NOTE BOOK

Manufactured with best ruled foolscap
Brings easier & cleaner writing

研究メモ
June, 1959 ~ Aug. 1959
Kiev 学会つづき ~
外国旅行: San Diego ~ Copenhagen ~ London ~ München ~ Moscow ~ Kiev ~ Pauling ~ Vigier ~ Kyoto.

VOL. XI

YUKAWA

Nissho Note

日章 BA4 45

XI

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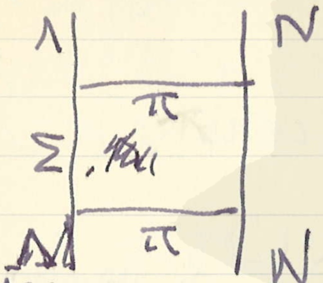
CHAPTER	DESCRIPTIONS	PAGE
Kiev 学会記 つづき		
San Diego	General Dynamics	
Copenhagen		
London	Conference on Nuclear Forces	
München	Max-Planck-Institut	

Kiev 学会つづき

[illegible]: K - hyperon の parity

$P_{\Sigma\Lambda} = (-)$ と考えると困る。

∵



$m_\Sigma = m_\Lambda$ }
$(\Sigma\Sigma\pi) = 0$ }
$(\Lambda\Sigma\pi)$ = scalar

$= 0$

実際は $m_\Sigma - m_\Lambda = \frac{m_\pi}{2}$

$(\Sigma\Sigma\pi) \neq 0$ だから

N, Λ, Σ : parity (+)

static model で

$K^+ + p \sim 10$ mb 斥力

$K^- + p \sim 50 \sim 70$ mb

を説明出来ない。K (+) では困る

K (−)/pion: $I = 1/2$, $J = 3/2$ で resonance

200 MeV これは困る。

K^+p は力が[illegible]

K^-p を考えると困難はだめらしい…。

[illegible](北大):

実) K^+, K^- と K^0 の parity をかえると、一般に effect が大きすぎる。たとえば

mass diff.

は[illegible]くなる　$g_K^2 \cdot m_K (I_+ \pm I_0)$

baryon はすべて同じ parity

$K^\pm$: scalar, K^0: ps. scalar

$m_{\Sigma^-} - m_{\Sigma^0} \simeq m_{\Sigma^0} - m_{\Sigma^+}$

細川: K^0 と $K^\pm$ の mass diff.

9a: 福富模型
中川: β-decay の coupling const.

$g_{GT}/g_F = 1.25$

(meson theory では < 1) → one-pion region

S-state エバタイル core から出る?

で合せり　$g_G < g_G^0$

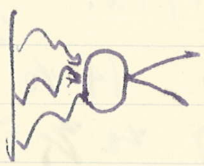
$N N \bar{N}$ 3ぱいの 奇parity をもつから

もっと 3ぱいの ~~higher~~ config. を考える。

$g_{GT}|_{max} = 1.378\, g_{GT}^0$

(I=0, vector or scalar meson)

3π configuration の contribution ?



松原・下東・前原

μ-capture の GT coupling

(i) $\mu^- + C^{12} \to B^{12} + \nu$
$\downarrow$
C^{12}

$(g^\mu_{GT})^2/(g^\beta_{GT})^2 = 1.375 \pm 0.08$

Burgman, P.R.L. 1 469 ('58)

Ca^{40}　(ii) $\cong 1.34$

$1 + \frac{2m_\mu}{3M}\beta + \frac{m_\mu^2}{12M^2}\beta^2 + \cdots$

$\beta \simeq -8$　どの程度がむずかしい…?

conserving current

$\Sigma^+ \to p^+ + \overset{n}{\Lambda}$?

$\Lambda \to N + l + \nu \qquad g'$

$N \to P + e + \bar{\nu} \qquad g \qquad \left(\frac{g'}{g}\right)^2 \simeq \frac{1}{10}$

小川: 前提 (i) Λ, P, N i 対称性 $\lambda(\bar{\psi}\psi)^2$

(ii) μ, e, ν と同様 short range で Λ と P, N の mass difference 生ずる $\psi = \begin{pmatrix} P \\ N \\ \Lambda \end{pmatrix}$

結論 (i) $\underbrace{K^{\pm}, K^{0,\bar{0}}, \pi^{\pm,0}, \pi_0'}_{ps,\ spin\ 0.}$) 9つの state

π_0 ?

(ii) $(NN\bar{P}) \to \Xi\ (\Lambda, \Lambda, \bar{P})$

$J = \frac{3}{2}^+$

(iii) $l=0$ が一番安定.

Λ, Σ の parity は逆.

(iv) $K_{e3} \to \pi^0 + e + \nu$

$\to \pi^{0\prime} + e + \nu$

$m_{\pi_0'} = 680\, m_e \pm 10\, m_e$

$\pi_0' \to \pi + \pi \quad \times$

$\searrow \pi + \gamma \quad \times$

$\searrow 2\gamma$

$\searrow \pi + \pi + \gamma$

多重発生

Frautschi, $N\bar{N}$-annihilation (未発)

Fermi model. $V = \frac{4\pi}{3}a^3$　$a = \frac{1}{\mu}$

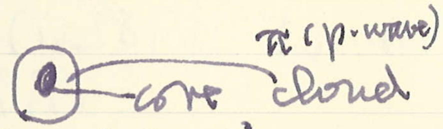
では multiplicity $N = 2 \sim 3$ ($N_{exp} \sim 5$)

~~…~~ K/N が大きすぎる

1) V を大きくするか

2) π-π 相互作用を入れる

3) Koba-Takeda



特に K のでてくる star で K の kinetic energy をしらべれば

1) 100 MeV

2) 120 MeV

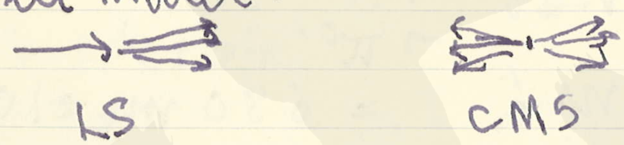
3) 170 MeV ✓

16 events

西村; 宇宙線実験

東大.

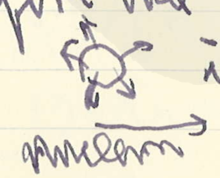
Niu model:



Ciok

Cocconi

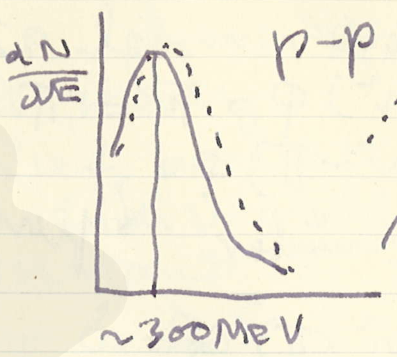
Takagi-model



fire ball の不変 ($\gtrsim 10^{11}$eV $\sim 10^{13}$eV) ($\sim 10^{10}$eV)

エネルギー分布　数百 MeV

Planck分布
$kT \sim \mu c^2 \sim 2\mu c^2$

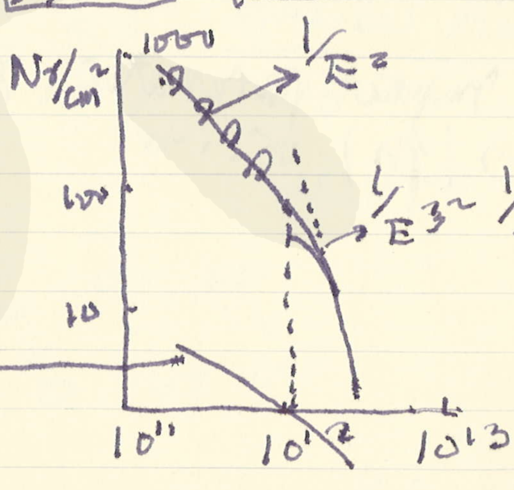


p-p
$10^{12} \sim 10^{13}$ eV
~ 6.2BeV

3×10^{14} eV - event
$\gtrsim 10^{14} \sim 10^{15}$ eV　　1 Ton　1 m^2
2時間 ~ 3日 確かな例あり.
山の上で時間を短く?

