUR

(ALMOST NO p, n LEFT OUTSIDE)

A ${}^4He$
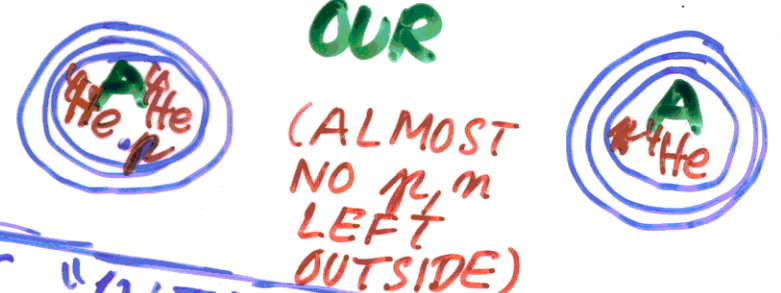
5. THE CONTRAC-TION OF ALTERNA-TIVE VACUUM STABI-LIZED BY FERMI SEA OF NUCLEONS AND NU-CLEI

${}^4He$ ${}^4He$ A ${}^4He$ OUR
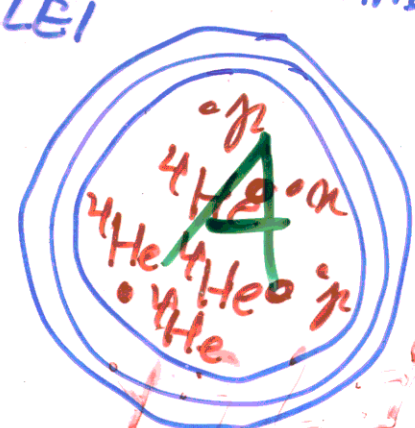
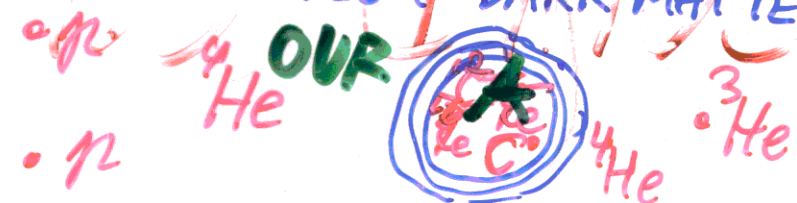**6.** "INTERNAL FURTHER FUSION" TO HEAVIER NUCLEI TAKE PLACE QUICKLY AND EXCESS ENERGY 'CAUSE PRO-DUCTION OF FREE NUCLEONS RUNNING OUT

OUR

${}^{12}C$ ${}^{16}O$ ${}^4He$ A
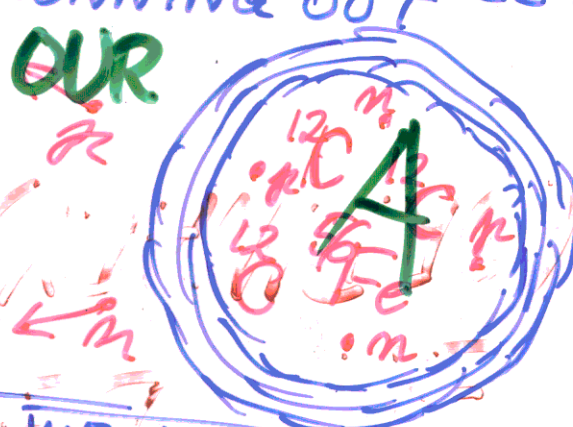
7. USUAL BIG-BANG NUCLEO-SYNTHESIS OF THE ESCAPED NUCLEONS START

