N101

NOTE BOOK

Manufactured with best ruled foolscap
Brings easier & cleaner writing

VOL.

Jan. 1974.

湯川

Nissho Note

101

c034-002～051挟込

c034-001

N101

INDEX

年　月　日
年　月　日

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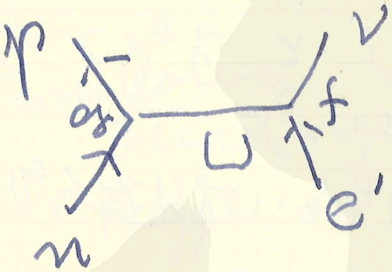
ベータ崩壊とその周辺
研究会

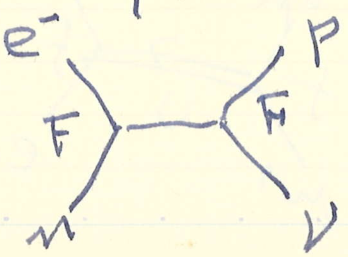
Jan. 28~30, 1979
基研

Jan. 29:
中村誠太郎：ベータ崩壊の中間子論



Sakata
1942

U　0^-
0^+
1^-
1^+



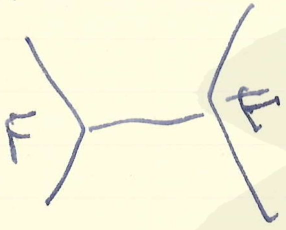
Tanikawa
1943

Ogawa　V

Feynman - Gell·Man　V-A

universal coupling

current · current



$G_F = \sqrt{2}\frac{F^2}{M_U^2}$

Nakamura　conserved vector constant

U : π ρ ω η etc ζ (scalar meson)
A, B, …

B. K. Kim
Igarashi
Saito
Nakazawa

1. (strong int.　U と 相互の)
(non-der.) + (der.)

2. U と lepton との弱い相互作用
は V-A

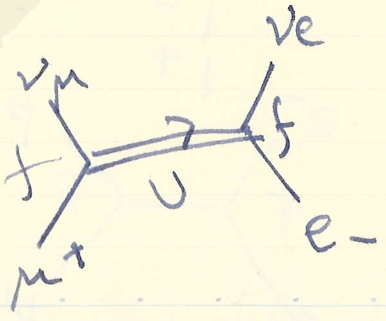
3. CP - invariant

μ-e-decay

$(\mu^+, \overset{\nearrow R}{\nu_\mu})$

(ν_e, e^-)

$\bar{\nu}$
Ref.



$$G_{\mu e} \sim \frac{\sqrt{2}\, f_\mu f_e}{M_{\psi_V}^2 - \frac{3}{5} M_\mu^2}$$

1) lepton は弱い相互作用 Ⓐ only

$$G_{\mu e} \sim G_p = \frac{1 \times 10^{-5}}{M_p^2}$$

ν 放出はないなら

$f_\mu, f_e \to f_L$, $f_L^2 \sim 10^{-10} \sim 10^{-14}$

とするなら

$$M_V \sim 140\,\mathrm{MeV} \sim 420\,\mathrm{MeV}$$

V meson の存在？

Tanikawa

duality

Regge

湯川：「素粒子の模型

宮沢弘成：弱い相互作用の古代史
green 関数の方法
strong と weak の分化

I. vector

II. scalar　第2量子化.

III, IV : vector

Street - Stevenson 1937
$m_\mu \sim 130\, m_e$

1938年 [illegible]

Internal pair production
K-capture

Fermi
K.-U.
Fierz (1937), Helvetica

Landau 重力論.
(1932)

RaE
Beck β, e^+e^-, γ
$Z \to Z + e^+ + e^- \to (Z+1) + e^-$

1938: Sakata - Taketani

$N \to P + e^- + \bar{\nu} + \mu_0$

plus neutrino

K. U.

1948: “~~[illegible]~~崩壊の研究”
~1949 Goto, Kanai, Kobayashi

~~S. Takagi~~

modified K. U. Theory

$N \to P + e^- + \nu + 2\nu$

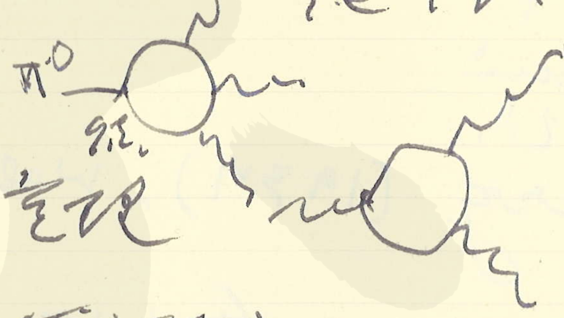
〃 $+ 2\nu' + 2\nu'' + \cdots$

S. Takagi, $\pi \to \mu + \nu$

$\to e + \nu + \mu_0$

$\pi^0 \to 2\gamma$

$\to 3\gamma$



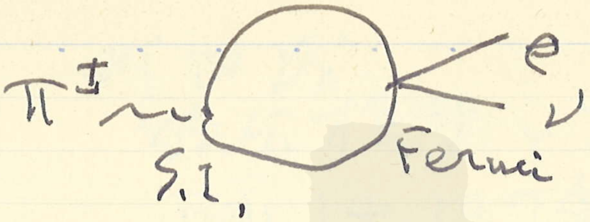
Furry の定理

β-interaction
π-decay } を[illegible]す

S, V, A, $\boxed{PS}$

PS, A

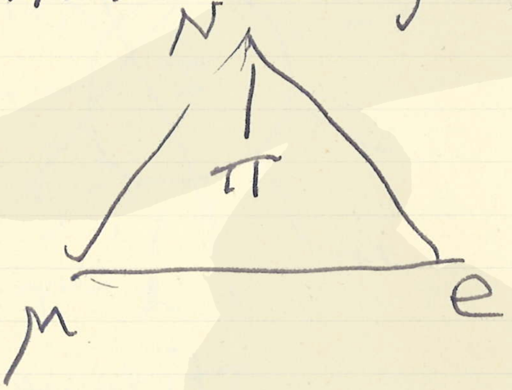
π-decay & β-decay



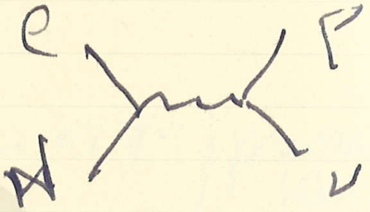
Moller - Rosenfeld
混合場 (V), (PS)

Møller - Rosenfeld - Rosenthal
$V \rightarrow e + \nu$ $PS \rightarrow e + \nu$

核力中間子と崩壊中間子を合せる

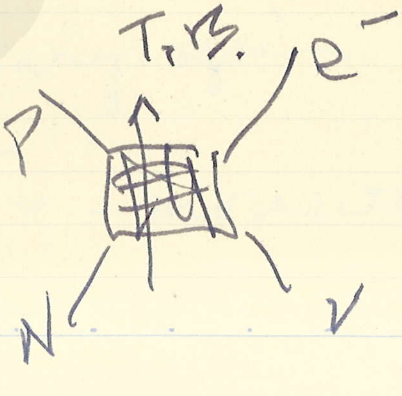


Tanikawa boson
↔ weak boson

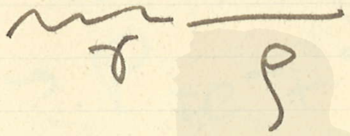


$\pi \rightarrow \mu + \nu$
$\rightarrow e + \nu$?

Tanikawa



$$\sum \frac{G}{s - M^2}$$
$$\downarrow$$
M^2

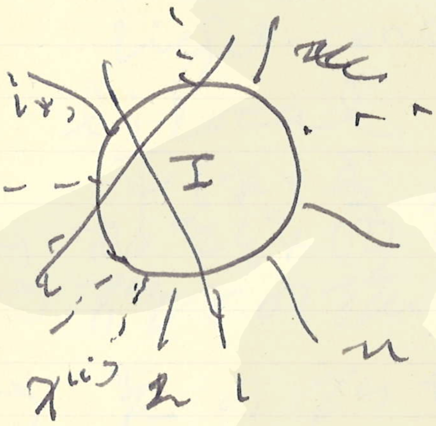

γ
ρ

場論会

町田 茂
結合模型 と duality
Feb. 14, 1974　荒待

$$T = \int \prod_i \chi^{(i)}(P_i, q_i) \, I(P_1 q_1; \cdots P_n q_n) \, d^n q(q_1 \cdots q_n)$$

↓
improper kernel



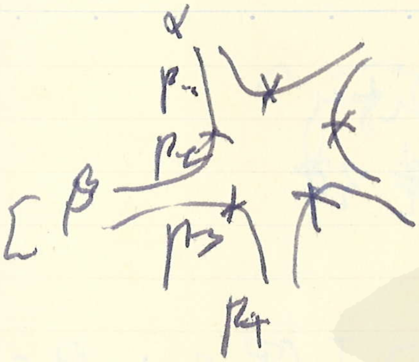
duality

i) cyclic symmet. form of [illegible]
ii) factorizable

} proper kernel I_0

$$I = I_0 \mp I_0 G I_0$$

[illegible] { unitary spin
spin
energy - momentum　$w \gtrless w_0$

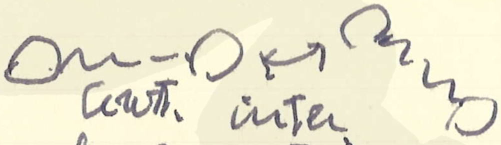


$h(p_1)h(p_2)h(p_3)h(p_4)\cdots$

$h(p)=A(p^2)\gamma p+B(p^2)$

$\delta_{\alpha\beta}$

meson



x_i γ_5 degree → $SU(6)\otimes O(3)_L$

d ?

$U(3,2)$

?

baryon

片山泰久 氏

拡がった粒子の理論方向

1974年 3月14日

談話会

1. 電子の拡がり

Schwinger. Imamura

Adler

light-cone singularity

bilocal current

$\bar{\psi}(x+\frac{\delta}{2})\gamma_\mu\psi(x-\frac{\delta}{2})$

→ 相互作用の拡がり

→ 粒子の拡がり

→ 光の拡がり

2. Weiberg 理論

gauge場 → abelian 型

→ Non-Abelian Yang-Mills

→ 光子 mass 0, nonzero (WIB)

Higgs mechanism ↓

neutral current

3. 非局所場

bilocal

内部自由度 { スピン / アイソ・スピン (Y-K)

電磁場) bilocal　　gauge 不変な 結合系

Abelian → Non-Abelian

$$A(X,r) \equiv (X+\frac{r}{2}|A|X-\frac{r}{2})$$

$$\psi \to G\psi$$

$$\psi(X,r) = \int d^4x'(X+\frac{r}{2}|G|x')\,\chi(x'|\psi|X-\frac{r}{2})$$

$$A_\mu \to G A_\mu G^{-1} - \frac{1}{e_0}[\partial_\mu G]G^{-1}$$

$$G = e^{ie\Lambda}$$

$$[\cancel{A}\Lambda, A_\mu] \neq 0$$

$$F_{\mu\nu} \to G F_{\mu\nu} G^{-1}$$

$$F_{\mu\nu} = [\partial_\mu A_\nu] - [\partial_\nu A_\mu] - ie[A_\mu, A_\nu]$$

$L = L_n + L_f + L_i$

$A_\mu, F_{\mu\nu}$: 光子？

基底状態　　励起状態

Abelian　　Non-Abelian isospin

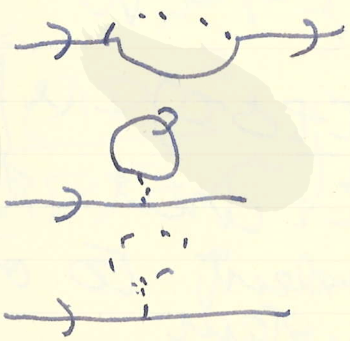
ψ : 電子？

$$\langle T^*\{\psi(x;r)\bar{\psi}(x'r')\}\rangle_0$$

$$= -\frac{1}{2}S(x-x'; r, r')$$

$$= \frac{1}{2}S(x-x')F(r, r')$$

δm



繰り込み

Adler Term は摂動論からしか出ない

談話会

差分方程式と Dual Resonance Model

仲滋文

1974年 4月25日 基研

1. string model
南部-Susskind

$x_\mu(\sigma, \tau)$

2. 差分方程式

$x_\mu(\tau)$ $u_\mu(\tau) = \frac{dx_\mu}{d\tau}$

自由場合 $u_\mu(\tau+d\tau) - u_\mu(\tau-d\tau) = 0$

$d\tau \to$ 無限小

$\to u^\mu(\tau+\Delta\tau) - u^\mu(\tau-\Delta\tau) = 0$

$\Delta\tau$: const. 有限

→ equivalent to oscillator system

$\frac{1}{D}\left(e^{\Delta\tau D} - e^{-\Delta\tau D}\right) u_\mu(\tau) =$ (D^2) $D = \frac{d}{d\tau}$