1. balloon　　10 hr
2. airplane　　1000 hr
3. mountain　(2.7 km 乗鞍 → 4000時間 / 1年
　　　　　　(5.5 km ボリビア → 1ヶ月

空気中のγ線
single γ
cascade γ
$\frac{\text{cascade } \gamma}{\text{single } \gamma}$



Powell : comet

balloon

並木：場の確率 model の基礎.

$$(\Box - m^2)\phi = F = \Pi\cdot\phi + f$$

$$(\Box - m^2 - \Pi)\phi = f$$

c-number　　fluctuating source でおきかえ

$$(\Box - m^2 - \Pi) G = \delta$$

$$\mathcal{H} = \int f\phi\, d^3x$$

fluctuation - dissipation theorem

$$\langle f(k, \omega) f^*(k', \omega')\rangle = \coth\frac{\omega}{2T}(\mathrm{Im}\,\Pi)\,\delta(k-k')\cdots\delta(\omega-\omega')$$

小沼：核の現象にある一つの様相

(1) interaction time の一定 $t \simeq 0.68\,\mu^{-1}$

(2) strong interaction

$$e^{i(H_0+H_I)t} \simeq e^{iH_0t}\, e^{iH_It}\, \cancel{e^{[H_0, H_I]t^2}} \cdots$$

(3) relative cross-section

北沢：impact parameter と摂動論

ps (pn) が……

Frautschi

Charge Renormalization Group

June 9th, 1959

renormalizable theory
charge, vertices, wave fns
propagators individually contain
arbitrary constants.

Q.E.D. is invariant under
$$\left\{\begin{array}{l} S_{F_2} = Z S_{F_1} \\ \Gamma_2 = Z^{-1}\Gamma_1 \\ D_2 = Z_3 D_1 \\ e_2^2 = Z_3^{-1} e_1^2 \end{array}\right\}$$

invariant under simultaneous change of momentum scale and charge
(Gell-Mann-Low 95 (1954), 1300)
$k^2 \to \infty$, bare charge is independent of physical charge

dispersion relation:
$$\lim_{\omega\to\infty} D_0(\omega) = \frac{2}{\pi}\int_0^\infty \frac{d\omega' \omega' A_0(\omega')}{\omega'^2 - \omega^2}$$
indep. of f^2 — depends on f^2

so $D_0(\infty) = \underline{0}$ or ∞

so $A_0(\infty) = 0$ or ∞

Ex. 1: $d = \dfrac{1}{1 - \frac{e^2}{3\pi}\ln x}$ (Landau)

Bogoliubov N.C. 3 ('56)

845,

ex. 2:

非平衡；力学＋統計

June 9, 1959

定理1. 自由度 n が充分大で、
$H(q,p)$, $A(q,p)$ が或る性質を満すとき.
(i) t に於ける a の distribution が
$\langle a(t)\rangle$ の所に非常に大きな peak をもつ
(ii) $\lim_{t\to\infty} \langle a(t)\rangle = a_{eq}$ が存在する
(iii) $\lim_{t\to\infty} \langle a(t)\rangle = \langle\langle A(p,q)\rangle\rangle$ phase average

Liouville の定理 (Born)
$\pi(\alpha,\varphi,t) = \pi_0(\alpha, \varphi - \nu(\alpha)t)$,
α, φ : const of motion

定理3. π_0 が $t=0$ α に関する distrib.
と φ に関する distrib の direct product
ならば
$$\sigma_i(t)^2 = t^2\langle(\nu_i - \langle\nu_i\rangle)^2\rangle_0 + \sigma_i(0)^2$$
$$\sigma_i(t)^2 = \langle(\varphi_i - \langle\varphi_i\rangle)^2\rangle$$
但し $\langle\nu_i\varphi_i\rangle = \langle\nu_i\rangle\langle\varphi_i\rangle$

Schrödinger方程式　wave packet
のどこがちがう　q と p は揃えて
では…

M. Fukutome, Math. Foundation of the Axiomatic Construction of Q.F.T.

Fundamental Assumptions.

i) local field operator system の存在

$f_\alpha(x_\alpha \xi_\alpha) \equiv f(x_1 \xi_1, x_2 \xi_2, \dots x_n \xi_n)$

$f_\alpha(L x_\alpha \xi_\alpha) = \sum \prod_{i=1}^{n} C_{\xi_\alpha \xi'_\alpha}(L) f_{\alpha}(x_\alpha, \xi'_\alpha)$

無限回微分可能. complex 値 compact 台をもつ. test 関数の空間 $\mathfrak{J} \ni f$

Hilbert space $\mathfrak{H}$

$Q(af + bg) = aQ(f) + bQ(g)$

$f(x_1 \dots x_m \dots x_n) = g(x_1 \dots x_m) h(x_{m+1} \dots x_n)$

$Q(g \otimes h) = Q(g) Q(h)$

$f \to Jf$: conjugate linear

$Q^*(Jf) = Q(f)$

Q : real.

ii) Vacuum $\Phi \in \mathfrak{H}$

$\Psi = C_0 \Phi + C_1 Q_1(f_1) \Phi + C_2 Q_2(f_2) \Phi$

Ψ が $\mathfrak{H}$ で dense. → $\mathfrak{H}$ は separable

$Q_2 \to \int Q(x_1) Q(x_2) f(x_1, x_2) dx_1 dx_2$

iii) Invariance

$(\Phi, Q^*(f) Q(g) \Phi)$

$= (\Phi, Q^*(U(L)f) Q(U(L)g) \Phi)$

$= W(f, g)$ Wightman fn

iv) Uniqueness of vacuum

Φについて invariance の要求を課すと

の[illegible]…

$W(f, f) > 0$ positive definiteness

pure state の必要条件.

[illegible]で vacuum の存在を[illegible].

$Q(f)\Phi = \Phi_f$ $(\Phi_f, \Phi_g) = W(f, g)$

weakest topology

$\overline{\mathfrak{J}_W}$: completion

displacement operator を $\mathfrak{H}$ の上で定義する条件.

$W(f, U(a)g) = (\Phi_f, \Omega(a)\Phi_g)$

Conjecture : W - slow increasing distribution

$|W(x_1, \ldots x_n)| < C x^n$

(Fourier transform の場合)

$|W(k_1, \ldots k_n)| < C k^n$

Energy の positive definiteness

$-k_\mu^2 > 0 \qquad k_0 \geq 0$

の条件 Wightman distrib. [illegible]

なる。

Conjecture: displacement operator が hermite → $-k_\mu^2 > 0$.

Particle aspects:

$W(f_1, f_2, f_3) = (\Phi, Q^*(f_1) Q(f_2) Q(f_3) \Phi)$

十分条件

Q: normal i.e. $[Q(f_t), Q(g_t)]_I = 0$

Conjecture:

local commutability (microcausality)

Asymptotic field

$Q(e(m) f) = Q^{asp(m)}(f)$

Travel Abroad
June 23 ～ Aug. 2, 1959

June 23 leave Tokyo for Los Angeles by JAL.

June 24 7.30 Los Angeles
9.58 San Diego by UAL
Dr. Rostoker comes to see and take to ~~the~~ Town House Hotel in La Jolla.
6.30 p.m. Reception and Buffet dinner at La Jolla Beach and Tennis Club

June 25 Dedication ceremony of John Jay Hopkins Laboratory for Pure and Applied Science, General Atomic Division, General Dynamics.
Speakers: F. de Hoffmann, N. Bohr and many others.
Strong sunshine pours on my head.
Dr. Rosenbluth take care

June 26
9. a.m. Colloquium
"The Meaning of Quantization in Field Theory" Yukawa
"Interpretation of High Intensity Radiation Rings Around the Earth"
Afternoon: Film Interview with Rosenbluth
taken many pictures
Dine with Rosenbluths and Rostokers. near air port of San Diego

8.55 p.m. leave for Los Angeles by UAL

23.55 leave Los Angeles for Copenhagen by SAS through Winnipeg, Canada and Greenland.