OUR D ${}^4He$ A ${}^4He$
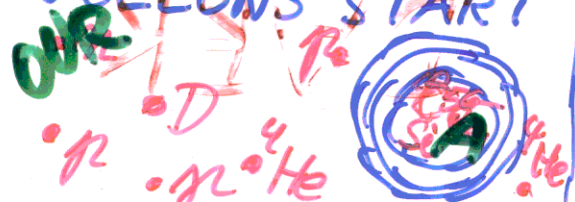
8. WE HAVE GOT USUAL NUCLEI PLUS REMAINING "ALTERNATIVE VACUUM" BAGS (= DARK MATTER)
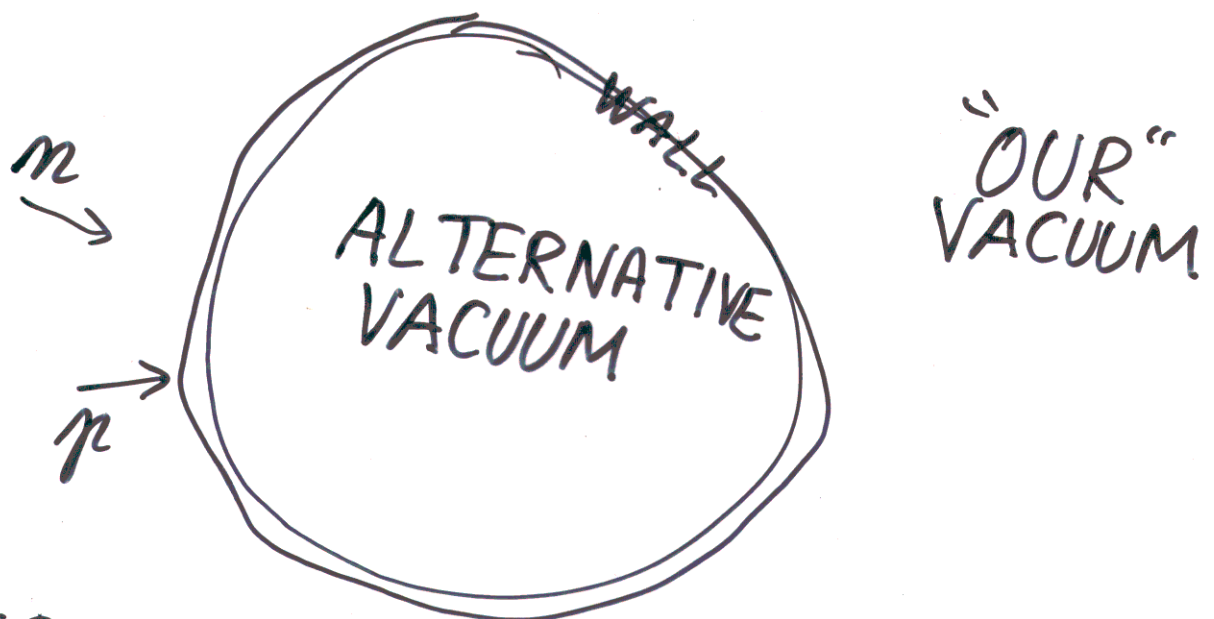
${}^4He$ OUR A C ${}^4He$ ${}^3He$

AT LEAST AT BIG BANG TEMPERATURES OF NUCLEAR SYNTHESIS ERA:

A DARK MATTER BALL OR ANY "ALTERNATIVE VACUUM REGION"
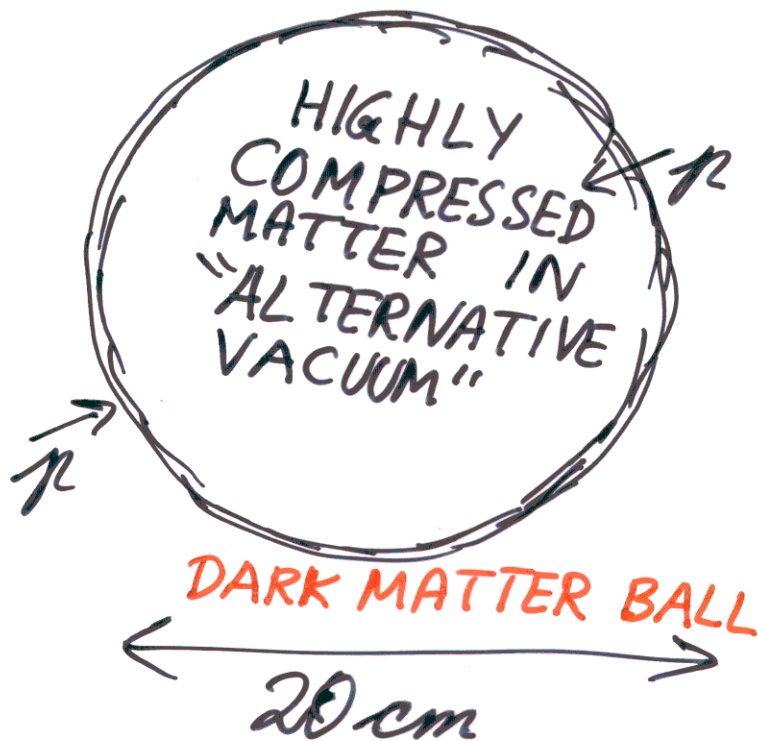
EATS NUCLEONS

n

p

WALL

ALTERNATIVE VACUUM

"OUR" VACUUM

NUCLEONS HAVE LOWER MASS (BY A COUPLE OF MeV SAY) INSIDE THE BALLS THAN OUTSIDE

LIKELY THAT A MUCH
LOWER TEMPERATURE IS
SUFFICIENT FOR PROTONS
TO FUSION WITH DARK
MATTER THAN WITH
TRITIUM (AS IS HOPED IN
ENERGY PRODUCING FUSION)

HIGHLY
COMPRESSED
MATTER IN
"ALTERNATIVE
VACUUM"

r

r

DARK MATTER BALL

⟵ 20 cm ⟶

THE PROTONS — LET ALONE THE
NEUTRONS — TEND TO BE CAPTURED
IF THEY PENETRATE THROUGH THIN SKIN;
MASSES OF NUCLEONS LOWER INSIDE

AT FIRST WE HAVE
ABOUT COMPARABLE
VOLUMES OF BOTH PHA-
SES, "ALTERNATIVE" and "OUR".

PARAMETER

$$\equiv \stackrel{\wedge}{=} \frac{\text{DENSITY OF WALLS}}{\text{KIBBLE DENSITY}} \text{(= 1 WALL PER HORIZON DISTANCE)}$$

AT TIME WHEN CONTRAC-
TION OF THE REGIONS TO
BE BALLS (of dark matter) GETS
SIGNIFICANT.

SUGGESTED RANGE

$$10^5 < \equiv < 10^7.$$

FROM FORMATION CONSIDERA-
TIONS.

BALL STABILITY
REQUIRES SUFFICIENTLY
BIG BALLS $\Rightarrow$ NOT TOO
HIGH WALL DESITY AT
FORMATION.

SO

$$\Xi < 10^6$$

WHERE

$$\Xi \triangleq \frac{\text{DENSITY OF WALLS}}{\text{KIBBLE DENSITY}}$$

(= ONE WALL PER HORIZON DISTANCE)

SO FINAL SUGGESTED RANGE

$$10^5 < \Xi < 10^6$$

OUR TYPICAL BALL TAKEN
FOR $\Xi \sim 3 \cdot 10^5$

TYPICAL PARAMETER VALUES FOR OUR DARK MATTER.

$(\text{FOR } \Xi \sim 3 \cdot 10^5)$

RADIUS OF BALL (NOW)   20 cm

ELECTRON FERMI MOMEN-TUM   5 MeV

BARYON NUMBER OF ONE BALL $N_B \simeq \dfrac{10^{54}}{\Xi \simeq 3} = 3 \cdot 10^{37}$