$$2\Delta\tau\cdot\frac{\sinh(\Delta\tau\cdot D)}{\Delta\tau D} \qquad D^2 x_\mu = 0$$

$$\downarrow$$

$$f_1(\lambda D) D^2 x_\mu = 0$$

$$f_1(z) = \frac{\sinh \pi z}{\pi z}$$

$$= \prod_{n=1}^{\infty}\left[1+\left(\frac{z}{n}\right)^2\right]$$

$$\Delta\tau = \pi\lambda$$

$$x_{0,\mu} = f_1(\lambda D)\, x_\mu$$

$$x_{n,\mu} = \sqrt{2}\,\mathrm{Re}\, f_1(\lambda D + in)\, x_\mu$$

$$(n = 1, 2, \cdots)$$

$$= \sqrt{2}(-1)^n \frac{(\lambda D)^2}{(\lambda D)^2 + n^2} f_1(\lambda D)\, x_\mu$$

$$D^2 x_{0,\mu} = 0$$

$$\left[D^2 + \left(\frac{n}{\lambda}\right)^2\right] x_{n,\mu} = 0 \quad (n = 1, 2, \cdots)$$

$$x_\mu = x_{0,\mu} + \sqrt{2}\sum_{n=1}^{\infty} x_{n,\mu}$$

$$L_\lambda = -\frac{m_0}{2} D x_\mu f_1(\lambda D) D x^\mu$$

$$\approx \bar{L}_\lambda = -\frac{m_0}{2} \sum_{n=0}^{\infty} \boxed{(-1)^n} \left[(D x_n)^2 - \left(\frac{n}{\lambda}\right)^2 x_n^2 \right]$$

$$f_2(z) = \frac{\tanh \pi z}{\pi z} \quad - \ (-1)^n \text{ 1ν } \text{[illegible] } 53$$

$$f_2(\lambda D) D x_\mu = 0$$

$$\langle 0 | \bar{\pi}^2 | 0 \rangle = \frac{\varphi \lambda}{m_0} \log 2$$

$$x_\mu \Rightarrow \tilde{x}_\mu = \frac{1}{2}\left[x_\mu\left(\tau + \frac{\pi\lambda}{2}\right) + x_\mu\left(\tau - \frac{\pi\lambda}{2}\right) \right]$$

$$[x^\mu(\tau), x^\nu(\tau')]$$

3. Path Integral

Wiener 積分.

第二部
ハドロン構造との閉じこめ
の理論をめぐる論議
1974. 5. 23
深沢会.

Bag theory
quark (積極的 excitation → {記号的 (symbol的)
消極的 { N.R. SU6
free quark/
quark parton

{q(x)
gluon → Y. M. gauge場

confinement

Casher-Kogut-Susskind

Weinberg　Asymptotically free
Infrared slavery
$g^2 = e^2$

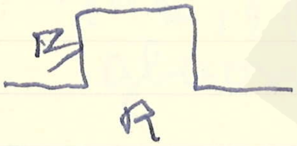
Amati-Testa

(1) Bag theory　MIT
A New Extended Model of Hadrons,
MIT Preprint #387
A. Chodos, B. L. Jaffe, K. Johnson
C. B. Thorn, V. F. Weisskopf

$B(>0)$: potential

$B \sim \mathrm{GeV}/1\,\mathrm{fm}^3$

$$W = \int_{t_1}^{t_2} dt \int_R d^3x \left(\frac{1}{2}\dot\phi^2 - \frac{1}{2}(\vec\nabla\phi)^2 - B \right)$$



$\delta W = 0$

$-\Box\phi = 0$ in R

$$\left.\begin{array}{l} \hat{n}\frac{\partial R}{\partial t}\dot\phi + \hat{n}\cdot\vec\nabla\phi = 0 \\ \frac{1}{2}\dot\phi - \frac{1}{2}(\nabla\phi)^2 = B \end{array}\right\} \text{on } S$$

$n_\mu \partial^\mu \phi = 0$

$$\left.\begin{array}{l} R \to \infty \\ B \to 0 \end{array}\right\}$$

T.D. Lee and G.C. Wick

素研シンポジウム

July 3, 1974

荒木氏：複合模型の諸問題

(fractional charge
fractional baryon number
統計性
3色多元模型
相互作用：多色性 8元
gluon

① $(\pi^0 \to 2\gamma) \propto \mathrm{Tr}\, Q I_3 \sim 0.48$
→ 3色多元模型
② weak [illegible]結果 → $\boxed{\text{3色4元模型}}$.
(Weinberg)
③ asymp. free
④
⑤ vector 的力.
$\Pi - \pi$

課題
① l～q 対応　　　統一的に見るには
② 分数荷電
hadronの相互作用はなぜ強いか；
③ 多色性の自由度
(a) 内空の自由度？
(b) 大域・局所：order 3 の para

SU(5) Yang-Mills 場
(Georgi, Glashow)

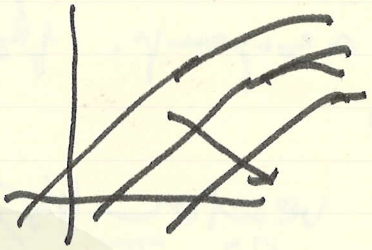
かなり弱い相互作用だが　出てこれてない
energy gap → 離れても引き延ばされる
→　　が深い 1 に近え
　　　に伸びる。

→ 究極統一理論 →

Yang-Mills 場
⊕ (+−) ……

→ (bag theory) ←→ triviality じゃないか?)

→ string が切れる　　2 GeV



総合討論

duality

scaling

phase transition

(力学
場の理論

string model
↓
α' 長さの次元をもった定

(free particle
strong interaction
〃
gauge 理論
{weak
E.M.

I. order 3 の parafermion : $q_\alpha(X)$

II. $[F(V), F'(V')]=0$ $(V \cap V'=0)$, macro な概念.

⇒ ~~確~~ F(V) は
$[q_\alpha(x), q_\beta(y)]$
$[q_\alpha(x), q^\dagger_\beta(y)]$ } current
$[q^\dagger_\alpha(x), q_\beta(y)]$
の関数.

III. [current, N] = 0

F(V) n

⇒ $[q_\alpha(x), q^\dagger_\beta(x)]$ の値 ある

$q^i_\alpha(x)$; $i=1,2,3$ Fermi

を $O(3) \rightarrow U(3)$

$\sum_i [q^i_\alpha(x), q^i_\beta(y)] \rightleftarrows [q_\alpha(x), q_\beta(y)]$

$\{q^i_\alpha(x), q^{j+}_\beta\} = \delta_{ij}\delta_{\alpha\beta}\delta^3(x-y)$

$\times\ q_\alpha = \sum_i q^i_\alpha$

大貫氏
Hadronと内部の対称性
談話会
7月18日, 1974年

内部対称性
exact symmetry v. approximate symmetry
特定の space
時空の構造.

統計の拡張.
Parastatistics
反対称 $\longrightarrow$ p
para-bose of order p
対称 $\longrightarrow$ p
para-fermi order p

Parafermi

$$[\{\psi(x), \psi(y)], \psi(z)] = 0$$

$$\{[\psi(x), \psi^\dagger(y)], \psi(z)] = 2\delta(y-z)\psi(x)$$

etc.

$$\frac{1}{2}[[a_k^\dagger, a_k], a_{k'}] = -\delta_{kk'}a_k$$

$$H = \frac{1}{2}\sum_k \omega_k [a_k^\dagger, a_k] + \mathrm{const},$$

non

$$i\dot{\varphi} = [\varphi, H]$$

(parafermion → spin, 半整数
〃 bose → spin, 整数
⟷ relativ. から出る)

non-rela. の話;

$$\hat{\varphi}(x) = \begin{cases} \psi(x) \\ \psi^{\dagger}(x) \end{cases}$$

$$\delta(\hat{x}, \hat{y}) = \begin{cases} \delta(x-y) \leftarrow & \hat{\varphi}(x),\ \hat{\varphi}(y) \Downarrow \psi(x)\ \psi^{\dagger}(y) \text{ or } \psi(y)\ \psi^{\dagger}(x) \\ 0 \leftarrow & \text{otherwise} \end{cases}$$

上記の交換関係は、いれ、いこ、け order を含くむ.

$p = 0 \leftrightarrow \hat{\varphi} = 0$

$p = 1 \leftrightarrow \{\hat{\varphi}(x), \hat{\varphi}(y)\} = \delta(\hat{x}, \hat{y})$

$p = 2$

H.S, green

$p = 3$

i) $\psi(x)|0\rangle = 0$

ii) 表示の一意性

(Greenberg - Messiah)

$$\psi(y)\psi^{+}(x)|0\rangle = \rho\,\delta(x-y)|0\rangle$$

I　　　　　　　　II

$\psi^{+}\psi^{+}\cdots|0\rangle$　　　　observable?

Fock space

$$\hat\psi\cdots\hat\psi = \sum C\{\underbrace{\hat\psi\cdots\hat\psi}_{m}\}\underbrace{[\hat\psi,\hat\psi]\cdot[\hat\psi,\hat\psi]}_{k}$$

$$n = m+2k$$

standard state vector

の張る Hilbert 空間

$\mathfrak{H}^{(n)}$

完結性.

observable の定義;

(i) $[F(V), F'(V')] = 0$　　V, V' が space-like に離れていれば,

(i) $[F(V), \hat{\psi}(x)] = 0$ $x \notin V$

space-like に はなれてる

(p-odd から (i) → (ii))

(ii) を仮定すると

$F(V)$ は $[\hat{\psi}(x), \hat{\psi}(y)]$ の functional

$x, y \in V$

Green Ansatz

$$\psi(x) = \sum_{\alpha=1}^{p} \psi^{(\alpha)}(x)$$

$$\{\hat{\psi}^{(\alpha)}(x), \hat{\psi}^{(\alpha)}(y)\} = \delta(\hat{x}; \hat{y})$$

$$[\hat{\psi}^{(\alpha)}(x) \; \hat{\psi}^{(\beta)}(y)] = 0 \quad \alpha \neq \beta$$

$$\psi^{(\alpha)}(x)|0\rangle = 0 \rightarrow \psi(x)|0\rangle = 0$$

$\downarrow$ [illegible]

$$\psi(x)\psi^{\dagger}(y)|0\rangle = p\,\delta(x-y)|0\rangle$$

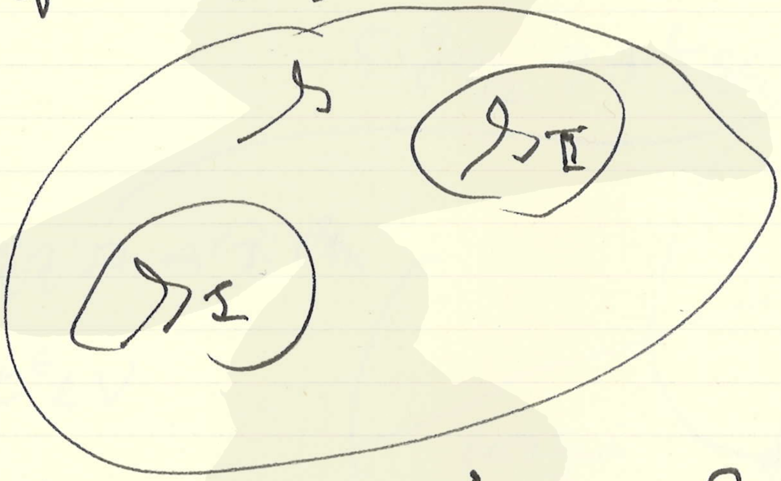
$$\psi^{+*}(x) \cdots |0\rangle \in \mathfrak{B}^{(n)}$$

$$\hat{\varphi}(x) = \sum_{\alpha=1}^{p} \cdot K\hat{\varphi}^{(\alpha)}(x)$$

$$[\hat{\varphi}(x), \hat{\varphi}(y)] = \sum_{\alpha=1}^{p}[\hat{\varphi}^{(\alpha)}(x), \hat{\varphi}^{(\alpha)}(y)]$$

$O(p)$

$U(p)$ → α is hidden variable



cluster property?