June 28, 4.30 a.m. arrive Copenhagen

Mr. Yamaguchi of Embassy of Japan takes to Ambassador Tatske's Residence

Afternoon Mr. Tatske with Shimazaki and Fujisaki comes back from week-end vacation

stay at Tatske's Residence

June 29:

10 a.m. go to Embassy with Tatske

Telegram to Prof. Massey

Aerogram to Sumi Massey Yamazaki 第1信

Afternoon: stay home

July 1 30:

11 a.m. go to British Embassy to get visa with Mr. Yamamoto of Japanese Embassy.

afternoon: Ex-Ambassador Shima from Stockholm stays at Tatsuke's home until after dinner.

July 1: Wednesday
Stay at Tatsuke's Residence whole day; preparing for the coming conferences in London and Vien, mostly reading papers by Japanese physicists such as Iwadare and Miida.

July 2: Thursday
Stay home, ~~Read~~ Summarizing the works by Iwadare, Miida et al. in the form of "Present Status of Meson theory".
Go out for a walk around the residence in the evening. Populus, cherry trees, nice ~~houses~~ brick houses, quiet atmosphere ......

July 3: Friday
Dinner with the Japanese delegates to London Conference on Whale Fishery at Tatsuke's Residence.

July 4: Saturday, Fine and warm
In the evening walk ~~to the~~ through the forest to the sea-shore with Tatsuke

July 5: Sunday, fine and warm
Go by train to Odense. Ferry boat.

8.40 Copen.) express train
12.00 Odense.)
13.50 ") " "
17.13 Copen

July 6: Monday

July 7: Tuesday, Mr. K. Makimura
Copen 10.30 SAS 501.
London 13.30
Mr. H. Murata, Embassy in London
Tavistock Hotel, Tavistock Square
London, W.C.1.
British Museum
Science Museum
Very warm in London

Nuclear Forces and Few Nucleon
London Conference
University College

July 7: 7 p.m.
Reception at University College
Dinner at Amb. Ohno's Residence
July 8: Very warm and fine
Massey: Opening Address

R. Marshak   Phenomenological Aspects of Two-Nucleon Interaction

$$V = V_0(r, k, L) + V_1\,\sigma_1\cdot\sigma_2 + V_2 S_{12} + L\cdot S\,V_3 + (\sigma_1 L\cdot\sigma_2 L + \ldots)V_4 + \sigma_1 p\cdot\sigma_2 p\,V_5$$

non-local potential
depolarization?

G. Breit   Two-Nucleon Phenomenologic
Phase shift versus Energy fits
one-pion exchange
$10 < g_0^2 < 15$.
$L \gtrsim 5$.

H. P. Noyes; Energy Dependence of the $^1S_0$ phase.
1.397, 2.425 MeV ~ 40 MeV
dispersion v. hard core

J. Gammel: Non-locality in the Two-Nucleon Potential.
spin-correlation: large

R. Wilson: Experimental Status of the Nucleon-Nucleon Interaction

p-p scattering

low energy, polarized beam

2.6 MeV (Wisconsin)
3.5 MeV

30° cm	0 ± 0.15%
45°	0.2 ± 0.2%
53°	0.4 ± 0.2%

18 MeV

0.5 ± 0.6%

310 MeV (Berkeley) ($p+p \to \pi^+ + D$)

320, 380 MeV (Liverpool)

147 MeV (Harvard) } disagreement
142 (Harwell) }
95 MeV (Harvard) }
98 MeV (Harwell) }

(Rochester)

---

n-p scattering

L. H. Johnston, p-p ang. distrib. from 10 ~ 68 MeV.
phase shift max. of S-wave at 10 MeV.

A. E. Taylor, Rotation parameter in p-p-scattering (R)

E. Heer, Triple Scattering Experiments at 210 MeV

J. K. Perring. Phase shift Analysis of p-p-scattering.
140 MeV Harwell

E. L. Lomon, Nucleon Interaction as a boundary condition

$$V(r) = g^2 m_\pi c^2 \tau_1 \tau_2 \frac{e^{-\mu r}}{r} \Big[(1 - e^{-\beta_1 r} + \alpha_1 e^{-\mu r}) \left(1 + \frac{3}{\mu r} + \frac{3}{\mu^2 r^2}\right) S_{12}$$

$$+ \sigma_1 \sigma_2 (1 - e^{-\beta_2 r} + \alpha_2 e^{-\mu r}) \Big]$$

$$, r > r_c$$

$$r < r_c ; \quad \frac{u_{\ell j s}}{u'_{\ell j s}} = f_{\ell j s}$$

N. Bolsterli ; Finite-Range Delta Function Potential.

J. J. Thresher ; n-p ang. dist and polarization in the range 20 ~ 120 MeV

R. Marshak

S. M.

G. T.

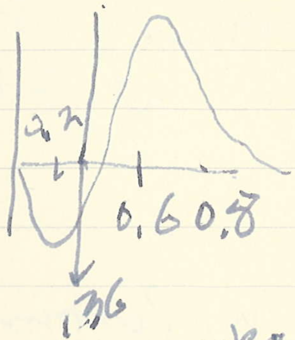
V_c^0 (G)

V_c^e (G) $\mu r = .21$

V_T^0

150 MeV − 310 MeV

R. Bryan



$V_0 \frac{1}{x}\frac{d}{dx}\left(\frac{e^{-\kappa x}}{x}\right)$

||

21 MeV TY(R)

110 TY(3) − 40 TY(2)

K. A. Brueckner, Meson Theory of Nuclear Forces

TMO

FST

KMO

BW : Brueckner − Watson

G : Gartenhaus

Pair suppression.

$\psi = \left(1 + \frac{1}{W - H_0} h\right)\psi_0 , \quad E = \frac{(\psi,(H_0 + h)\psi)}{(\psi, \psi)}$

$W = E_D$ $\quad V_2(r) + \frac{\{V_2(r)\}^2}{(\omega_n)_{av.}}$ {IMO, FST, KMO

or $W = E$ $\quad V_2(r)$

p-p-scattering 3.9 MeV ?
$(\delta p)_{av}$?

J. Iwadare : Recent work done in Japan on the Two-Nucleon Interaction

p-p $\quad$ 4 MeV $\quad \delta^{n}_{{}^3P} < 0$

18 MeV $\quad \delta^{n}_{{}^3P} > 0$

${}^3O$-potential

Intermediate region
$D(O)$?

A. Klein, Meson theoretical Origin of the Spin-Orbit Coupling
two meson exchange
$V_{LS} \sim (\mu/M)\, V(\text{static})$

July 9: a little cooler
9 a.m. chairman: Yukawa
H. McManus, Impulse approx. and Scattering from Light Elements
L. Castillejo, Impulse approx. for p-d and n-d scattering
(Sakumoto and Sasakawa n-d and n-α scattering)
R. J. N. Phillips. Charge exchange reaction in d.
A. Cromer, Small angle p-α and p-p.

4:10 p.m. Chairman: Gunn
W. Dixon, Photonuclear reactions with light nuclei.