MASS OF THE BALL $M_B = 10^{11} \text{ kg} =$
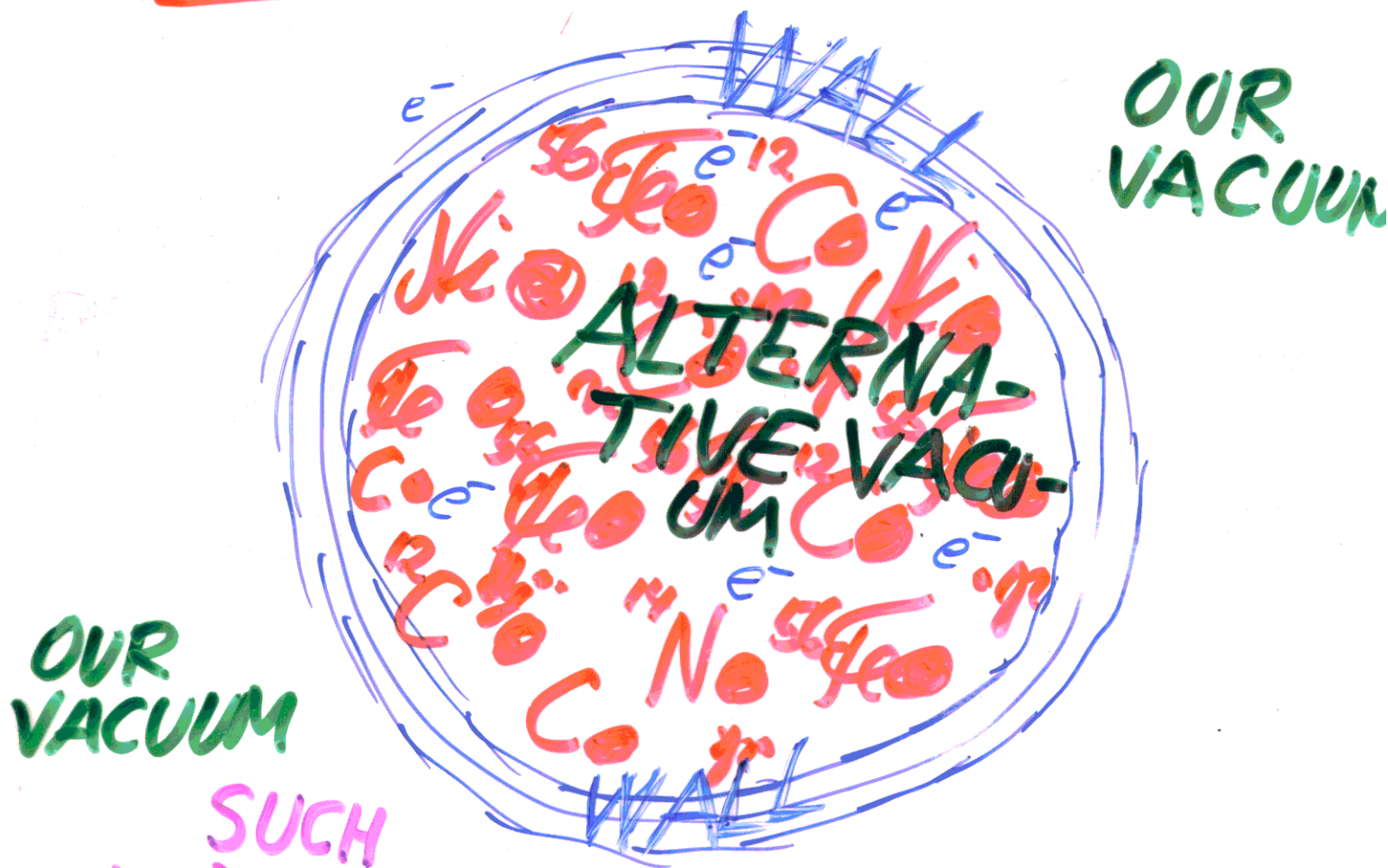$$= 10^{-19} M_\odot = 10^{-14} M_\oplus$$

(TOO LIGHT FOR BEING SEEN BY MICRO-LENSING WHICH REQUIRES MASS $> 10^{-7} M_\oplus$)

ABOUT 1 BALL IN VOLUME OF
$$(20 \text{ ASTRONOMICAL UNITS})^3$$

OUR DARK MATTER IS EXPLOSIVE!