gauge group

superselection Rule

統計とかは[illegible]や

粒子 → 場 → 場の交換関係

統計

談話会　基研 Oct. 3, 1974

岩崎博一

くりこみ理論と unitarity

QED

Muonic heavy atom spectrum, discrepancy 深刻

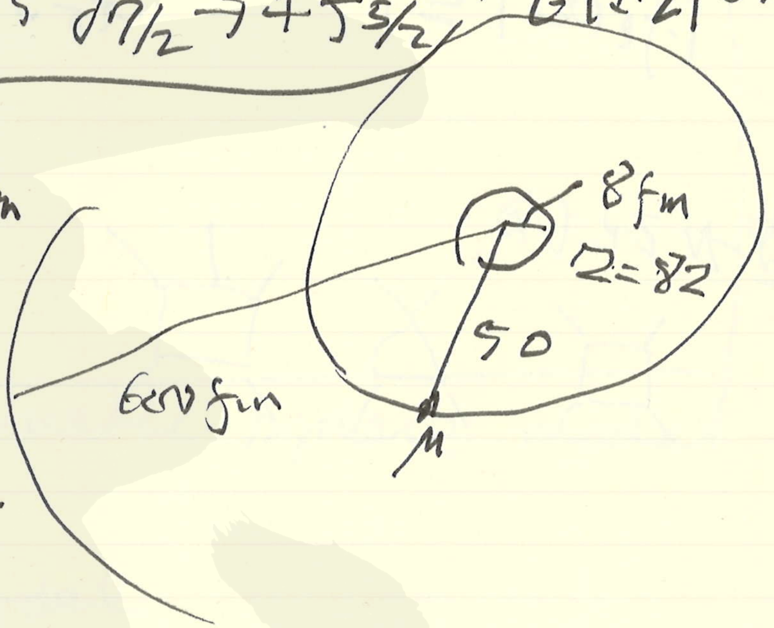
$^{208}P_{82}$　$5g_{9/2} \to 4f_{7/2}$　46±18 eV

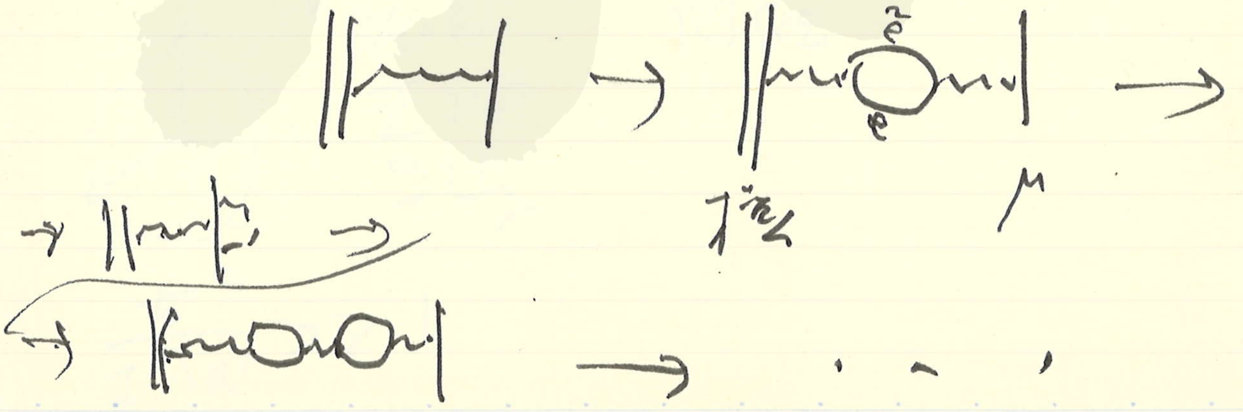
$5g_{7/2} \to 4f_{5/2}$　61±21 eV

理論 → 実験

10^6 eV

理論値の誤差 ≲ 10 eV





Pauli-Villars regulation

$\ln \frac{M}{m}$ renormalization

unitarity?

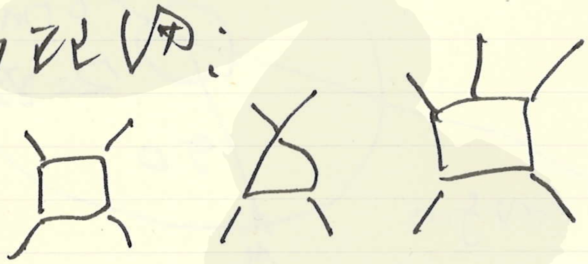
n-dimensional reg.

$\frac{1}{n-4}$

Weak int.

$|f_l(s)| \leq 1$ $G_F s \to > 1$

電力比例:



時空記述研究会.

基研　10月4日, 5日

湯川

観測されるものは何か

素領域・剛体,　準粒子

例　deformable sphere model

{ 流体模型
string model

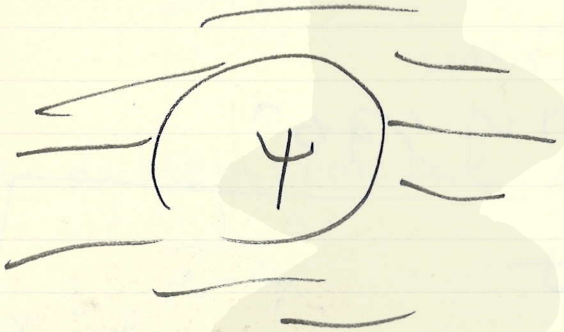
振動　回転

主軸

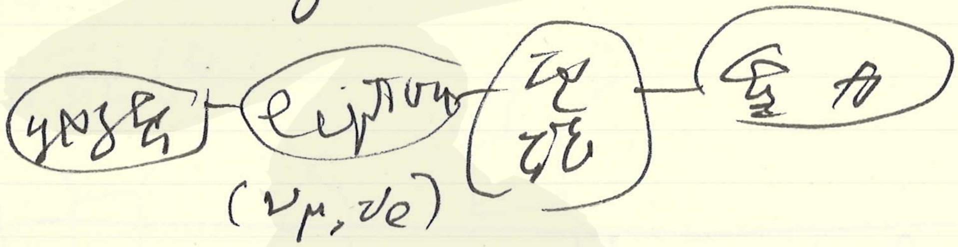
SU_2

$$\frac{\hbar^2}{I\lambda a^2} >> 1$$

Bag theory



5次元理論
Kaluza



弦模型; string model
Pythagoras
Kepler

$$\delta \iint L \, d\sigma \, d\tau = 0$$

$$L = -\kappa \sqrt{(G_{11} + \omega) G_{00} - G_{10}^2}$$

$\omega \neq 0$ realistic model $\tau \to \tau'$

$\omega = 0$ geometric model

→ general covariance $(\sigma, \tau) \to (\sigma', \tau')$

linear multilocal

$$\overset{1 \cdots\cdots N}{\text{chain}} \quad N \to \infty \to \text{continuum}$$

第2量子化

Fermi oscillator
parafermi oscill.

10月5日
片山: $\boxed{\text{素領域}}$
Yukawa K.
Weisskopf - Bag

Y-K-{ 差分

~~Yukawa~~
~~Bag~~ ~~Weisskopf~~
Naka → string

$\boxed{\text{4次元的量子化}}$
Current (Nambu)
K.T.Y. Takab.
Okubo S行列

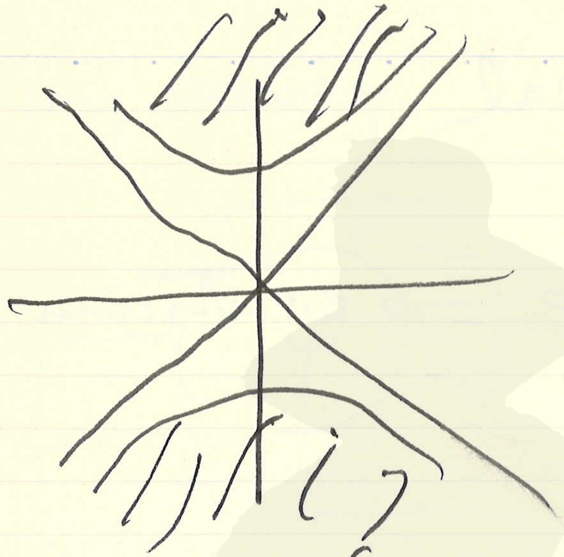
$$[\phi(x), \phi(y)] = G(x,y)$$

$$\begin{cases} x_0 \sim y_0 & G(x,y) = 0 \\ x_0 \gtrless y_0 & \neq 0 \end{cases}$$

$$S^\dagger S = 1$$

谷川.

因果律 $(x-y)^2 > -l_0^2$ space
Markov-Komar. $< -l_0^2$ time
Takano



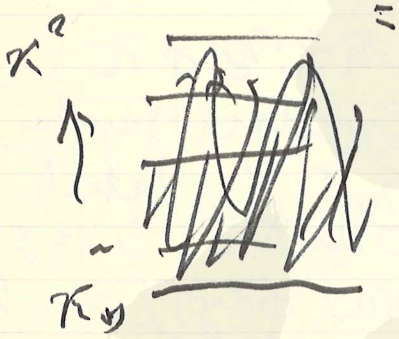
$$G(x,y) = \int d\kappa^2 \, \rho(\kappa^2) \, G(x,y;\kappa^2)$$

$$\rho(\kappa^2) = \delta(\kappa^2-\kappa_0^2) - \frac{l_0^2}{2} \frac{H_1^{(1)}(l_0\sqrt{\kappa^2-\kappa_0^2})}{l_0\sqrt{\kappa^2-\kappa_0^2}}$$

$$\kappa^2 > \kappa_0^2$$

$$= \delta(\kappa^2-\kappa_0^2) \quad . \quad 0$$

$$\kappa^2 < \kappa_0^2$$

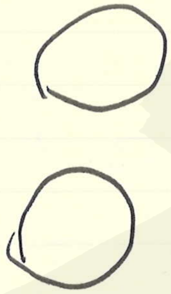


素領域

$f(x) = a + b^{\mu} x_{\mu} + c^{\mu\nu} x_{\mu} x_{\nu}$

力学変数.

見かけの力



$\boxed{D_i}$　$x^i \in D_i$

4次元的量子化

$a(x)\,\Omega_{\mu} = 0$

↓

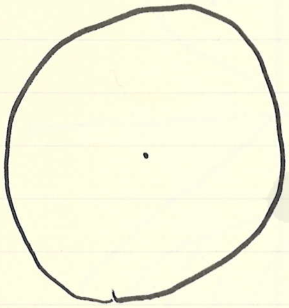
離散化

$$G(x,y) = e^{-l_0 \frac{\partial^2}{\partial(x_0-y_0)^2}}\, G(x-y, x_0^2)$$

$n_\mu^2 = -1$:

$$\left(e^{l_0 n_\mu \frac{\partial}{\partial x_\mu}} + e^{-l_0 n_\mu \frac{\partial}{\partial x_\mu}}\right) G(x,y)$$

後藤：Bag



$$x^\mu = a^\mu_{(\tau)} + \sum_{r=1}^{3} b^\mu_{r(\tau)} u^r$$

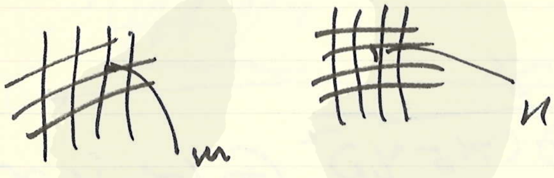
$$(b_r, b_s) = -\delta_{rs}$$

$$\sum_{r=1}^{3} u^{r2} \leq r_0^2$$

$$I = \int_\Omega \mathcal{L}(\varphi^A, \varphi^A_{,\mu})\, d^4x$$

$$\varphi^A = \varphi^A(x) = \varphi^A(u, \tau)$$

長谷川：



φ'_m　　φ_n

$$\varphi'_m = L_m^{\ n}(x)\,\varphi_n$$

$$L_m^{\ n}(x) = \int \hat{\varphi}_m(x x')\, \varphi_n(x')\, dx'$$

$\rho_n(x)$: 素領域 n の波動関数

素領域の変換

$$\rho_m'(x) = L_m^n(x)\rho_n(x)$$

$$= \rho_m(\kappa x) = \rho_m(x')$$

$$\int e^{i f(p) m - i p x} \sqrt{f'(p)}\, dp$$

$$L_m^{n'}(\kappa) L_{n'}^{n}(\kappa') = L_m^{n}(\kappa\kappa')$$

構造と相互 研究会

1974年 1-2月 7日

[illegible]

I. 新粒子 データ

小川 ①

丹生 ①

杉本　　加速器　205 GeV p.