	MeV	Rel. yield
$\gamma\ p\ {}^3H$	19.8	1.0
$\gamma\ n\ {}^3He$	20.0	.95 ± 0.04
$\gamma\ pn$	25.4	{ .19 ± .01
$\gamma\ 2p$	28.2	
$\gamma\ d$	23.7	≤ 0.02

G. Breit, Photodisint. of deuteron

J. Iwadare, "

A. Klein "
meson exchange current
above 100 MeV.

Marshak

7 p.m. Dinner at Mr. Murata's appartment
8 p.m. Regent Park : Twelfth Night
~10.30 p.m. by W. Shakespeare
very cool in the evening

July 10, Friday. cooler in London
get up at 6.30
plane delays one hour
PAA: London 10.00 a.m
Frankfurt
Stuttgart
München 3.15 p.m.
Dr. Yamazaki comes to the airport
Go to Continental Hotel (Grand Hotel Continental) (Telefon 55797))
Rm. 212.
Visit Prof. Heisenberg at Max-Planck-Institut, a new, modern, well-equipped building.
Give Talk on the present status of meson theory from 4.30~6.00 p.m.
Talk with Heisenberg about his theory privately with Dürr and Yamazaki.
Back to the hotel with Yamazaki.
After dinner, take a walk in the street where we meet accidentally with Prof. Kaya and other two members of the mission to Germany. Drink beer at Löwenbräu.
Very warm in München!!!

c033-626〜628挟込

July 11, Saturday
warm and fine.
Mr. Numa from Kyoto University, Faculty of Medicine took Yamazaki and me by car to Schloss Linderhof, south of Munich near the border between Germany and Austria. 2 hours ride up the slope between Bayerische Alpen. cool, rain and thunder.

7 p.m. Dinner at Heisenberg's Residence, Rheinland Straße 1, with Yamazakis, Biermann, come afterwards, +
Go back to the hotel about 11.30 p.m.
+ talked about many things. In particular, Heisenberg told how Pauli fought with devil in relation to 2, 2^2, ... divisions, "Zweifel" is thought to be the ~~effect~~ power of devil. Pauli was interested in philosophy and psychology.
Heisenberg told of his son Wolfgang ~~sail~~ coming to Japan by boat in August. Pauli answered Dirac in 1927 "You have your religion. There is no god. You are the prophet."

Sunday

July 12, Still very warm, fine.
Go to ~~the Ins~~ Max-Planck-Institut with Yamazaki. Heisenberg kindly took us around.
In the afternoon, Numa took us ~~at~~ first to Hofbräuhaus to drink beer and ~~take~~ lunch. After that, visited Deutsches Museum and Pinakotek.
Went to the airport, but SAS ~~air~~ jet plane delayed two hours. So we came back to the town and visited Frauenkirche. Jet plane leave Munich about 7.30 and arrived Copenhagen 9.15. Height is 20,000 ft. and very smooth.

July 13, Monday
Fly over to Moscow by SAS 11am ~ ~~4.3~~ 5 p.m. 門脇大使, 松尾氏. Prof. Iwanenko 等出迎え. 大槻氏, Segré, Moyer, Yennie, Lederman 等アメリカ人多数と同じ飛行機. 門脇大使の車で, УКРАИНА ホテルまで行く. モスコー大学, 住宅地等をすぎる. ホテルで手続きに大分時間を食う.
泊り; Rm. 403.
松尾氏に通訳してもらって, 大槻氏とホテルで夕食中, 木庭氏もやってくる.
小沼氏に会う.
モスコーも非常に暑い.

ストックホルム

July 14, Tuesday 引つづき晴天で非常に暑い.
木庭・大槻両氏とホテルの簡易食堂で朝食. 牛乳のかためたようなものを飲む. ll時より 松尾氏の案内で Kremlin 宮殿を見る. 昔式武器の陳列, 宗教絵画, 旧帝王室等を見せてもらい, Aragvi で Georgia 料理 (鶏料理) を食べ, 市内を車で一周. 芸術座, ボルショイ劇場等を見る.
4時から G ~~[illegible]~~ 近くまで, Intourist との交渉に手間どる. 小沼氏等とあう. 中国代表と一緒に Pekin Hotel で支那料理を食べる.
久二あて第2信.

July 15, Wednesday
今日も暑い。一人で荷物を立て[illegible]。
午前中 部屋で休息。少し足が痛い。
1時 YKPAИHA ホテルを大槻氏と一しょに出発。
3時5分 Moscow 発の AFL 867

エルガキ： 田代夫妻
ロンドン村田氏
山内夫人
8千メートルの高さを飛ぶ

木原氏 ~~[illegible]~~
飛行場まで
一しょについて
きてくれる。
大使館

4時40分 Jet機にて Kiev着。
N. V. Mitskevich（重力論の研究をやってる、サマルカンドの人）の案内で
YKPAИHA Ukraina Hotel につき、
途中 ドニエプル河を渡る。森につつまれた
丘の上の キエフの 街は公園のように
美しい。
Kiev もなかなか暑い。旅館の部屋は(いくぶん)
部屋はあまりモダーンでない。Rm 515。虫が入ってくる

July 16, Thursday
10時に Organizing session のある
Kiev State University (Schevchenko
Boulevard 12) へ行く。
11時すぎから Landau の話を聞く。
[illegible]、武田両氏到着。一緒に昼食。
夕食。Kasachstan の Alma-Ata
から来た Bakibaev 氏と一しょに
夕食。

キエフ市は Ukraina Soviet Socialist Republic の首都で ソ連で最も古い都会の一つ 第三の都会, 人口約百二十万.
10世紀から12世紀に亘って 東スラブの強国 Kievskaya Rus の首都であった.
1654には ウクライナとロシヤが合併
ヨーロッパ指折の大河である Dnieper の上に立ち.
chestnut, poplar, linden, maple 等の並木で 美しい緑地帯をつくっている
人情も純朴で, 人なつこい.

July 17, Friday.

3.30〜6.20 p.m. Bus Trip
Sight-Seeing　　シェフチェンコ Monument — [illegible] —
アンドリゥ教会 — Sophia Cathedral — Monastry
— カタコンブ
Perrin, Møller, Weisskopf, Iwanenko

July 17
Boat trip down Dniepr
sleep in the boat "Chernyshevsky"
(the other boat: "Stahlin")
July 18. Saturday
10 ~ 13 : High Energy Commission
Meeting on the boat
Bakker, Marshak, Panofsky, Peierls.
Tamm, Veksler
Amaldi, Brode, Blochintsev, Yukawa
Agenda:

About three o'clock in the afternoon, arrive Kanev. Climb up the wooden steps to the big statue of Shevchenko. Very warm.

~~In the~~ From 6 to 7 o'clock, a group of young boys and girls perform folk songs and dances.

Sleep in the boat.

Talk with Raysky.

July 19. Sunday.

Come back to Kiev about 10.30 in the morning. 少し涼しい。

お腹の具合が[illegible]あまりよくない。

4時〜6時半 M. Markov, Komar, Koba と non-local field theory について話しあう。

$$\bar{D}(s^2) \to \bar{D}(s'^2) = \frac{\delta(s^2-a^2)}{4\pi} \qquad s^2 = c^2t^2 - r^2$$

とか之

Plenary Sessions I ~ X

July 20 Monday
~ July 25, Saturday

October Palace of Culture

gear ear-phone

speech [illegible]
discussion: consecutively translated

July 20 (Monday)
chairman: D. I. Blokhintsev
opening speech
Davidov, Mayor of Kiev, greeting
34 countries
Procedure
y. Bernardini: Photo production and Compton-effect on nucleon.
2nd, 3rd maximum
Sakurai, polarization

$\frac{\downarrow - \uparrow}{\downarrow + \uparrow} = 0.59 \pm .07$ 700 MeV

$0.30 \pm .12$ 500 MeV

$D(3/2)^-$ $(P(3/2)^+)$

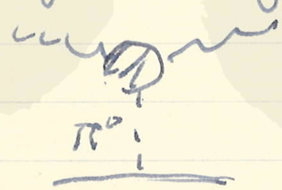
S ?

Wilson model

double pion states

$f^2 = 0.081_3 \pm 0.00$

non-existence of ρ_0
Compton effect



$2 \cdot 10^{-18} < \tau_{\pi^0}$

$8 \cdot 10^{-18} < \tau_{\pi^0} < 5 \cdot 10^{-17}$
?

Adamovich

Bogdansky

Baldin

Frisch

Cini

Fubini 

?

B. M. Pontecorvo, π–~~N~~ scattering and single π-production in π–N and N–N collision.

Walker

Bernardini π–π-int.