OUR VACUUM

WALL

ALTERNA-TIVE VACU-UM

e^- ^{56}Fe ^{12}Co $^{}K$ Ni Co ^{56}Fe $^{}Co$ Co ^{14}No ^{56}Fe C Co
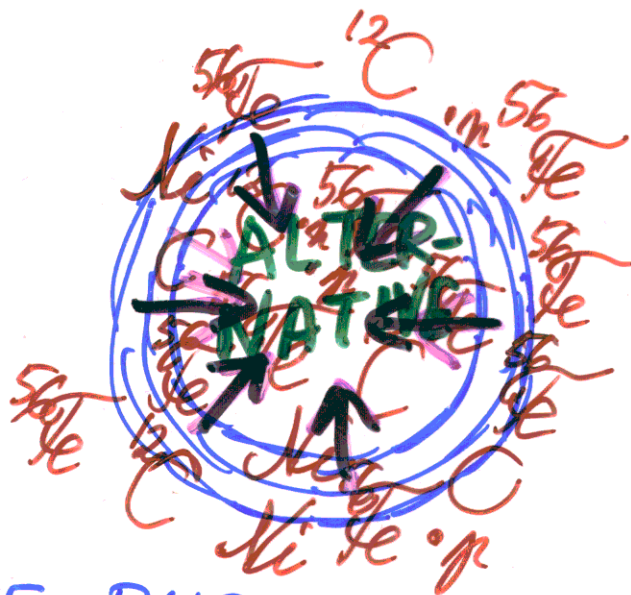
WALL

OUR VACUUM

OUR VACUUM

SUCH

IF A BALL OF ALTERNA-TIVE VACUUM IS OR BE COMES SMALLER THAN A CRITICAL SIZE THE PRES-SURE IT PROVIDES GETS TOO HIGH FOR NUCLEAR + ELECTRO-NIC MATTER TO RESIST THE PRESSURE. IT WILL CONTRACT EXPLOSIVELY

EXPLOSIVE DARK MATTER CONTINUED:

THE NUCLEAR AND ELECTRONIC MATTER CAN, ALTHOUGH IT IS "UP HILL," BE PRESSED OUT THROUGH THE WALL — IF E.G. THE WALL WERE KNOKKED IN BY A HARD BLOW —
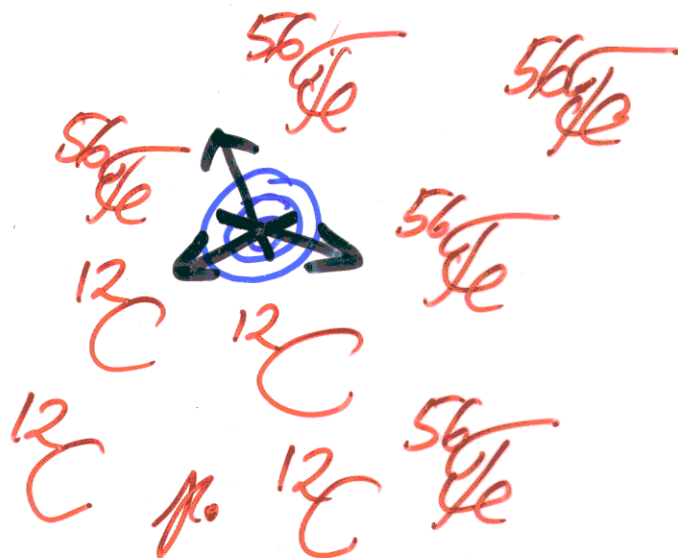
OUR VACUUM.

OUR VACUUM

IF THE BUBLE GET SMALLER, IT PROVIDES A HIGHER PRESSURE, AND AT SUFFICIENT PRESSURE THE REST OF THE NUCLEI AND ELECTRONS WILL BE PRESSED OUT THROUGH THE WALL.

(GREISE-ZATZEPIN-KUZMIN-LIMIT)
EXPLOSIVE DARM MATTER, YET CONTINUED:

$^{56}_{26}Fe$ $^{56}_{26}Fe$
$^{56}_{26}Fe$
$^{56}_{26}Fe$
^{12}C ^{12}C
^{12}C
^{12}C ^{12}C $^{56}_{26}Fe$

AT THE END OF AN IMPLOSION OF THE WALL A LOT OF KINETIC ENER-GY OF THE WALL WILL BE CONCENTRATED OF THE BY THEN VERY MUCH SMAL-LER WALL. PERHAPS USE-FULL PROCESS FOR OUR DARK MATTER BEING THE META-STABLE PARTICLES CALLED FOR AS DARK MATTER IN KUZMINS TALK.