~ 2 GeV　　5.7×10^{-13} sec

$A \to p\eta^0(1.49$ GeV$)$

$\to K\eta^0(1.66$ GeV$)$

II. Abstract 的

数 . 4元模型

$\phi(I=Y=0)$

$\psi(3105) \Rightarrow \Gamma_\psi \simeq 75$ KeV

≤ 1.0 KeV (hadronic

$(//) \to \chi + \gamma$

$\chi_0(960)+\gamma$

5 KeV　$\mu\bar{\mu}$

5 KeV　$e\bar{e}$

$\psi(3700)$

? $\psi(2400?)$

? $\psi(4100?)$

6元模型　$p\,n\,\lambda\;\xi\;l\;\lambda'\;\xi'$ ⋮

(素研 Ⅱ Nr. 2)

近藤： $SU(2) \otimes SU(2)$

O^-　$\underset{L}{}$　$\underset{\overline{U}}{U}$

$\psi 3100 \to L \bar{L}$

$m_W = 1600\ (1900)$

沢田：

$\psi(3700) \to \pi^0 \pi^0 + \psi(3105)$

武田：

$V^0 \supset \sim\sim \gamma$

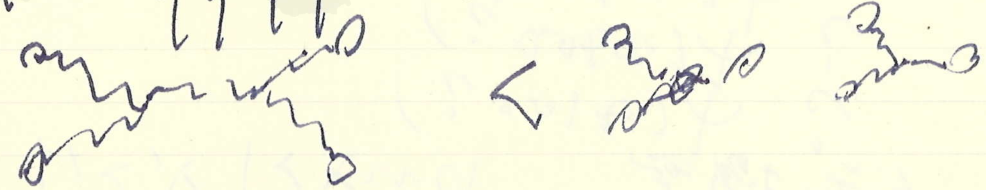
$\alpha_n' = \frac{1}{n^2} \alpha_0'$

岩崎：

p. Iizuka-Okubo rule

(p') { exotic
radical excitation

益川： $\bar{q}\bar{q}\bar{q}\bar{q}$



小谷氏 中之と :

$\psi_1 \cdots \psi_n \cdots$

continuum は 6 %

31.05

$\psi_N \to \psi_{N'} + h.$) gON

3.1 2.4

(radial
(relative time
bag excitation

岩田 : L-R symmetry
→ quarter

L-R excitation

山田 : [illegible]
strong interaction があるか?
weak ~~series~~ ?
el. mg. order ?

相田 : $(\bar{q} q)_{1-}$ $(\bar{q}_{(1)} q_{(1)})_{1-}$ - - -

$q_{(1)} \to q.t.U$
mag.

nbaryon family

斎藤： Regge slope の変化
(細谷・斎藤)

Higgs model
Nielsen-Olsen
vortex → string

$\alpha'(n) = \frac{1}{n^2}\alpha'(1) = \frac{1}{n^2}\times 0.9$

$\left(\frac{eg}{4\pi} = \frac{n}{2}\right)$

$\left(= \frac{4}{0.9} l + M_0^2\right.$

$M_l^2 = 4.4\, l + 1.0$

l	M_l
0	1.0 $\leftarrow \phi_c$
1	2.3
2	3.1
3	3.7
4	4.3
5	4.8
6	5.2

黒川： Urbaryon $\leftarrow l\text{-}\bar{l} + B^P \to$ 蓄e
$(N_e = N_\mu = 0)$

花川： weak boson

$m_{Z^0} = m_W{}^2$ $\qquad \frac{2g^2}{m_{Z^0}^2} = \frac{G_W}{\sqrt{2}}$

$Z^0 \to \mu\bar{\mu}$ $\qquad \Gamma \sim 1.6\,\text{keV}$

$Q = I_3 + Y$　　F : fermion number

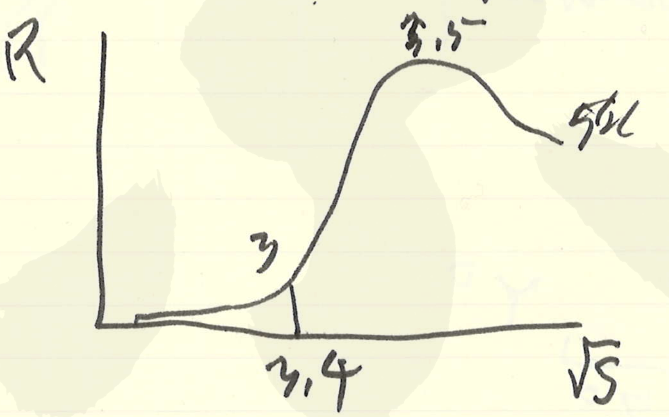
Higgs → Weinberg

$e^2 \left(\frac{1}{g^2} + \boxed{+} \right) = 1 \longrightarrow g > e$

大槻：

牟田：　$pp \to \mu^+ \mu^- X$

仮定
① charm の existence
② charmed hadron の existence
③ charmed hadron の decay mode と mass spectrum は ordinary hadron と similar



$M_c = 1.7$ GeV

$M_{B_c} > 3.0$

$E_{lab} = 22 \sim 29$ GeV　$m_{\mu\mu} > M_c$

(Brookhaven)

$m_{\mu\mu} = 2.8$ GeV

$M_{\text{陽}c} \approx 3.5$ GeV

蔡 (~~[illegible]~~)(S. Y. Tsai)

Han - Nambu 分 Triplet model

"medio-strong: I_3, Y, Q" → 工作[illegible]を作る

ca

~~m~~ weak int.

gluon $m_g \sim 2$ GeV

$\Psi(3105), \Psi(3700)$ vs gluon?

原 [illegible] : CERNにいけて.

1. $\boxed{\Phi_{c\bar{c}}}$
2. Han - Nambu
3. $\boxed{Z^0}$
4. Higgs

$W^+ \underbrace{W^0 \quad W^-}_{\gamma, Z^0} \quad Y^0$

$SU(2) \times U(1) \underbrace{\times U(1)}_{Q = I_3 + \frac{Y_n + Y_e}{2}}$

check point model	巾をせばめる	仲間がどれだけ	decay mode	production cross-section	X 消えたとの関係	その他
多元i級之 励起 2値 中元 2値 excitat. exotic 重なりi級 三重i級 (特性. $\gamma \to X$)	I.O.	少数	$\Phi \to X + \gamma$ Φ(多価) $\to \Phi$(引力) + 2せは 困るか.			悪い septur
新系列						
W.B. Higgs						

談話会

新粒子の状況

小沼通二

12月12日 2 pm, 1974

ψ(3105)

① MIT-BNL PRL 33 ('74) 1404 (Aubert)

② SLAC-LBL (Augustin … 1406

③ Frascati (C., Batti …) 1408

ψ(3695)

④ LBL-SLAC (Abrams)…) 1453

J, J (Ting)

11.11. 1 a.m.: 公開. (BNL)

① BNL:

$p + Be \to \underline{l + \bar{l}} + X$ —— $e^+ + e^-$

SLAC, Frascati

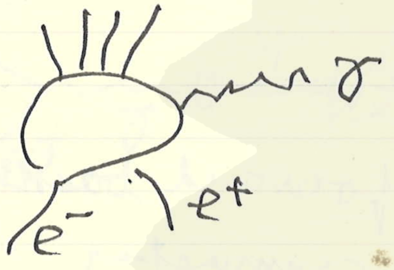
②③ $e^+ + e^- \to \begin{cases} e^+ + e^- \\ \mu^+ + \mu^- \\ \text{hadrons} \\ \pi, K, \gamma \end{cases}$

① BNL: $J \to e^+e^-$
vector particle

② SLAC:

$e^+e^- \to$ hadrons

3.105 ± 0.003 GeV



$\delta M < 1.9$ MeV

~~e~~ $e^+e^- \Rightarrow e^+e^-$

$e^+e^- \to \mu^+\mu^-$ ($\pi^+\pi^-$, K^+K^-)

③ Frascati:

$e^+e^- \to$ hadrons, e^+e^-

④ SLAC-LBL

3.695 ± 0.004 GeV

① MNW → 1.5 ~ 5.5 GeV
→ (28 GeV p)

$\sqrt{s} = 2m_p + 5.5$ GeV

② SLAC　3.1 $\rightsquigarrow$ 5 GeV $\rightsquigarrow$ 9 GeV
0.5 MeV

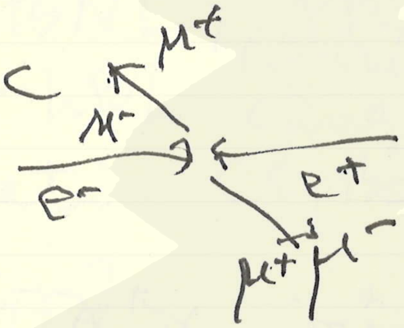
③ Frascati　1.5 — $\rightsquigarrow$ 3 GeV → 3.1 GeV
0.5 MeV

DESY　DORIS

3.1 GeV をしらべる.

← 7 GeV → 10 GeV

SLAC



forward-backward asymmetry

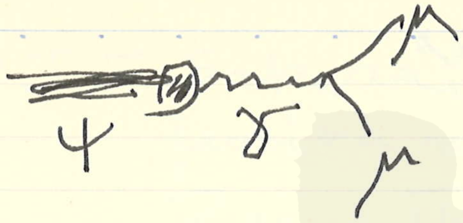
parity 非保存がみえそう.

、あるいは spin 1.

Decay mode:

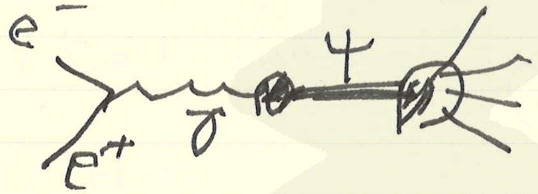
SLAC: $\psi(3695) \to \psi(3105) + \pi^+ + \pi^-$?

比率 ~30%　?



$\Gamma_\mu = 4$ keV

~ 5 keV



$\Gamma_{tot} = 120$ keV

↓

hadron $\underline{75 \text{ keV}}$

ψ(3695)

~~ψ~~ $\Gamma_\mu = 2.4$ keV

$\Gamma_{tot} = 240$ keV ?

BNL 1970年ごろから

$p + p \to$ lepton

1) intermediate boson

2) vector meson

$\rho\ \omega\ \varphi$

3) charmed particle

quartet $p\ n\ \lambda\ p'$

4) heavy leptons

$\frac{\text{lepton}}{\pi} \sim 1.0^{-4}$

{ NAL
ISR (CERN)
Serpukhov

候補:

I { ρ' 4.3〜5 GeV の ~~charmed~~
colored quark
exotic ?

II weak boson

III New Matter

(1) Iwasaki ρ'
(2) Okubo ρ'
(3) 〃
(4) Schwinger { q ... / φ ... ρ, ω, ϕ / ρ', ω', ϕ'

(5) J.J. Sakurai　weak boson
fermion ~~number~~ current boson
$Z_\mu \cdot \bar{\psi}\gamma_\mu\psi$

(6) Cabibbo . . . : weak boson

(7) Hori, . . . ;

(0) 北門 ; . . . : ρ'
(8) 牧・梅村,
(9) Nam, color

$\psi(3105)$　　$\psi(3695)$

charm　$p\bar{p}'$ $I=Y=0$
$\rho^0, \omega, \phi(1020)\phi'$
$\phi' \simeq (p'\bar{p}')$
$\psi \to c + \bar{c}$

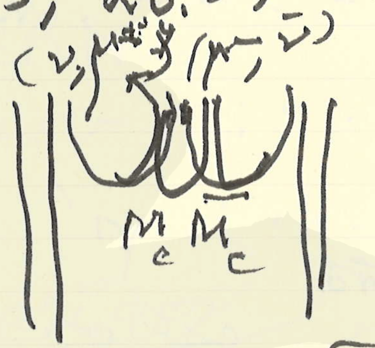
radial excitation
daughter 説
exotic?
orbital excitation

2nd charm
2nd strangeness
(牧 [illegible])

BNL　Lederman et al '70
PRL 25, 1523. ('70)
PR　('750

$$p + U \to \underbrace{\mu^+ + \mu^-}_{\text{invariant mass}} + X$$

$E = 22, 25, 28.5, 29.5$ GeV



$$\mu + p \to \mu + \gamma + M_c + \bar{M}_c$$

$$\qquad\qquad\qquad\quad \downarrow \qquad\quad \downarrow$$

$$\qquad\qquad\qquad\quad \mu\bar{\nu} \qquad \bar{\mu}\nu$$

$M_c \sim 1.7$ GeV ~ 1.8 GeV

New particle

$X \to$ "ch" $+ \pi^0$

1.3 GeV $\leftarrow \pi^+ + \pi^0$

1.7 GeV $\leftarrow K^+ \quad 0$

2.8 GeV $\leftarrow \rho$

絶対回転[illegible]

Mach原理について
1975年2月6日
混沌会.

Newton の水桶, 1686 Principia

[illegible]:

Einstein

Thirring ~~rotating~~ spherical shell) PN

Møller rotating ring

$\frac{GM}{Rc^2}$

	G	G^2	G^4
(v/c)	N	P.N	PPN
$(v/c)^2$	P.N	PPN	
$(v/c)^3$	PPN		
$(v/c)^4$			

$\Sigma \propto G\omega v$

coriolis $G\left(\frac{v}{c}\right)^2 \rightarrow$ P.N

centrifugal $G\omega^2$ → PPN

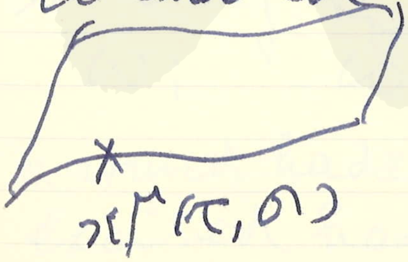
物質の慣性

時空理論研究会

March 13, 14, 15, 1975
基研 エにきう 4室.