Chew

Afternoon
Chairman : R.R. Wilson

E. Segré : Anti-nucleon and their interaction

mass 1%

BeV	total	el.	ex
1.0	~~92~~ 97	33	~~34~~ 4
1.25	90	—	6
2.	79	23	~~2~~ 7

2/3 (within 3%) goes to π±

$$\frac{p-\bar{p}}{pn-\bar{p}} \sim \frac{2}{1} \; ?$$

$$p + \bar{p} \to \Lambda + \bar{\Lambda}$$

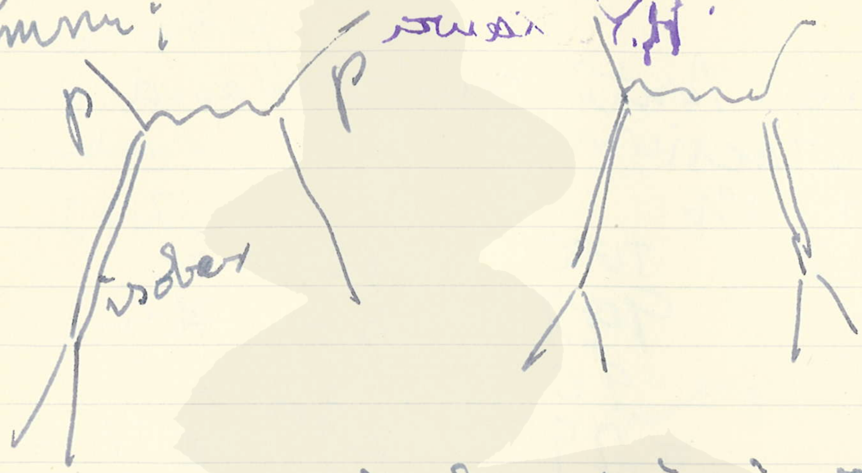
K-meson ?

Piccioni
π-π-interaction

Wang. 7 BeV π-beam

V. I. Veksler, N-N and π-N interaction at 3~9 BeV.

Tamm:



forward-backward anisotropy

transverse momentum transfer constancy.

Feinberg: cosmic ray

[illegible]

July 21, Tuesday
morning 10.0 ~ 12.30
chairman: H. Yukawa
Snowdinsky, N-N scattering
up to 1 BeV

Chew, Theory of Strong Interaction

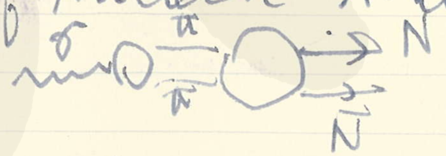
Interviews with journalists.

Afternoon Chairman: Peierls

Panofsky,
Experiments on High Energy QED.

Hofstadter, Nuclear Structure
neutron charge distribution?

Schiff, Theory of Nucleon Structure



F_{2V}

F_{π}

F_{1V}.

F_{1S} F_{2S}

{ Hiida : perturbation
{ Tamm : dispersion integral

Sachs: gage inv.
Hiida: $K \to \mu$

Chew: π-radius large.

July 22, Wednesday
No plenary session
10 a.m. Seminar at Academy
of sciences of Ukranian Republic.
Iwanenko was the chairman.
Heisenberg talked on his theory.
new symmetry $p \to \nu$, $\Lambda \to \mu$
$n \to e$. (Marshak, Okubo, . .)
$l_N \to -l_N$.
Question: What are the observable
quantities in Heisenberg theory?
Answer: Masses etc. and S-matrix.
Gramovsky, Mass spectrum.
Interviews with journalists
二十数年前、我々は"原子は単純である"と信じていた。それに反し、原子は予想外に
内容豊富であることがわかってきた。
それにつけ我々は原子はその内部において

学者であることを信じている。

7 p.m. ~ 9.30 p.m.
Seminar at Academy of Sciences
Chairman: Iwanenko
Zelavitch: N-N force at short distance
Moller: Energy-momentum Affine Tensor
i) conservation $T_{\mu}{}^{\nu}{}_{,\nu} = 0$
ii) energy density $T_4{}^4$ should be independent of choice of space coordinates
iii) $\int T_4{}^4 \, dx^1 dx^2 dx^3 = M_0 c^2$
not positive definite
gravitational wave?
quantization?

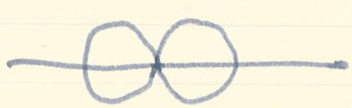
Mitskevitch:

~~Dinner~~ Supper with Terletsky and Shushurin

July 23. Thursday, Morning
Chairman: Wang
J. Steinberger: strange particle production
1. Berkeley
a. $\pi^- + p \to \Lambda^0 + K^0$
b. $\begin{cases} \pi^- + p \to \Sigma^0 + K^0 \\ \pi^- + p \to \Sigma^- + K^+ \end{cases}$
c. $\pi^+ + p \to \Sigma^+ + K^+$

a. 1030 MeV/c: π^- big resonance
b. no resonance
b, c. 1230 MeV/c data do not violate charge independence.
2. Berkeley, Powell
1.15 BeV/c $K^- \to \Xi^-$ 16
$K^- + p \to \Xi^- + K^+$ 2
$Q(\Xi^- \to \Lambda^0 + \pi^-) = 64.0 \pm .5$ MeV
$\tau_{\Xi^-} = 1.9^{+1.7}_{-.6} \times 10^{-10}$ sec.

3. Berkeley, Moyer
$p \xrightarrow{6.2\,\text{BeV}} \varphi^0$ γ-ray production almost isotropic
decay of K^0?



Dubna data (Chinese group)

π^- 6.8 BeV/c bubble chamber

13,500 [illegible]

flat $\pi^- + p \to \left\{ \begin{matrix} \Lambda^0 \\ \Sigma^0 \end{matrix} \right\} + K^{\pm}_0 + n\pi \to 1/3$

~~5000~~ (300 cases)

increase with energy $\pi^- + p \to \left\{ \begin{matrix} K^0 + \tilde{K}^0 + N + n\pi \\ K^0 + K^- + N + n\pi \\ \tilde{K}^0 + K^+ + N + n\pi \end{matrix} \right\} 2/3$

~~[illegible]~~

(50 cases)

$n_\pi \cong 1.9$

total 3 mb

angular distribution

Λ^0 : $\frac{F}{B} = \frac{5}{14}$

K : $\frac{F}{B} = \frac{25}{21}$

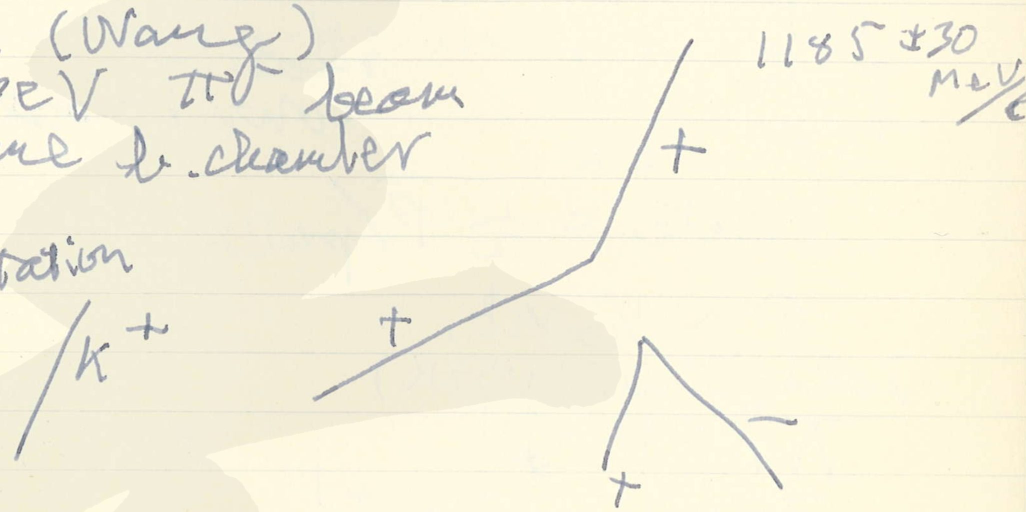
π^{+-} $\frac{F}{B} = \frac{7}{1}$

π^- $\frac{F}{B} = \frac{8}{5}$

statistical theory does not agree
with experiment.
K-K-π doubtful in high energy
region.

