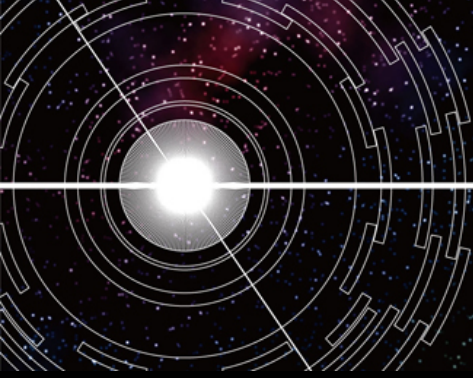


FLAVOR PHYSICS & CP VIOLATION

FPCP 2015

NAGOYA, JAPAN, 25 – 29 MAY 2015



Welcome Address

Hideyo Kunieda

Vice President, Trustee

Nagoya University

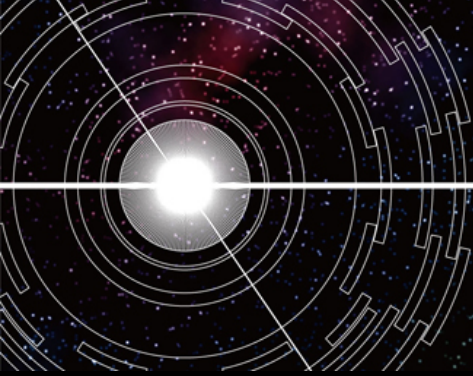


NAGOYA
UNIVERSITY

FLAVOR PHYSICS & CP VIOLATION

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Opening Remarks

Toru Iijima (FPCP2015 chair)

Kobayashi-Maskawa Institute

Nagoya University



Kobayashi-Maskawa Institute
for the Origin of Particles and the Universe

FPCP History

1. 2002 Philadelphia
2. 2003 Paris
3. 2004 Dageu
4. 2006 Vancouver
5. 2007 Bled
6. 2008 Taipei
7. 2009 Lake Placid
8. 2010 Torino
9. 2011 Kibbutz Maale Hachamisha
10. 2012 Hefei
11. 2013 Buzios
12. 2014 Marseille
13. 2015 Nagoya

BCP (B Physics & CP Violation)

- BCP₁ (1994), BCP₄ (2001) hosted by Nagoya

Flavor Physics Conference

 Merged into FPCP series

Flavor physics at Nagoya Univ.



- Sakata Model (1956) → Quark model
- Maki-Nakagawa-Sakata (1962) → PMNS
- Kobayashi-Maskawa theory (1973) → CKM
- Prediction of large CPV in B decays
 - Carter, Sanda (1980)
 - Bigi, Sanda (1981)

A simpler and more elegant scheme can be constructed if we allow non-integer charges. We can dispense entirely with the baryon b if we assign to the triplet the properties: spin $\frac{1}{2}$, $z = -\frac{1}{3}$, and baryon number $\frac{1}{3}$. We then refer to the members $u^{\frac{2}{3}}$, $d^{\frac{1}{3}}$ of the triplet as "quarks" q and the members $\bar{u}^{\frac{2}{3}}$, $\bar{d}^{\frac{1}{3}}$ of the anti-triplet as anti-quarks \bar{q} . Baryons can now be constructed from quarks by using the combinations (qqq) , $(qqq\bar{q})$, etc., while mesons are made out of $(q\bar{q})$, $(q\bar{q}q\bar{q})$, etc. It is assuming that the lowest baryon configuration (qqq) gives just the representations **1**, **8**, and **10** that have been observed, while the lowest meson configuration $(q\bar{q})$ similarly gives just **1** and **8**.