	午前	午後
13日	谷川 石田 (鈴藤)	高林, [illegible] 鈴藤 (大貫)
14日	田地 中西 (荒川)	田中 山崎, 荒川 ([illegible])
15日	塩崎 大貫, 宮山 〃 (中西)	湯川 (谷川)

荒谷川; Helical Spin Wave (Williamson; Carlson, Chang, Mansouri)
Conductive String



$$\left.\begin{array}{l}\dfrac{\partial x^\mu}{\partial\sigma}\dfrac{\partial x_\mu}{\partial\tau}=0\\[2ex]\left(\dfrac{\partial x^\mu}{\partial\tau}\right)^2+\left(\dfrac{\partial x^\mu}{\partial\sigma}\right)^2=0\end{array}\right\}$$

collective motion

spin 分布

$\varphi(\tau, \sigma)$: Pauli spinor (2 comp)

$\varphi^{+}(\tau,\sigma)\sigma^{i}\varphi(\tau,\sigma)$

classical

$\sigma^{\mu}\left(\begin{array}{l}\sigma^{0}=1 \\ \sigma^{i} : \text{Pauli spin}\end{array}\right.$

$\varphi^{+}\sigma^{\mu}\varphi$

$(\varphi^{+}\sigma^{\mu}\varphi)^{2}=0$ light-like vector

$\left.\begin{array}{l}u_{+}=\tau+\sigma \\ u_{-}=\tau-\sigma\end{array}\right\}$ $\begin{array}{l}\varphi(u_{+}) \\ \varphi(u_{-})\end{array}$

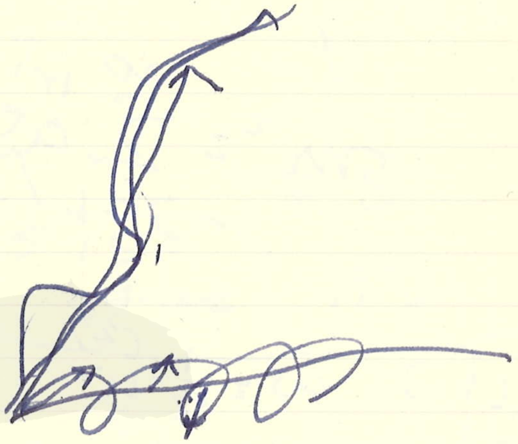
$$i\frac{\partial\varphi}{\partial u_{\pm}}=\frac{\sigma^{\mu}}{2}\eta'_{\mu}(u_{\pm})\varphi$$

$$\eta'_{\mu}=\frac{\partial\eta_{\mu}}{\partial u}$$

helical motion

$$\frac{\partial x^\mu}{\partial u_\tau} = \varphi^\dagger(u_\tau)\sigma^\mu\varphi(u_\tau)$$

$$\frac{\partial x^\mu}{\partial u_\tau}\frac{\partial x_\mu}{\partial u_\tau} = 0$$



[illegible]

($\varphi(u)$ [illegible]
($x(u)$ [illegible]

[illegible]: [illegible]　　$\Psi(3,1)$　$\Psi(3,7)$
string 模型
ω:　$\omega^{(r)} = r\omega$　　$r = 1, 2, \cdots$

[ground hadron: $\omega = 0$
[excited hadron: $\omega^{(1)}$　　$r = 1$.
y. m. particle

$\psi(3,2) \cdots$ $\overset{(2)}{\omega}$ $r=2$

$\vdots$

$$m^2 = \sum_{r=1}^{\infty} a_\mu^{(r)\dagger} a_\mu^{(r)} \cdot \overset{(r)}{\omega} + s_0$$

$$\overset{(r)}{\omega} = r\omega$$

$r = 1, 2, \cdots$

(i) $\omega = \frac{1}{2}\overset{(2)}{\omega}$

$\psi(3,1)$ $(a_\mu^\dagger a_\mu^\dagger)^n |G\rangle$

トチツリアウ

$\psi(3,2)$ $(a_\mu^\dagger a_\mu^\dagger)^{n-1} |G\rangle$

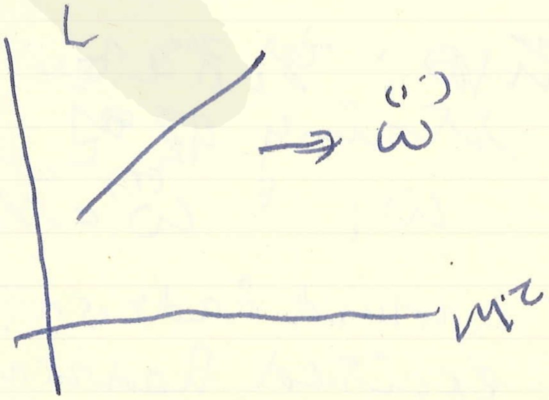
$$\omega = \frac{1}{2}\overset{(2)}{\omega} = \frac{1}{4}[(3.695)^2 - (3.105)^2]$$

$$\fallingdotseq 1.003 \ (\mathrm{BeV})^2$$

q.m.p.

$\omega = \overset{(1)}{\omega} \simeq 1.1 \ (\mathrm{BeV})^2$ (baryon)

$\simeq 1.08 \ (\mathrm{BeV})^2$ (meson)



V^{G}　　$V^{(2,1)}$　　$V^{(2,2)}$

m(MeV) 0.8 (1.0)　　2.2 (2.3)　　3.1

Γ(MeV) 150　　0.5　　1.5

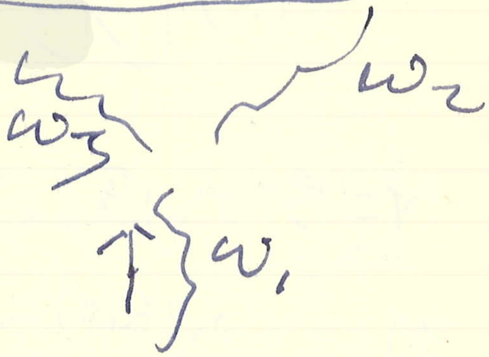
$V^{(2,3)}$　　$V^{(2,4)}$　　$V^{(2,5)}$

m 3.7 (3.8)　　4.3　　4.8

Γ 1.5　　1.5 150　　150

27-152

$(\omega = 1.1 (GeV)^2)$



Σ [illegible]

[illegible]

[illegible] Σ. [illegible].

(a) $G \to G + G$

(b) $\underline{1} \to G + G$

(c) $\underline{2} \to \underline{1} + \underline{1}$

multi-string model
spring

$$V = g_0 \prod_i R(i)$$

$$R = \frac{\gamma^2}{\omega_i^2 - \omega_F^2 + i\gamma^2}$$

$$|R|^2 = \frac{\gamma^4}{(\omega_I^2-\omega_F^2)^2+\gamma^4}$$

$\boxed{\gamma=\omega}$ と置く.　　　Γ MeV

(a) $1^5 = 1$　　　150

(b) $\frac{1}{(1+1)^2}\cdot 1 = \frac{1}{4}$　　　40

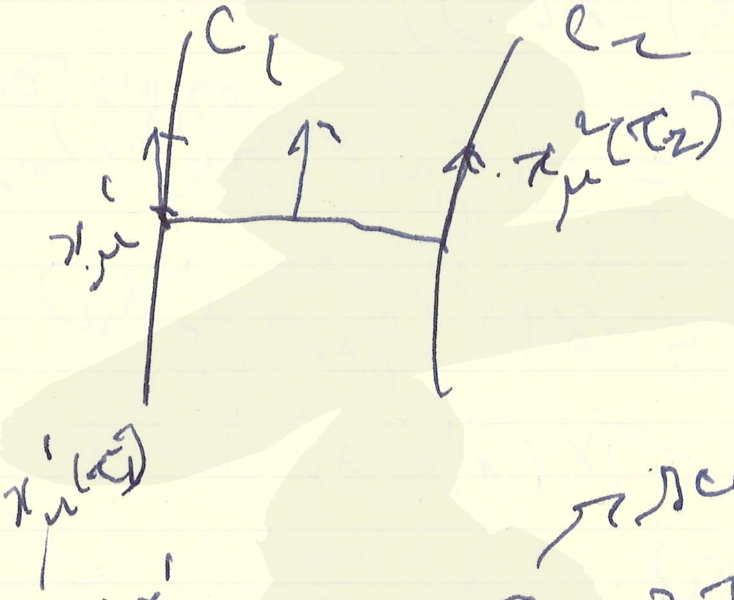
(c) $\left[\frac{1}{(3^2+1)}\right]^2 = 10^{-2}$　　　1.5 MeV

$r=3$	V^g	$V^{(3,1)}$	$V^{(3,2)}$	$V^{(3,3)}$
m	0.8(1.0)	2.7(2.8)	3.7(3.8)	4.5(4.6)
Γ	150	0.04	0.04	0.04 0.2

$$\Phi^{B}_{\Lambda}(x, \phi^{(1)}(\sigma_1), \phi^{(2)}(\sigma_2))$$

高林：Relativistic Mechanics of two Interaction Particles and Bilocal theory

遠隔作用.



$$\left.\begin{array}{l}\dfrac{dx^1_0}{d\tau_1} > 0 \\[2ex] \dfrac{dx^2_0}{d\tau_2} > 0\end{array}\right\}$$

は scalar で vector でない

$\tau_1 \to \tau_1'(\tau_1)$

$\tau_2 \to \tau_2'(\tau_2)$

covariance

$$\frac{\dfrac{dx^1_\mu}{d\tau_1}}{\sqrt{-\left(\dfrac{dx^1_\mu}{d\tau_1}\right)^2}} = u^{(1)}_\mu$$

$$\left(x_\mu^{(1)}(\tau_1) - x_\mu^{(2)}(\tau_2) \right) \left(u^{1}(\tau_1) + u^{2}(\tau_2) \right)$$

$$= 0$$

$U(s)$

$$s = \left(x^1(\tau_1) - x^2(\tau_2) \right)^2$$

$$\frac{U(s)}{\sqrt{-(\dot{x}^1)^2}} \frac{d \cdot u^{(1)}(\tau_1)}{d\tau_1} = -\left(g_{\mu\nu} + u_\mu^{(1)} u_\nu^{(1)} \right) \frac{\partial U}{\partial x_\nu^1}$$

$$= -2U' \left(g_{\mu\nu} + u_\mu^1 u_\nu^1 \right)$$

$$\times \left(x_\nu^1 - x_\nu^2 \right)$$

$$\dot{x}^1 = \frac{dx(\tau_1)}{d\tau_1}$$

式の数 $2 \times 3 = 6$

relative time のあいまいさなし(!!!

$$\frac{d\tau_2}{d\tau_1} = \frac{\sqrt{-(\dot{x}^1)^2}}{\sqrt{-(\dot{x}^2)^2}} \rightarrow (dx^1)^2 = (dx^2)^2$$

$$p_\mu^{(\alpha)}(\tau_\alpha) = \kappa \sqrt{U} \cdot u_\mu^\alpha(\tau_\alpha)$$

$$\frac{1}{\sqrt{-(\dot{x}^1)^2}} \frac{d p^{(1)}_\mu}{d\tau_1} = -2\kappa \frac{\partial \sqrt{U}}{\partial x^1_\mu}$$

$$P_\mu = p^1(\tau_1) + p^2(\tau_2)$$

$$\frac{d P_\mu}{d\tau_2} = 0 \qquad \tau_2(\tau_1)$$

$$P_\mu (x^{(1)}_\mu(\tau_1) - x^2_\mu(\tau_2)) = 0$$

$$M_{\mu\nu} = x^{(1)}_\mu(\tau_1)\, p^{(1)}_\nu(\tau_1) + \cdots ②$$

$$\frac{d M_{\mu\nu}}{d\tau_1} = 0$$

free limit : $U(s) \to$ const. U_0

後藤 i

bilocal

$$P^2 + (p^2 + \kappa^2 \xi^2) + m^2 = 0$$

$$P\xi = 0$$

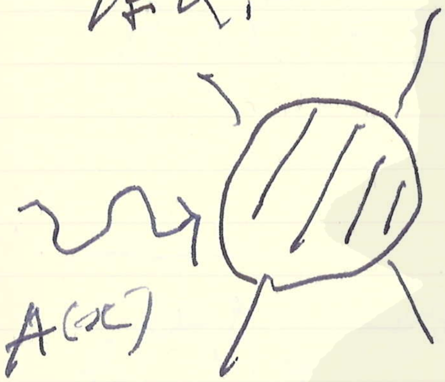
$$Pp = 0$$

$$P^2 = 0$$

$$\xi_\mu \left(g^{\mu\nu} - \frac{P^\mu P^\nu}{P^2} \right) \xi^\nu$$

3月1.4日
[illegible]

deformable sphere
の相互作用!