Dubna (Wang)
6.8 BeV π^- beam
propane b. chamber

interpretation
i)



$K^+ + N \to \pi^+ + K^0 + N$

ii) $E_N \approx 7$ MeV

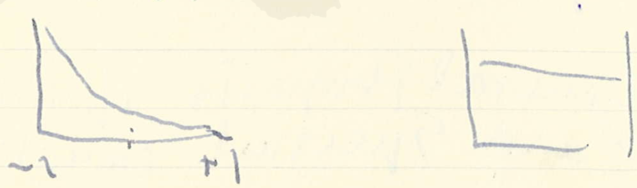
$D^+ \to \pi^+ + K^0 + Q$

$M_D = 742 \pm 25$ MeV

$Q = 108 \pm 25$ MeV

new particle

Dubna ( )
1.85 BeV · π^- - beam
23 Λ^0 　 28 K^0



Stevenson (Berkeley)
bubble chamber of Zürich.
$p + p \to \bar{\Lambda} + \Lambda$
1.6 BeV/c

$\bar{p}$ 1
π 0.1 relative constituent
μ 2.6

Rate = $\frac{1}{2}$ $\bar{p}$/pulse

$\sigma \sim 1/10$ mb.

Zeldovitch: (USSR)
$\bar{\Lambda}\Lambda pN = D^p$ $g = 2$
$I = 0$ $I = +1$
$I = 1$ $I = 0$.

Salam: Strange Particle Theory

Afternoon: Theoretical Investigations
Chairman: Votruba (Czechoslovakia)
Shirkov, Dispersion Relations

Karplus, Taylor, Mandelstam

Lehmann, General Properties of Transition Amplitudes and Spectral Functions.

~~Landau's Rem~~
Schwinger, Unstable Particles
continuous mass spectrum
in green function

Landau's remarks on Lehmann's Report.

July 24, Friday
chairman: Tamm

1. Landau:
Nakanishi
Pomeranchuk
Non-locality
Heisenberg
diagram technique
composite particle

2. Markov:
Komar

$$s^2 \to s'^2 = s^2 - a^2$$

$$\Delta^{(\ )}(s'^2) = \int \Delta^{(\ )}(s, \kappa^2)\rho(\kappa^2)d\kappa^2$$

$$D^{ret} = \frac{1}{4\pi}\left[\delta(s'^2) + \varepsilon(x_0)\delta(s^2)\right]$$

$$\Delta^{ret} = \bar{\Delta}(s'^2) + \frac{1}{2}\Delta(s^2)$$

$$D^{ret}_{t\to 0} = 0 \qquad r^2 \gg a^2$$

$$D^{ret}_{t \gtrless 0} = \frac{1}{4\pi}\left[\frac{\delta(\sqrt{r^2+a^2} - c|t|)}{2\sqrt{r^2+a^2}} \pm \frac{\delta(r - c|t|)}{2r}\right]$$

$L\varphi = -\hat{j}$

$D - m^2 \to L = \sim[\quad\quad]^{-1}$

$j = 0 \to (D - m^2)\varphi = 0$

$\{\varphi^{out}, \quad\} = \{\varphi^{in}, \quad\}$?

Thirring model

form factor $\to \delta''(s'^2)$

Blochintsev. high energy interaction

Glaser

L.S.Z. $\to$ non-local theory

3. Thirring

		unitary	
N	2	1	
T N	4 real	2	Heisenberg theory
U N T	6	3	
G N T U	6	6	Sakata

min. number of fields : 6-fields

4. Touschek

$\psi' = e^{i\gamma_5 \alpha}\psi$

rest mass

$R\psi(x)R^{+} = i\gamma_4\psi(\tilde{x})$

mass multiplet

$\psi \to \varphi$,　　$f[\psi] \to \varphi_2$
$e^{-i\gamma_5\alpha}$
existence

5. Heisenberg
Landau, revol. spirit
Touschek
degeneracy, mass
$l \to -l$.
mass reversal
Thirring　　2-component
fermion
helicity → parity

Nambu,　analogy between
(γ_5-invariance in field theory
(gage invariance in super-
conductivity

(free electron gas
(mass　　$N\bar{N}$　pseudoscalar
(energy gap

Schenberg.
+ 0 −　　sub set
space orientation : Faraday

Rayski
Thirring
group considerations)
physical meaning

Bernardini
CERN experiment
parity violation 600 MeV
no !! π- S wave

Dotsenko
Nambu
π-cloud, $\hbar/2Mc$
core

6. Wataghin, non-local theory
i) causal laws 2) existence of 4-dim. domain
are incompatible

i) propagation approximate CM of physical particles
2) S-matrix cut-off in p-space macrocausality
time-like form factor

non-linear Lagrangian with form factor

Koba, Def. of CMS.

Wataghin,

Unitarity

7. Drell, spin-statistics
micro-causality をすてると。
逆の場合も考え得る。

$\pi^+ + P \to \Xi^0 + K^+ + K^+$ 2.3 BeV

$K^- + P \to \bar{\Lambda} + K^+ + K^+$ 1.3 BeV

$(\Box - m^2)\varphi = 0$

$[\varphi(x), \varphi^*(x')] = i\Delta(x - x')$

$\Delta(y) = -\Delta(-y)$

$\Delta(y) = 0$. y: space-like

$\Delta_1(y) = +\Delta_1(-y)$

$\Delta_1(\vec{r}, 0) \sim e^{-mr}$ $r \gg 1/m$

$\{\psi, \psi^*\}_+ = \Delta_1$

$\psi_{out}(x) = S^{-1}\psi_{in}(x)S$

$S^{-1} = S^\dagger$

$P^\nu = \int d^3k \cdot k^\nu (a_{in}^* a_{in} + \cdots)$

4 th order まで macrocausality を
満足させる。

$$(S_2)^2 = S_4 + S_4^\dagger$$

$$j^{\pm}(x) = S^\dagger \frac{\delta S}{\delta \varphi_{in}^{\mp}(y)}$$

Mandelstam

Tanger

Drell: no dispersion relation

Iwanenko:
Same conclusions

Drell unitarity is maintained to
4-th order

8, van Hove, extension of Lee model

$V \rightleftarrows N + \theta$ $\quad g_1^0$

$N \rightleftarrows V + \theta$ $\quad g_2^0$

exactly renormalizable

$K \gg \mu$

$$g_1 = g + \gamma$$

$$g_2 = g - \gamma \qquad g = \sqrt{g_1^0 g_2^0}$$

$$\gamma = g \frac{g_1^0 - g_2^0}{g_1^0 + g_2^0} \left(\frac{\mu}{K}\right)^{g^2/2\pi^2}$$

$K \to +\infty$: $g_1 = g_2 = g$　　Yukawa interaction $N \rightarrow V$

no interaction between Θ & N, V

$\mu \ll K < +\infty$:
modification of regym. of N, V (g^2)
weak interaction $(g\gamma)$
between (Θ, N), (Θ, V)

Gramowskii
Cut-off
Heisenberg

Blochinzev
~~non~~ tuning effect
in functional space

A. Wightman; Examples of
Consistent Field Theory
$(\Box + m^2)\, u_{n+1} = g\, u_n^2 + Re_n$
$u(x) = \lim_{n \to \infty} u_n$

$(\Box - m^2)\, u = j$

. . .