A formal mathematical model based on field theory can be built up for the quarks exactly as for p , n , Λ in the old Sakata model, for example ³⁾ with all strong interactions ascribed to a neutral vector meson field interacting symmetrically with the three particles. Within such a framework, the

Gell-Mann paper (1964)

Kobayashi-Maskawa paper (1973)

CP-Violation in the Renormalizable Theory of Weak Interaction 657

Next we consider a 6-plet model, another interesting model of CP -violation. Suppose that 6-plet with charges $(Q, Q, Q, Q-1, Q-1, Q-1)$ is decomposed into $SU_{\text{weak}}(2)$ multiplets as $2+2+2$ and $1+1+1+1+1+1$ for left and right components, respectively. Just as the case of (A, C) , we have a similar expression for the charged weak current with a 3×3 instead of 2×2 unitary matrix in Eq. (5). As was pointed out, in this case we cannot absorb all phases of matrix elements into the phase convention and can take, for example, the following expression:

$$\begin{pmatrix} \cos \theta_1 & -\sin \theta_1 \cos \theta_3 & -\sin \theta_1 \sin \theta_3 \\ \sin \theta_1 \cos \theta_2 & \cos \theta_1 \cos \theta_2 \cos \theta_3 - \sin \theta_2 \sin \theta_3 e^{i\delta} & \cos \theta_1 \cos \theta_2 \sin \theta_3 + \sin \theta_2 \cos \theta_3 e^{i\delta} \\ \sin \theta_1 \sin \theta_2 & \cos \theta_1 \sin \theta_2 \cos \theta_3 + \cos \theta_2 \sin \theta_3 e^{i\delta} & \cos \theta_1 \sin \theta_2 \sin \theta_3 - \cos \theta_2 \sin \theta_3 e^{i\delta} \end{pmatrix}. \quad (13)$$

M. Kobayashi T. Maskawa I. Sanda



Particle Physics at Nagoya Now

- Belle
- Belle II
- ATLAS
- OPERA (+ DM search)
- Neutron (lifetime, EDM, ...)
- Cosmic Ray (SK, LHCf, Fermi, CTA)
- Theory

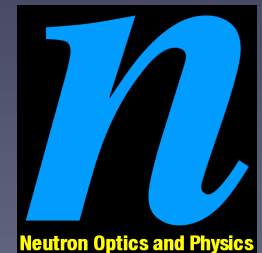
– Lead by Professors M. Tanabashi and J. Hisano

Kobayashi-Maskawa Institute (2010~)