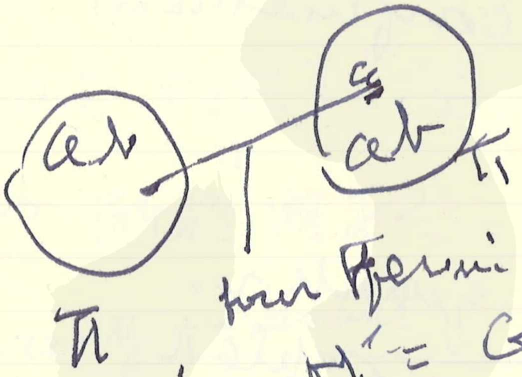
black box の ふ・たを
あけたら

$$H = (p^2 + \lambda x^2)$$

$$+ \frac{\Pi^2}{2I}$$

$$\Pi = S - J$$

$$I = 0, 1/2, \ldots$$



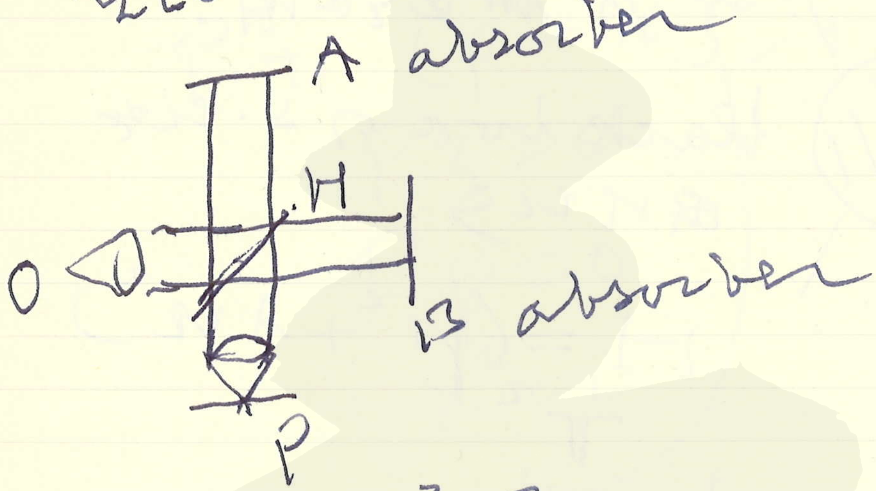
four Fermi interaction

$$H' = G\psi\bar{\psi}\psi\bar{\psi}$$

↓

$$(\partial^\mu \Pi_a \cdot \Pi_b - \partial^\mu \Pi_b \cdot \Pi_a)\rho \ldots$$

[illegible]氏: QM, Rel. and Causality.
文[6]



$\beta = 10^{-3}$?

中西氏: quark confinement

S
final　E: real
intermediate　quark~ complex ghost
$E_1 \neq E_1^* =$ real
pair creation
initial　E: real

non-rel.

$E_1+E_1^* = \text{real}$

rel

M: complex

$E_1 = \sqrt{M^2+q^2}$

M^*

$E_2 = \sqrt{M^{*2}+(p-q)^2}$

$p=0$ ~~[illegible]~~

$E_1+E_2 = \text{complex}$

pair creation の確率は negligible

e^{iE_1t} の時間依存,

$e^{-\varepsilon^2t^2}$

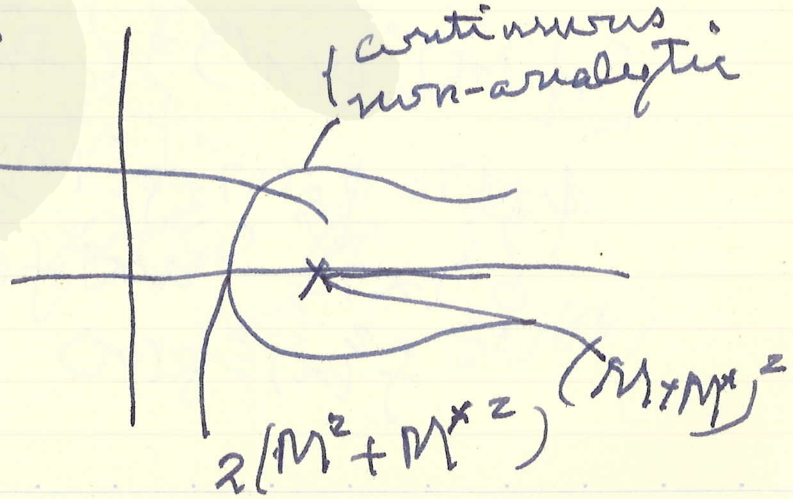
$$\int_{-\infty}^{+\infty} dt\, e^{i(E_1-E)t} \wedge$$

$$= 2\pi\,\delta(E_1-E)$$

$$\int_{-\infty}^{+\infty} dE\, \varphi(E)\,\delta(E_1-E) = \varphi(E_1)$$

↓ 解析函数

Lorentz invariant では..



B-S eq.
decay?

[illegible]:

markov 1959
高野

indefinite
metric

1962 Markov
continuous mass

$$\tilde{D}_a \to D_a(x) - \int \rho(\kappa^2)\Delta(x,\kappa^2)\,d\kappa^2$$

$$\rho(\kappa^2) = \frac{1}{2}a^2\frac{J_1(a\kappa)}{a\kappa}$$

$$[\phi(x), \phi(x')] = -i\tilde{D}_a(x-x')$$

$$\phi(x) = \phi_0(x) + \varphi_c'(x)$$

$$\phi_c'(x) = \int d\kappa^2 f(\kappa^2)\,\varphi(x,\kappa^2)$$

$$f^2(\kappa) = \rho(\kappa)$$

Riemann-Lebesgue

$\Phi(\vec{x}, x_0) = 2\lim(z\varepsilon a)^{-1/2}$

$\int a\bar{y} \quad . \; . \; .$

山本滋君: complex ghost

花川君: [illegible] と Yang-Mills 場
| 4 次元空間

1) 格子空間の Y. M. 場.

$D_\mu \psi = \frac{1}{a}(\psi_n - \psi_{n-\mu})$

$(D_\mu - igA_{n\mu}^{*})\psi_n$

電磁 弱 強

U(5) U(1) SU(3)

磁単極: magnetic monopole

$eg = \frac{1}{2}\hbar c n$　　$n = 0, 1, 2, \ldots$

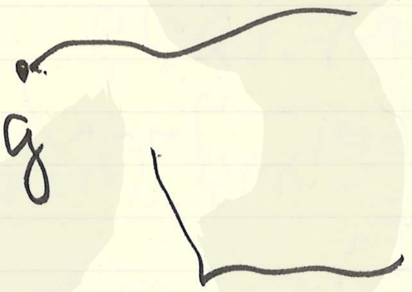
(Dirac, 1931)

$g^2/\hbar c = 34.25$　　$n = 1$

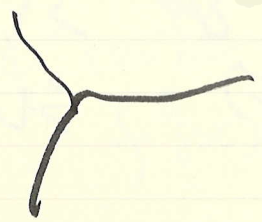
超強 ⤵
強
電磁
弱

検出: $p + p \to p + p + g + \bar{g}$
$+ X$

dipole exchange

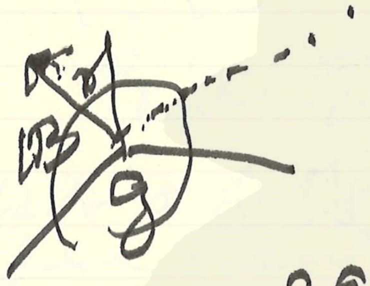


$G_{\mu\nu}(x, y)$



大学Q: monopole

i) nonrelat.
radiationless



$$\mathbf{B} = \frac{g}{4\pi}\frac{\mathbf{r}}{r^3}$$

$$m\ddot{\mathbf{r}} = \frac{eg}{4\pi}\left(\dot{\mathbf{r}} \times \frac{\mathbf{r}}{r^2}\right)$$

$$S = \frac{eg}{4\pi}$$

$$H = \frac{1}{2m}\dot{\mathbf{r}}^2$$

$$\mathbf{J} = m(\mathbf{r} \times \dot{\mathbf{r}}) - \frac{\mathbf{r}}{r} S$$

$$m\dot{\mathbf{r}} = \mathbf{p} - e\mathbf{A}$$

$$\nabla \times \mathbf{A} = \mathbf{B}$$

どこでも

$$\frac{eg}{4\pi} = 0, \tfrac{1}{2}, 1, \cdots$$

$$\left.\begin{aligned} eA_x &\simeq S\,\frac{y}{r(r-z)} \\ eA_y &\simeq S\,\frac{-x}{r(r-z)} \\ eA_z &= 0 \end{aligned}\right\}$$

$$i\frac{\partial\varphi}{\partial t} = H\varphi$$

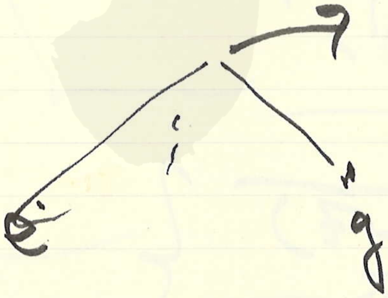
$$\chi \in \left(\begin{matrix}0\\0\\ \vdots\\ \varphi\end{matrix}\right)\Big\} \rightarrow 2s+1$$

$$\left(s+\frac{s\cdot r}{r}\right)\cancel{\chi}\,\psi = 0$$

$$i\hbar\frac{\partial\psi}{\partial t} \triangleq \mathcal{H}\psi \triangleq \frac{1}{2m}\left(p + \frac{s\times r}{r^2}\right)^2\psi$$

$$J \longrightarrow \cancel{m}(r\times p) + s$$

$$\ddot{r} - - - \frac{1}{2}\left(\dot{r}\times\frac{r}{r^3} - \frac{r}{r^3}\times\dot{r}\right)\frac{(s\cdot r)}{r}$$



$\rightarrow (E\times r)$

~~[illegible]~~ 定向

a spin

佐藤勝彦氏

弱い相互作用と天体核現象
—太陽ニュートリノを中心として—

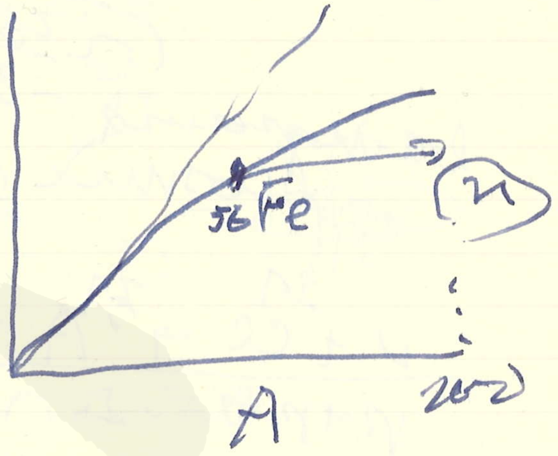
1975年3月27日

談話会.

核融合の直接の証拠
→ solar neutrino

$$p \to {}^4He \cdots\cdots {}^{56}Fe \to n$$
$$\downarrow e \ \downarrow \nu_e \qquad \Downarrow \nu_e \qquad \downarrow \nu_e$$

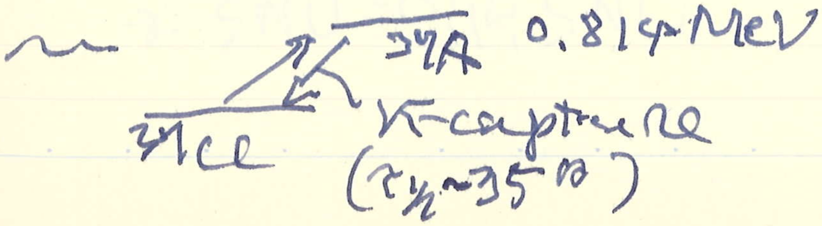
$SNU = 10^{-36}/\text{atom sec}$
↓
Cl atom



理論 = 5.6 SNU
(4.8 ~ 7.4 SNU)

実験 = 0.2±1.0 SNU

Davisの実験 → 29.73年現在
C_2Cl_4
地下 1480 m の金鉱



$$\frac{^{37}A}{^{37}Cl} = \frac{10^{-36}}{3.3\times10^{-7}} \sim 3\times10^{-30}$$

$$N_{^{37}Cl} = \frac{610\times10^{6}\ 6\times10^{23}}{(172/4)}$$

$$\sim 8.5\times10^{30}$$

$^{37}A \sim 25.5$ 個

回収率 = 95%

1日 カウント数 ~ 0.7 カウント

$\left(\sim \frac{25.5}{35}\right)$

background
cosmic rays ~ $\mu + n \to \nu p e n$
(0.4 SNU) ~~

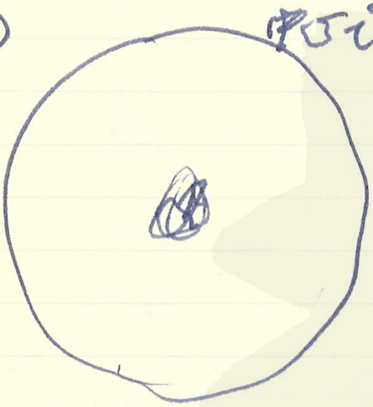
$$\nu + {}^{37}Cl \to {}^{37}A + e^-$$

$p + p \to$ …… ^ …… ^

$$^{8}B \to {}^{8}Be^{*} + e^{+} + \underline{\underline{\nu}}\ (14.06\ \mathrm{MeV})$$

何がおかしいか

① 中心で混合がある。



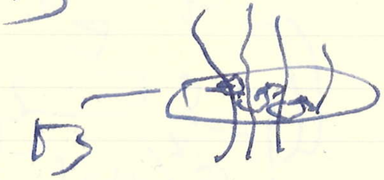
$\phi_{SNU8} = \frac{1}{4}\phi_{理論}$

② 化学組成を変える。
重いものが~~[illegible]~~表面へ

→ 1.4 SNU

③ 強い磁場が中心にある。

$B = 10^{-6}\left(\frac{\rho_{\odot}}{\rho_{星間}}\right)^{2/3}$



地磁?