Lorentz invariance

$(\Box - m^2) u^{(0)} = 0$ and g. f. c. r.

$$u = u^{(0)} - \int \Delta R j$$

local solution of local source $j(x)$

$(\Psi_0, u(x_1) u(x_2) u(x_3) \Psi_0)$ in terms of matrix elements of j

$j(x) = g\phi^2(x)$; → no solution

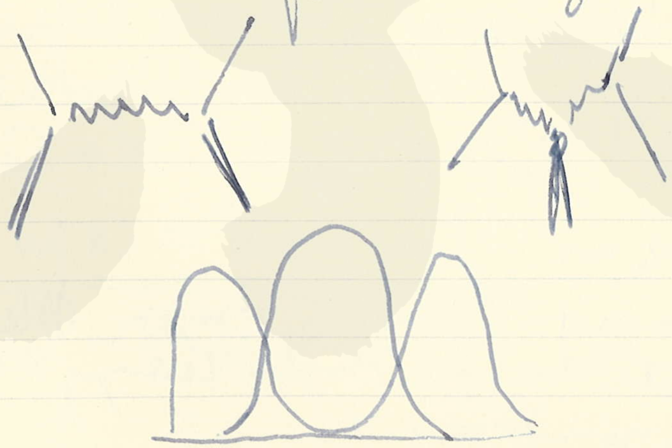
Taylor,

8 p.m ~ 11 p.m,
High Energy Commission Meeting
Collaboration in High Energy Machine,
outside countries ?

July 25, Saturday Morning
chairman: Heisenberg
1. Powell: Nuclear Processes at
Super-High Energies

Koba:

2. Feinberg: Multiple production
at Super-High Energies



Wataghin. high energy momentum
Transfer in CMS. → cut-off
Heisenberg weak → strong

Conclusion:
i) Space-time concept
ii) Q. F. T. high density system
hydrodynamics - thermodynamics
iii) diagram technique

Photograph

3. Dalitz, Hyperfragments
singlet int,
Triplet int.
three body int.

Iwanenko: 3-body force small

4. Tamm: Concluding Remarks
No sensation!!!
Instrumentation
Automatization

8 p.m. Reception by the Presidium of Academy of Sciences of Ukrainian Soviet Socialist Republic at the October Palace of Culture

July 26, Sunday
Leave Kiev by special plane (with about 100 participants of the Conference)
Ty 104 10.25 a.m. Arrive
Moscow in one hour, altitude 8~
9 km. very smooth!
~~Stay~~ Matsubara of Japan Embassy
comes to meet us. (Yukawa,
Koba, (Otsuki) stay at
~~Mo~~ Hotel "Москва" near Kremlin.
still warm, very tired.
Take supper at Hotel Metropole.

July 27, Monday Dubna
9 a.m. ~ 11.30 a.m. Go by ~~bus~~
special bus to Dubna* with ~~40~~ 250
scientists who attended the Conference
including Bakker, McMillan, Alvarez,
Wataghin, Volkof, Schiff etc.
Blokhintsev, Director gave introductory
talk at salon.
~~Dja~~ Dzhelepov took us Synchro~~t~~
cyclotron (freq. mod.) of 680 MeV
proton which has been running
since 1949.
Vekslar took us around Synchro-

* old farmer houses, cows, sheep, canal
forests etc.

phasotron of 10GeV. completed in 1957.

~~Visit~~ Barashenkov took us to the newly (1959) built laboratory of Theoretical Physics directed by Bogolyubov.

Dinner at the salon

leave Dubna 5:30,* arrive Hotel Moscow at 8 p.m. On the bus, had a severe stomachache, unbearable.

10 p.m. Prof. Markov comes to ~~to~~ my room in Hotel Moscow.

July 28, Tuesday　Moscow State Univ

9時. Moscow Hotel で passport をかえしてもらう。12時に Moscow 大学へ行く約束で、木庭・大槻両氏及び Schiff 夫妻といっしょに Hotel で待っていたが、なかなか自動車が来ない。結局 Iwanenko 氏の車で Moscow 大学へ。着いたのは1時半頃。イタリー、インドの人たち5名といっしょになる。Iwanenko 氏の案内で、先ず物理教室の大きな建物に入り、Vice Dean の部屋で一般的説明をきく。ただのコースの5年半。半年が1 semester.

---

* A short detour to Volga.

試験3回するときされる。
1年 36 hours) lecture
2 30 excercise
: laboratory
5 24
1+1/2 of theory
experiment

17~20才で入学。free admittanceは
経験してない。競争試験をうける。落ちたら technical high school
などへ行く

History and philosophy of physics
という ~~cour~~ lecture がある。

2500~3000の学生
約450 在年
300 foreign students
(組織的で養成) pedagogical institute

exchange of students between
Columbia and Moscow
Harvard and Leningrad

50 post-graduate
300 professors ~ assistants
(170 full professors with Dr. degree)

職員全体で 2000人
28 chairs (including ~~mathematics~~)
structure of matter が電磁の話
geophysics
radiophysics
astronomy

物理教室と独立して化学教室.
main building (32階) の中に
geology, biology, . . .
の教室
には natural science [illegible]
学生の 60% が natural science
学生総数 23,000
post-grad. 2,000
学生の寄宿舎. 2000室?

物理教室の大講義室は 500人入る.
黒板が 五段位に動くしかけ.
実験設備もよい. Iwanenko教授
の部屋の額に "Nature is simple in its essence"
宇宙線実験室.
地下 45米
μ-mesons の group.
{diffusion chamber
counters
carbon counters
(40米 water equiv.)

と白板に書く. Dirac は
"physical law should be beautiful".

Vice-Rector に main building であう。
elevator で塔の上にあがる。はるかに Kremlyn が見える

5時 1/4 日ソ協会の人たちの reception に小野氏と、Iwanenko 夫妻と一しょに出席。元の日本大使館が 親善協会館になっている。日本語の上手な人が 何人もいる。

7時半：中川臨時大使邸で晩餐。江藤館員に会う。

July 29, Wednesday
5時半に起きる。6時10分 松原書記官の迎えで Moscow Hotel を出る。7時55分の Aeroflot TU104 で Copenhagen へ向う。2時間で Copenhagen につく。
少し涼しい。
時速 850 km. 高度 9 km.
西村大使邸に落ちつく。

July 30. Thursday
曇り. 小雨. 涼しい. 夏寒中 (140 Kr.)
大使館へ行く, Kiev の Report を air flight で送る.
1 ~ 3 p.m. Prof. Møller 邸で
Lunch. Wick, Toll, Wataghin
の諸君と一しよ.
霧がはれる.
読売講演会の分の原稿書きおわる.

July 31. Friday
朝. 荷物の整理.
午後. 霧雨, 朝8時頃 空晴れる
午後10時 Copenhagen 発 ~~[illegible]~~ の
SAS の engine 不調で
Stockholm に着陸. その夜 Palace
Hotel に泊る. Pauling 夫妻一しよ.
大分 [illegible].

Aug. 1 Saturday
朝11時. SAS DC7 Stockholm発.
13時間で Anchorage 着.

Aug. 2. Sunday
Anchorage から 21時間以内で羽田
着 午後10時前.
スミ, [illegible], [illegible] 夫妻 (小山 [illegible]
夫妻) 等出迎え. むし暑い.
稲田家におちつく.

Summing up

旅行の印象、書くべき事項。

1. 研究所 — 理論物理研究のための環境
   General Atomic
   Max Planck-Institut
   Dubna, Lab. Theor. Phys.
2. 大学
   Moscow 大学
   London 大学
   University College
   Imperial College
3. Science Museum
   London
   München
4. 住宅、住居
   (San Diego)
   London
   (München)
   Kiev
5. 見物
   Regent Park
   Schloß Linderhof.
   Kiev Cathedrals
   Kremlin
   Odeumek
6. 人物。
   Heisenberg. Iwanenko. Landau, Rayski,
   Markov, Møller, Schäff.
   紳士と野人。 Barashenkov, ..
   無作法。

c033-629～632挟込

国際協力、

7. 交信 [illegible]

Rosenfeld: 7.8月, 1960 Australia → 9月 [illegible]
Iwanenko: 4月 1960 or 9月,10月に[illegible]

Wataghin
Markov
Heisenberg

High Energy Commission
Bakker, Marshak,
Peierls, Panofsky,
Tamm Veksler
Yukawa (Amaldi)

Rochester Conference
August 25 ~ Sept. 3, 1960
Symposium at Univ. Calif.,
Berkeley

Accelerator program
3+3+3

Book: Meson Theory ?