- Center for Theoretical Studies
- Center for Experimental Studies



Kobayashi-Maskawa Institute
for the Origin of Particles and the Universe



Events in this week

25-May 25th	26-May 26th	27-May 27th	28-May 28th	29-May 29th
Welcome/Overview (9:00 – 10:15), chair: J. Hisano	Non-leptonic B decays (09:00 – 10:30), chair:	EDM/Neutron/Charm physics (9:00 – 10:30)	Muons (9:00 – 10:30), chair: Julie Whitmore	Tau / g-2 (9:00 – 10:30)
Welcome address (10:15-10:45) President, Nagoya Univ.	Charm physics (9:00 – 10:30), chair: Charm	EDM/Neutron/Charm physics (9:00 – 10:30)	Charm physics (9:00 – 10:30), chair: Charm	Recent results in tau decays (30), <i>Kiyoshi Hayasaka (Belle, Nagoya)</i>
Opening remarks (5), <i>Toru Iijima (FPCP2015 chair, Nagoya)</i>	Hadronic B decays (30), <i>Eduardo Rodrigues (LHCb, Manchester)</i>	Flavor Physics with neutrons (30), <i>H. M. Shimizu (Nagoya)</i>	MEG/Muon (30), <i>Yoshiyuki Shimizu (KEK)</i>	Hadronic cross section (30), <i>B. G. BaBar, UC Riverside</i>
Challenges for New Physics (10:45-11:15) Wolfgang Altmannshofer (Frankfurt Institute)	Hadronic B decays (30), <i>Marcello Rotondo (Bari)</i>	Recent Results in Charm Physics (Theory) (30), <i>Jeroen F. Kamenik (Ljubljana)</i>	mu \rightarrow e conversion experiments (COMET, Mu2e etc.) (30), <i>Akira Sato (COMET, Osaka)</i>	New g-2 experiments (30), <i>Mike Eads (Fermilab g-2, Northern Illinois University)</i>
Theoretical prospect for B physics (30), <i>Robert Fleischer (Nijmegen)</i>	Coffee break (10:30 – 11:00)	Coffee break (10:30 – 11:00)	Coffee break (10:30 – 11:00)	Coffee break (10:30 – 11:00)
Yulia U. Amsterdam (Amsterdam)	LOCD / Rare K (11:00 – 12:30)	Charm Physics (11:00 – 12:30)	Neutrino (11:00 – 13:00)	Future B expts. / Outlook / Closing (11:00 – 13:15), chair: <i>Toru Iijima</i>
Coffee break (10:15 – 10:45)	Lattice Calculation for Rare Kaon Decays (30), <i>N. Christ (Columbia)</i>	Mixing and time-dep CPV in charm decays (30), <i>Abhishek Mishra (IIT Bombay)</i>	Neutrino physics (theory) (30), <i>Z.Z. Xing (Beijing)</i>	LHCb upgrade (30), <i>Umberto Marconi (LHCb, Bologna)</i>
Non-leptonic B decays (10:45 – 12:45), chair:	Rare kaon decays: challenges and perspectives (30), <i>G. D'Ambrosio (INFN, Napoli)</i>	Time-integrated (direct) CPV in charm decays (30), <i>Stefano Perazzini (LHCb, Bologna)</i>	Long-baseline neutrino experiments (30), <i>A. K. Ichikawa (Kyoto)</i>	SuperKEKB/Belle II (30), <i>Matt Barrett (Belle II, Hawaii)</i>
Theoretical status of non leptonic heavy meson decays (30), <i>Rahul Sinha (IMSc)</i>	Mixing-induced CP violation in Bs decays (30), <i>Simon Akar (LHCb, Marseille-CPPM)</i>	Semileptonic D decays (+ others) (30), <i>Gangrong Rong (BES III, IHEP Beijing)</i>	Reactor neutrino experiments (30), <i>Seon-Geun Hong (Korea)</i>	Theoretical Outlook (30), <i>Zoltan Ligeti (LBL)</i>
Recent measurement of the UT angles (incl. gamma from B \rightarrow Dh) (30), <i>Markus Rothkrans (BaBar, Caltech)</i>	Lunch (12:30 – 14:00)	Excursion (with lunch box)	Hyper K (30), <i>Francesca Di Lodovico (HK, OMIU)</i>	Experimental Outlook (30), <i>K. Habeler (Lausanne/KEK)</i>
Lunch (12:45 – 14:15)	Top, Higgs, ... (14:00 – 16:00), chair: K.F. Chen	Excursion (with lunch box)	Lunch (13:00 – 14:30)	FCPCP2016 (10), <i>Markus Rothkrans (Caltech)</i>
	Interplay between LHC and flavor-physics (30), <i>Jorge Martin Camalich (U. Valencia)</i>	Excursion (with lunch box)	HF production / Spectroscopy (14:30 – 16:30), chair: <i>Xiao-Gang He</i>	Closing Remark (10:00 – 10:15)
Semileptonic & leptonic B decays I (14:15 – 16:15)	LHC (ATLAS, CMS, LHCb) Run 2 status (30), <i>Stephanie Zimmermann (ATLAS, Albert-Ludwigs-Universitaet Freiburg)</i>	Excursion (with lunch box)	Production and decay of HF baryons (30), <i>Nicola Neri (LHCb, Universita di Milano)</i>	
Theoretical status of rare and semileptonic heavy meson decays (30), <i>Christoph Bobeth (Munich)</i>	Top quark properties (Mass, W, tb anomalous couplings etc.) (30), <i>Jacob Thomas Linares (CMS, Fermilab)</i>	Excursion (with lunch box)	New results on quarkonium production and decays (30), <i>Peter Lewis (BaBar, SLAC)</i>	
EW: b \rightarrow s gamma (30), <i>Luis Hernandez (Belle, Bonn)</i>	Higgs couplings + BSM (30), <i>Peter Onyiah (ATLAS, University of Texas at Austin)</i>	Excursion (with lunch box)	Exotic hadrons at hadron colliders (30), <i>Sheldon Stone (LHCb, Syracuse)</i>	
Leptonic B decays (tau nu, l nu, l nu gamma) (30), <i>Chan Seok Park (Belle, Yonsei)</i>	Coffee break (16:00 – 16:15)	Excursion (with lunch box)	Exotic hadrons at electron colliders (30), <i>Zhiqing Liu (BES III, JGU)</i>	
Coffee break (16:15 – 16:45)	Top, Higgs, ... (16:30 – 17:30)	Excursion (with lunch box)	Coffee break (16:30 – 17:00)	
Semileptonic & leptonic B II / LOCD I / Discussion (18:45 – 18:45)	BSM searches (SUSY and others) (30), <i>Altan Cakir (CMS, DESY)</i>	Excursion (with lunch box)	Spectroscopy / Special lecture (17:00 – 18:15)	
new D(*) tau nu result from LHCb + non-B semileptonics (30), <i>Gregory Ciezarek (LHCb, Amsterdam-Nikhef)</i>	Light Higgs & dark gauge bosons (including results from Belle/BaBar) (30), <i>Abner Soffer (BaBar, Tel-Aviv)</i>	Excursion (with lunch box)	Exotic hadronic states with charm and bottom (30), <i>M. Oka (TIT)</i>	
new D(*) tau nu result from Belle + non-B semileptonics (30), <i>Thomas Kuhr (B, LMU)</i>	Poster session (17:30 – 19:00)	Excursion (with lunch box)	Special lecture (18:15 – 19:00) (moving)	
Testing the Standard Model and beyond with lattice QCD (30), <i>T.Vladikas (Roma)</i>	Excursion (with lunch box)	Excursion (with lunch box)		
Excursion (with lunch box)	Excursion (with lunch box)	Excursion (with lunch box)		
Reception Party (19:00 – 21:00)	Excursion (with lunch box)	Excursion (with lunch box)	Banquet (19:00 – 21:00)	