→ 11.4 SNU 〜 3.ある.

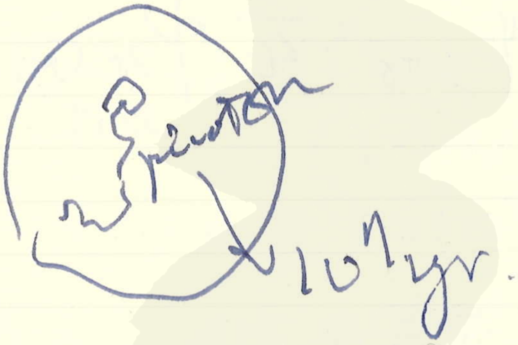
中心だけに強い磁場 → 1.9 SNU

④ 中心に回転コア

→ SNU = 0.99 SNU

⑤ 今、核源はわかってる．

Fowler



物理定数

① 重力、

(i) Dirac ('38)

$$G\frac{m_e m_p}{e^2} \sim 5\times10^{-40}$$

$$\left(\left\{\frac{ct}{e^2/m_ec^2}\right\}^{-1} \sim 4\times10^{-40}\right\}^{-1} \quad t \sim \frac{1}{H} \sim 10^{10}y$$

$$G \propto t^{-1} \qquad \times$$

(ii) Brans Dicke ×

G が Mi 内部によへる．

SNU は 否定されてる．

(iii) dilaton 模型 [illegible]．

$$V(r) = \frac{3/4\,GM}{r}\left(1+\frac{1}{3}\bigcirc e^{-\kappa r}\right)$$

$r \to \infty \quad G_\infty = \frac{3}{4} G_E$

$1/\kappa = 30\,\mathrm{km}$

$\frac{m_\phi}{m_e} = 10^{-17}$

(Weinberg → Higgs meson

$V(r) = \frac{1}{r}\left(g_{\phi NN}^2 e^{-m_\phi r} + G m_p^2\right)$

$m_\phi \overset{?}{<} 10^{-6}\,\mathrm{eV}$)

→ 1.7 SNU

② 弱い相互作用.

(i) $\nu_e \rightleftarrows \nu_\mu$ → 2.8 SNU

(ii) $\nu_e \to \nu' + \phi$ → 0 SNU

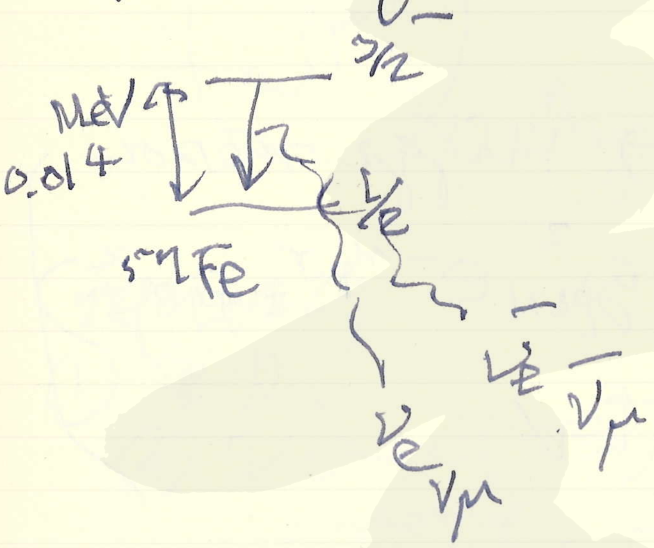
($m_{\nu_e} \lesssim 60\,\mathrm{eV}$)

~~$\nu_e \to \nu' + \gamma$~~

(11) G_F は不陥でおきない。

0.8 SNU

Weinberg



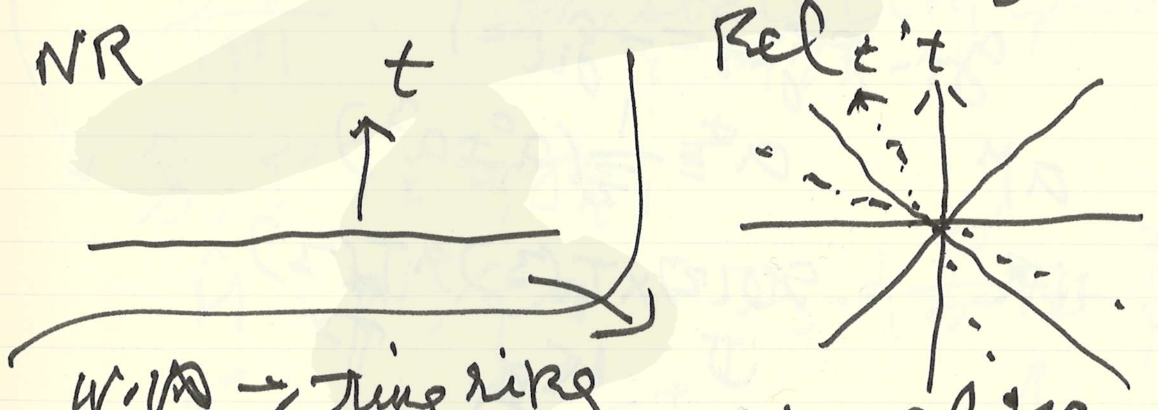
(江口西野)

lightlike plane 上での論の意義

1975.4.17.

—(研究会

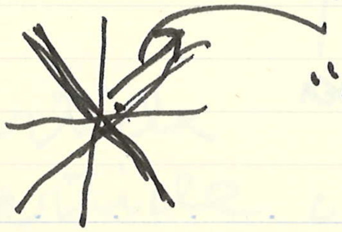
1. Why lightlike?
2. Where real difficulty?



W.内 → time like
空内 → spacelike

spacelike formulation

1. H.P. : spacelike
2. Dirac : lightlike formulation



"W.内" lightlike
"空内" { longitudinal → lightlike
Transverse → spacelike

安定性群 stability group

1. $SU(2) \times T(3)$

$\mathbb{J} \qquad \mathbb{P}$

2. $\{E(2) \times D\} \times T_+(3)$

$J_3, F_i, K_3 \qquad p^+, p^i$

$$F_i = \frac{1}{\sqrt{2}}(K_i \mp \varepsilon_{il} J_l)$$

$$g_{+-} = g_{-+} = -g_{ii} = 1$$

$$a^\mu \qquad a^\pm = \frac{1}{\sqrt{2}}(a^0 \pm a^3)$$

0. NR $\qquad SU(2) \times T_{\pi}(3) \times T_{x}(3)$

$\mathbb{J} \qquad \mathbb{K}_{gr} \qquad \pi^x$

$$\mathbb{P} \to \mathbb{P} + m\mathbb{V}$$

K.G. $\displaystyle [\phi(x), \phi(y)]_{x^+=y^+} = -\frac{i}{4}\varepsilon(x^- - y^-)\,\delta^2(x^i - y^i)$

$$\pi(x) = \frac{\partial\phi}{\partial x^-}$$

Dirac $\quad \psi(x) = \Sigma_+ \psi + \Sigma_- \psi$

$$\Sigma_\pm = \frac{1}{2}(1 \pm \alpha_3)$$

$$\{\psi_{+\alpha}(x), \psi^{\dagger}_{+\beta}(y)\}_{x^+=y^+} = \frac{i}{\sqrt{2}}(\Gamma_+)_{\alpha\beta}\,\delta(\vec{x}-\vec{y})$$

$$\vec{x} = (x^-, x^1, x^2)$$

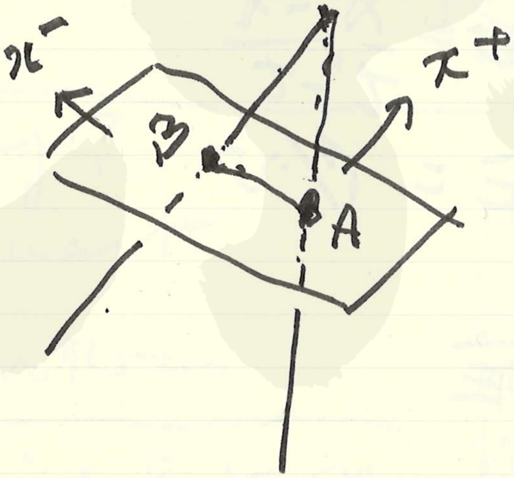
true vacuum

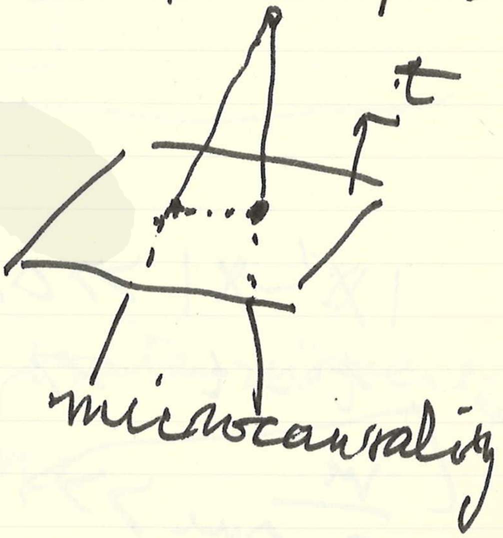
lightlike helicity helicity

$\frac{J\cdot P}{|P|}$: stability group と可換 と P^0

$\hat{S}$, P^- と可換

$\hat{M} = W^+/P^+ = J_3 - \{\frac{P^1}{P^+}F_2 - \frac{P^2}{P^+}F_1\}$





particle

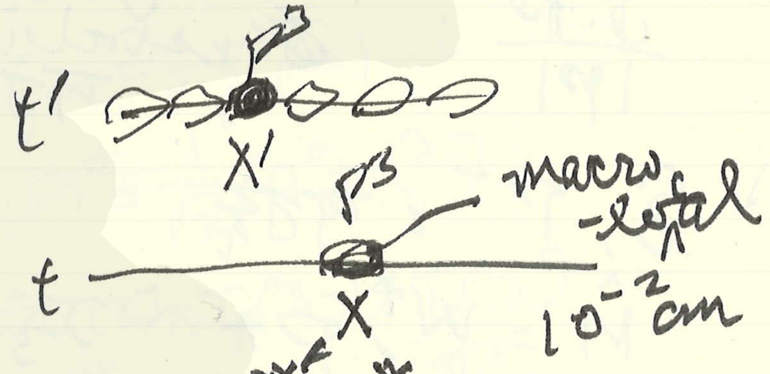
particle observable: m, p,
J, J_3, N_B, Q, Y, I, I_3

~~observable~~

1. 観測装置の同一性
stability group と交換

free form
explicit dependence on
interaction

direct observable → free form
indirect observable p^-



$$v = \frac{x'-x}{t'-t}$$

$$E = p/v$$

$$|x'-x| \gg \Delta x$$

$$t'-t \gg \frac{1}{\Delta E}$$

$$\frac{m}{E\cdot\Delta m} \gg$$

$$1 \gg \frac{\Delta E}{E} \gg \frac{\Delta m}{m}$$

J の測定
Stern-Gerlach

2. preparation の可能性

$$[O(x), O(y)]_{x^+=y^+} \overset{?}{=} 0 \quad \text{if } \vec{x} \neq \vec{y}$$

$$[J_a^+(x), J_b^+(y)]_{x^+=y^+} = i f_{abc}\,\delta(\vec{x}-\vec{y})$$
$$\times V_c^+(x) - \frac{i}{4}\partial_x^+ \partial_y^-$$
$$\times [\varepsilon(x^- - y^-)\delta(x^i - y^i)$$
$$\times \delta_{ab}]$$