湯川、[illegible]
西川: モスクワとキエフ (8月12日?) 失敗 寝ていて組まれ
試していない、
中川
[illegible]川

Conference or Symposium on (unorthodox) field theory.

Supplement : Introduction
Non-linearity and non-locality
in field theories

L. Pauling, Molecular Genetics
要領.　Sept. 11, 1959

sickle-cell anemia
HS . . . . . .

(α α
β β)　— — —
20

DNA
reproduction mechanism
permanence of original
DNA
insulin of man and pig
the same
information theory

Invitation to Miyako Hotel by
~~the~~ President Hirasawa.

S. Mandelstam

π-N scattering amplitude from dispersion relations and unitarity: general theory

P.R. 112 (1958), 1344

Consistency of QED

K. A. Johnson

(P. R. 112 (1958), 1367)

Källen, Helv. Ph. 5 (1958), 169)

Relativistic Hydrodynamics
of Rotating Fluid Masses
D. Bohm and J. P. Vigier
(P.R. 109 (1958), 1882)

$\partial^\nu T_{\mu\nu} = 0$ $\qquad T_{\mu\nu} = T_{\nu\mu}$

$\partial^\lambda L_{[\mu\nu]\lambda} = 0$ $\qquad L_{[\mu\nu]\lambda} = x_\mu T_{\nu\lambda} - x_\nu T_{\mu\lambda}$

$G_\mu = \int T_{\mu 0}\, dV = \text{const.}$

$\partial^\mu j_\mu = 0$

$j_\mu = D u_\mu \qquad D = (j^\mu j_\mu)^{1/2}$

Center of mass : X_μ
Center of matter : Y_μ
Internal angular momentum

$$\mathfrak{M}_{\mu\nu} = \int [(x_\mu - Y_\mu) T_{\nu 0} - (x_\nu - Y_\nu) T_{\mu 0}] \times dV$$

$$L_{\mu\nu} = \mathfrak{M}_{\mu\nu} + Y_\mu G_\nu - Y_\nu G_\mu$$

Neyssenhof's theory

J. P. Vigier

巴黎 1959, 8, 21

Quantum Theory of Internal Motions of Relativistic Rotators
(with D. Bohm and P. Hillion)

i) δ-fn point + isospin
ii) bilocal
iii) $t_{\mu\nu} = \rho u_\mu v_\nu + \theta_{\mu\nu}$
$\theta_{\mu\nu} v_\nu = 0 \qquad v_\mu v_\mu = -1$

$\rho u_\mu + v_\mu$: not a point particle
timelike tube

Møller : 1949

$\partial_\nu T_{\mu\nu} = 0 \qquad \partial_\mu j_\mu = 0$

$G_\mu = \int t_{\mu\nu} \, d\sigma_\nu$

intertial frame Π_0: $G_j = 0$
center of gravity
$X_\mu = \int t_{00} x_\mu \, dV / \int t_{00} \, dV$

I) $\frac{dG_\mu}{d\tau} = 0$

$M_{\mu\nu} = \int \{ (x_\mu - X_\mu) t_{\nu 0} - (x_\nu - X_\nu) t_{\mu 0} \} dV$

II) $\frac{dM_{\mu\nu}}{d\tau_n} = 0$

$S_\mu = M_{\mu\nu} G_\nu$

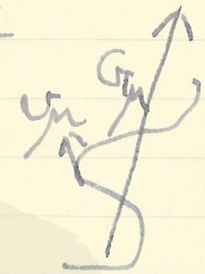
III) $\frac{dS_\mu}{dt} = 0$

Π_0 : $Y_\mu = \int x_\mu j_0 \, dv / \int j_0 \, dv$

Y_μ : centre of matter density

$m_{\mu\nu} = M_{\mu\nu} + G_\mu Y_\nu - G_\nu Y_\mu$

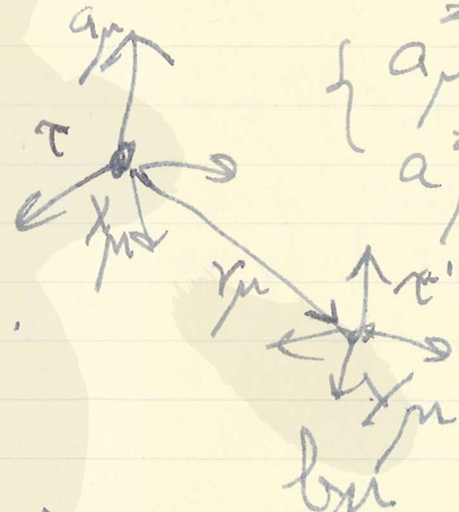
$\dot{m}_{\mu\nu} = G_\mu v_\nu - G_\nu v_\mu$



X_μ　　G_μ　　$M_{\mu\nu}$　　$G_\mu G_\mu = -M^2 c^4$

Y_μ　　v_μ　　$m_{\mu\nu}$

Π^0



$\left\{ \begin{array}{l} a_\mu^\xi a_\nu^\xi = \delta_{\mu\nu} \\ a_\mu^\xi a_\nu^\eta = \delta^{\xi\eta} \end{array} \right.$

6-parameters.

Σ^0

Nakano Lagrangian:

$I \underbrace{\omega_{ik}}_{M_{ik}} \omega_{ik} = I \dot{b}_i^\nu \dot{b}_i^\nu$

$\downarrow$

$I \omega_{\mu\nu} \omega_{\mu\nu} = I \dot{b}_\mu^\xi \dot{b}_\mu^\xi$

基研セミナー. 1959, 8. 27

Discussion with Nakano

$M_{\alpha\beta}\, G_{\beta} = 0$ X $M_{i4} \neq 0$

→ two points are separated

inertia a_μ^3 → $A_l^{r\pm}$
(X_μ)

moving b_μ^3 → $B_l^{r\pm}$
(Y_μ)

$I\omega_{\alpha\beta}\omega_{\alpha\beta} = I\dot{B}_j^{r+}\dot{B}_j^{r+} + I\dot{B}_j^{r-}\dot{B}_j^{r-}$

$(J^+)^2$ $J_3'^{+}$ J_3^{+}

$(J^-)^2$ $J_3'^{-}$ J_3^{-}

$B^{3\pm}$ $A^{3\pm}$

$j^+(j^+ + 1)$ m'^+ m^+

$j^-(j^- + 1)$ m'^- m^-

$J_3^+ + J_3^- = S^3$ → S^2

↓ spin

$\kappa = 0$

$j = 0, \frac{1}{2}$ hermitian

m

i) indefinite metric

ii) Euclidian internal space

isospin m'^+ strangeness m'^+ spin m

$D(\frac{1}{2},0) \oplus D(0,\frac{1}{2})$

	m_+'	m_-'	m	
e^-	1/2	0	±1/2	
ν	−1/2	0	〃	
μ^-	0	1/2	〃	
μ_0	0	−1/2	〃	$\underline{0}$

$D(1,1)$

π^+	1	0	0
π^0	0	0	0
π^-	−1	0	0

$D(\frac{1}{2},\frac{1}{2})$

K	1/2	−1/2	0
K^0	−1/2	1/2	0

$D(1,1/2)$

baryons except Λ^0

$D(1,0)$

γ	0	0	±1	
γ^+	1	0	〃	0
γ^-	−1	0	〃	0

vector mesons

$I\omega_{\alpha\beta} = M_{\alpha\beta}$

$M\dot{r}_a^2 = M_{\alpha\beta}\,G_{\mu}$

物理と認識の会
(四国生命, 新館8階)
Aug. 8. 26. 1959

Feynman path integral
高林氏
伊藤氏

Vigier-Bohm-Hillion model
of elementary Particles
湯川.

G. A. Baker, Formulation of Q.M. based on the Quasi-Probability Distribution induced on Phase space.
(P.R. 109 (1958), 2198)

C.f. T. Takabayasi, P.T.P. 11 (1954), 341.

I. E. Segal, Direct Formulation of Causality Requirements on the S-Operator
(P.R. 109 (1958), 2191)