EXCEPT FOR PERHAPS COSMIC RAY PRODUCTION THE REALISTIC EXPLOSION IS NOT THAT THE WALL CONTRACT AND DISAPPEAR, BUT RATHER THAT IT BECOMES SURROUNDED BY MATTER AND MAY EAT THE CENTRAL PART OF A SUPER NOVA, A NEUTRON STAR:

NEUTRON STARS COULD BE SWEPT INTO PIECE OF WALL:

FOR JUST GETTING
THE POSSIBILITY TO PACK
INTO AN ALTERNATIVE PHASE/
VACUUM REGION AN HAVING
SAY SOME BARYONS COUGHT
THERE IT IS NOT CRUCIAL
TO HAVE THE VACUUM INSIDE
HAVE JUST SAME COSMOLOGICAL
CONSTANT AS OUTSIDE. BUT
THE COSMOLOGICAL CONSTANT
DIFFERENCE BETWEEN THE
TWO VACUA MUST BE SMALLER
THAN THE PRESSURE WHICH
THE TO PUMP IT UP MATERIAL
CAN STAND.

SO TO BE PUMPED BY
SOFT MATTER THE COSMO-
LOGICAL CONSTANT DIFFE-
RENCE SHOULD BE SMALL.

A BIT
VII. 4. DO)

CONCLUSION

IN A MODEL BASED ON
JUST STANDARD MODEL AND
FINE TUNING <u>ALL</u> COSMOLOGICAL
CONSTANTS, NAMELY FOR ALL
VACUA:

- WE PREDICT THE TOP
YUKAWA COUPLING
$g_t \simeq 1.3$ (OR DOWN BY A $\sqrt[4]{y}$?)
COMPARED TO $g_{t\,exp} \simeq 0.9_5 \, TO \, 1.0$

- AND THE −LOGARITHM OF
THE − SCALE RATIO WEAK
TO PLANCK(="FUNDAMENTAL").
- HIGGS MASS SHALL BE THE
LOWEST ALLOWED BY OUR VACU-
UM NOT BEING "FALSE VACUUM"
A PRIORI $135\,GeV/c^2$, BUT OUR
BOUND STATE LOOP CORRECTION
BRINGS IT DOWN TO ABOUT $110\,GeV/c^2$
⟹ LEP ALREADY FOUND HIGGS!

CONCLUSION CONTINUED:
(NAMELY ON DARKMATTER):

• A SEVERAL VACUA-MODEL COULD PROVIDE A PACKING MECHANISM THAT CAN HIDE BARYONIC MATTER EVEN THROUGH BIG-BANG NUCLEAR SYNTHESIS WITHOUT THUS DISTURBING IT OR MIXING WITH THE BARYONS FORMING He, D, etc.

• WE GET A SURPRISINGLY WELL AGREEING NUMBER FOR THE RATIO OF DARK TO ORDINARY BY AN "INTERNAL FUSION" CAUSED EMISSION OF ORDINARY BARYONIC MATTER FROM THE TO BE DARK. MATTER.

CONCLUSION YET CONTINUED:

• THE DARK MATTER
— OF SQUEEZED INTO BAG
OF ALTERNATIVE VACUUM
BARYONIC MATTER — CAN
BE <u>EXPLOSIVE</u> SINCE
THE WALL MAY CONTRACT,
IF IT BECOMES TOO SMALL
SO THAT THE INSIDE MATTER
CANNOT STAND THE PRES-
SURE! :

    a) HELPING SUPER NOVAE
       EXPLODE?

    b) DE RUJULA'S "CANON-
       BALLS"

  (c) COULD IT CONTRIBUTE TO
COSMIC RADIATION?)