---

why ?

quark
parton

unified hadron model

infinite momentum frame

談話会

田中正氏　Nov. 13, 1975

連続質量をもった Unbaryon 理論について

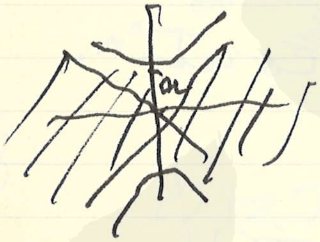
Markov, 1962

$$D(x) = \frac{\varepsilon(x_0)}{2\pi}\delta(x_\mu^2)$$

$$\to D_a(x) = \frac{\varepsilon(x_0)}{2\pi}\delta(x_\mu^2 + a^2)$$

$$= D(x) - \int_0^\infty \rho_a(m)\Delta(x, m)\,dm^2$$

$$\rho_a(m) = aJ_1(am)$$



Takahashi,

$\Delta(x, m)$: $D_a(x)$

$$\int_0^\infty \eta(a) D_a(x)\,da + \int_0^\infty dm\,\zeta(m)\Delta(x, m) = D(x)$$

$$\eta(a) = \int_0^\infty dm\,\zeta(m) J_1(am)$$

Pauli-Villars : discrete mass

$$\Delta_{reg}(x) = \sum_{n=1}^{\infty} c_n \Delta(x, m_n)$$

$$= -\int_0^{\infty} da \underbrace{\sum c_n m_n J_1(a m_n)}_{\eta(a)} D_a(x)$$

$m_n = \lambda_n (l_0)$: $J_1(\lambda_n) = 0$

$$\eta(a) = \sum_{n=1}^{\infty} \frac{c_n}{l_0} \lambda_n J_1\left(\lambda_n \frac{a}{l_0}\right)$$

Dini expansion

$0 \leq a < l_0$

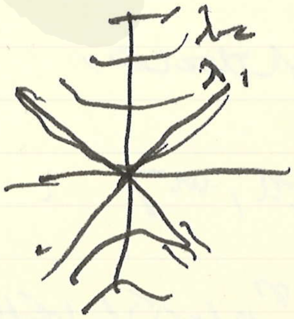
Discrete space : a ~~or~~ discrete mass or contin.

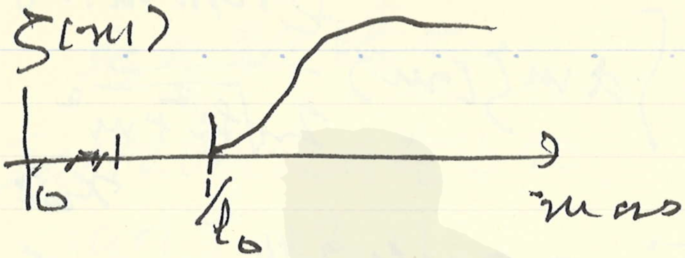
$$\sum_{n=1}^{\infty} d_n D_{a=\lambda_n l_0}(x)$$

$$= \int_0^{\infty} dm\, \underline{l_0 d_n \lambda_n}$$

$$\times \underline{J_1(\lambda_n l_0 m)}.$$

$$\times \Delta(x, m)$$





Markow; $\phi(x) = \phi_{normal}(x)$

$+ \phi'_{ficti}(x)$

unobservable ?

confineできるか ?

ゆやて : 束だけ生存させるか ?

composite state

$\Rightarrow$ discrete mass ?

§

$$\phi(x) = \int dm\, \zeta^{1/2}(m)\, \phi(x, m)$$

$$[\phi(x), \phi^{\dagger}(x')] = -i\hat{\Delta}(x-x')$$

$$\hat{\Delta}(x) = \int dm\, \zeta(m)\, \Delta(x, m)$$

$$\phi^{\dagger}(x) = \int dm\, \zeta^{1/2}(m)\, \phi^{*}(x, m)$$

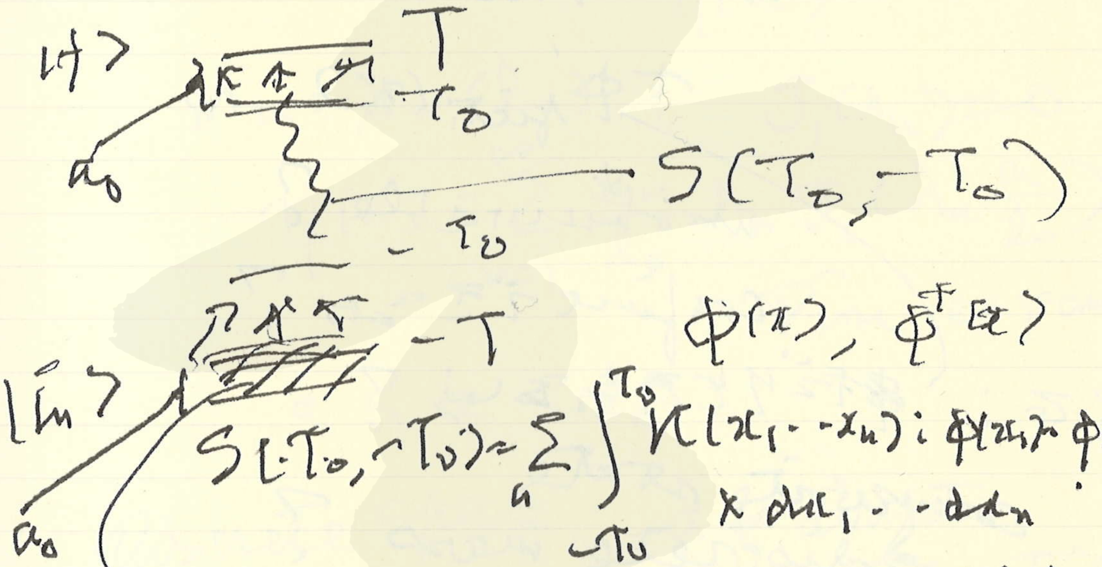
$$\langle 0 | P\phi(x)\phi^{\dagger}(x') | 0 \rangle = i\hat{\Delta}_c(x-x')$$

$$\hat{\Delta}_c(x) = \int_{m_0}^{\infty} \zeta(m)\, \Delta_c(x, m)\, dm$$

$$\Delta_c(\vec{k}, x_0) = \int dm\, \zeta(m) \frac{e^{\mp i\sqrt{k^2+m^2}\,x_0}}{2\sqrt{k^2+m^2}} \qquad \begin{matrix} x_0 \gtrless 0 \\ \lessgtr 0 \end{matrix}$$

asymptoticには0になる!!!

S-operator



$\Phi(x)$, $\Phi^{\dagger}(x)$

$$S(T_0, -T_0) = \sum_n \int_{-T_0}^{T_0} K(x_1 \cdots x_n)\, i\, \Phi(x_1) \cdots \Phi(x_n) \times dx_1 \cdots dx_n$$

|in> = 初期の wallの物体からの in field でつくる.

Hspace は $\{\Phi(x), -\infty < x_0 < +\infty\}$

$\sim \{\Phi(x), T - \frac{a_0}{2} < x_0 < T + \frac{a_0}{2}\}$

浮流院

長谷部勝也

素領域論日誌に記，

1975.12.11

慈雨ニワモリハ注.

photon?

談話会.

武田暁氏

弱相互作用の新結果

Second class current

1976年1月29日.

— β 崩 Viva Oiigisuo —

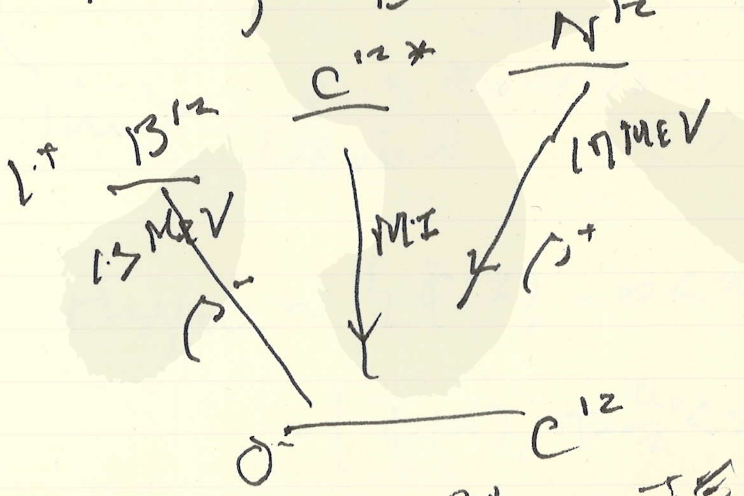
1950 θ-τ Puzzle

¢

弱い核力.

β線の角分布

$1 \pm \frac{4M_3}{J} \frac{p}{E} \{1 \pm \delta E\} \cos\theta$ $\beta^{\mp}$



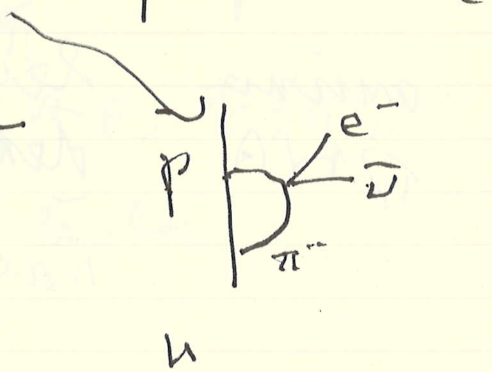
1970 確認 杉本

1959 武田

weak magnetism – pion cloud

CVC a test

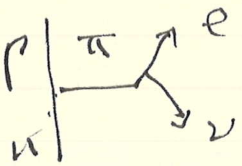
~~ten~~ induced tensor



$G = \exp(i\pi T_y)\cdot C$

$\pi^{\pm} = \frac{\pi_x \pm i\pi_y}{\sqrt{2}}$

$C\pi^{+} = \pi^{-} \rightarrow \pi_y \rightarrow -\pi_y$



180°回転 → $\pi_x \rightarrow -\pi_x$

$\pi_y \rightarrow \pi_y$

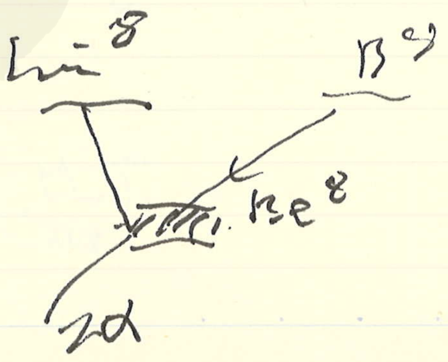
charge space での reflexion.

second class current

$V_\mu = \overset{+}{V}{}_\mu^{(1)} + \overset{-}{V}{}_\mu^{(2)}$

$A_\mu = \underset{-}{A_\mu^{(1)}} + \underset{+}{A_\mu^{(2)}}$

Wilkinson



偏極 polarized nuclei

amino levo

DNA dextro

racemic $= \frac{1}{2}(l \mp d)$

談話会

佐藤文隆君

Black Holeの熱学.

1976年2月26日木, 午後.

① small mass black hole
存在的 可能.

(曲った時空での量子化)

(Fundamental Breakdown of Physics
in Gravitational Collapse
(S. Hawking)
)

$$\bar{\rho} = \frac{M}{\left(\frac{2GM}{c^2}\right)^3} = 2\times 10^{16}\frac{M_\odot}{M}$$

$G,\ \hbar,\ c$

$$m_* = \sqrt{\frac{\hbar c}{G}} = 10^{-5}\,g$$

$$\frac{\hbar}{m_* c} \sim \frac{Gm_*}{c^2}$$

$$\frac{GM_*^2}{\hbar c} \sim 1 \qquad \sim\left(\frac{M}{m_*}\right)^2$$

重力のゆらぎ

$$+\frac{G\left(\frac{\hbar}{lc}\right)^2}{l} = \frac{\hbar c}{l} \rightarrow l_* = \frac{\hbar}{m_* c}$$

$$l_* \sim 10^{-33}\,\mathrm{cm}$$

$$m_*\left(\frac{m_*}{m_p}\right)^2 \sim 10^{33}\,g$$ fermion star の上限質量

$$m_*\left(\frac{m_*}{m_p}\right) \sim 10^{15}\,g$$ boson star の上限質量

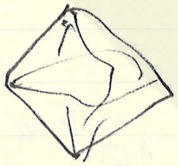
②曲った時空の量子化

Kerr metric

Klein paradox

$\tan p = t + r$

$\tan q = t - r$



$$k_BT = \frac{\hbar c^3}{8\pi GM} = \frac{1}{8\pi} m_* c^2 \left(\frac{m_*}{M}\right)$$

$$\sim 10^{22}\left(\frac{1}{M}\right)_{o}\, eV$$