Opening / Overview

Non-leptonic B decays

Non-leptonic B decays

Semileptonic & leptonic B

Discussion

Reception Party

Semileptonic & leptonic B decays / LOCD

LOCD + rare K

Excursion

Top, Higgs, ...

Top, Higgs, ...

Top, Higgs, ...

BSM searches (SUSY and others)

Light Higgs & dark gauge bosons

Excursion (with lunch box)

EDM/Neutron/Charm

Charm

Excursion (with lunch box)

Excursion (with lunch box)

Excursion (with lunch box)

Excursion (with lunch box)

Excursion (with lunch box)

Excursion (with lunch box)

Excursion (with lunch box)

Excursion (with lunch box)

Excursion (with lunch box)

EDM/Neutron/Charm

Muon

Excursion (with lunch box)

Excursion (with lunch box)

Excursion (with lunch box)

Excursion (with lunch box)

Excursion (with lunch box)

Excursion (with lunch box)

Excursion (with lunch box)

Excursion (with lunch box)

Banquet

Tau / g-2

Future B / Outlook / Closing

HF production Spectroscopy

Special Lecture Kobayashi-san

Banquet

Foods in this week

- Lunch served on the 1st floor (Mon – Fri)
 - Lunch box for everyone on Wed (27th)
- Reception on the 1st floor (this evening)
- Light meals and drinks during the poster session (26th)
- Banquet at Hotel Tokyu on Thu.(28th)
- Coffee / donuts available from 8:30 (Tue – Fri)

Don't worry about foods !

Acknowledgements

- Inoue Foundation of Science
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- Nagoya University
 - Program for Promoting the Enhancement of Research Universities



Enjoy your stay at Nagoya !

