Hadron Physics Research Journey with the Late Professor Yongseok Oh

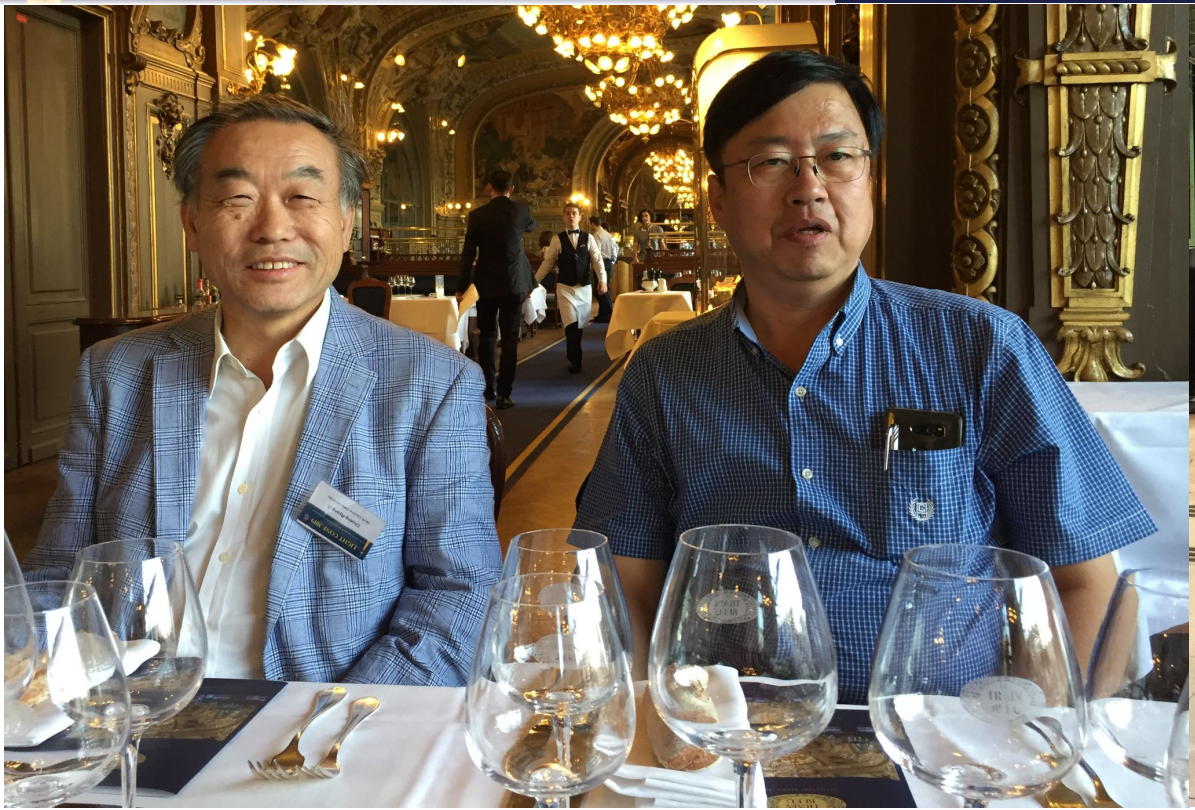
Chueng-Ryong Ji
North Carolina State University

14th APCTP-BLTP JINR Joint Workshop
- Memorial Workshop in Honor of Prof. Yongseok Oh
July 11, 2023

LIGHT CONE 2019

LC2019 - QCD ON THE LIGHT CONE: FROM HADRONS TO HEAVY IONS

Campus de l'École polytechnique
Palaiseau, France

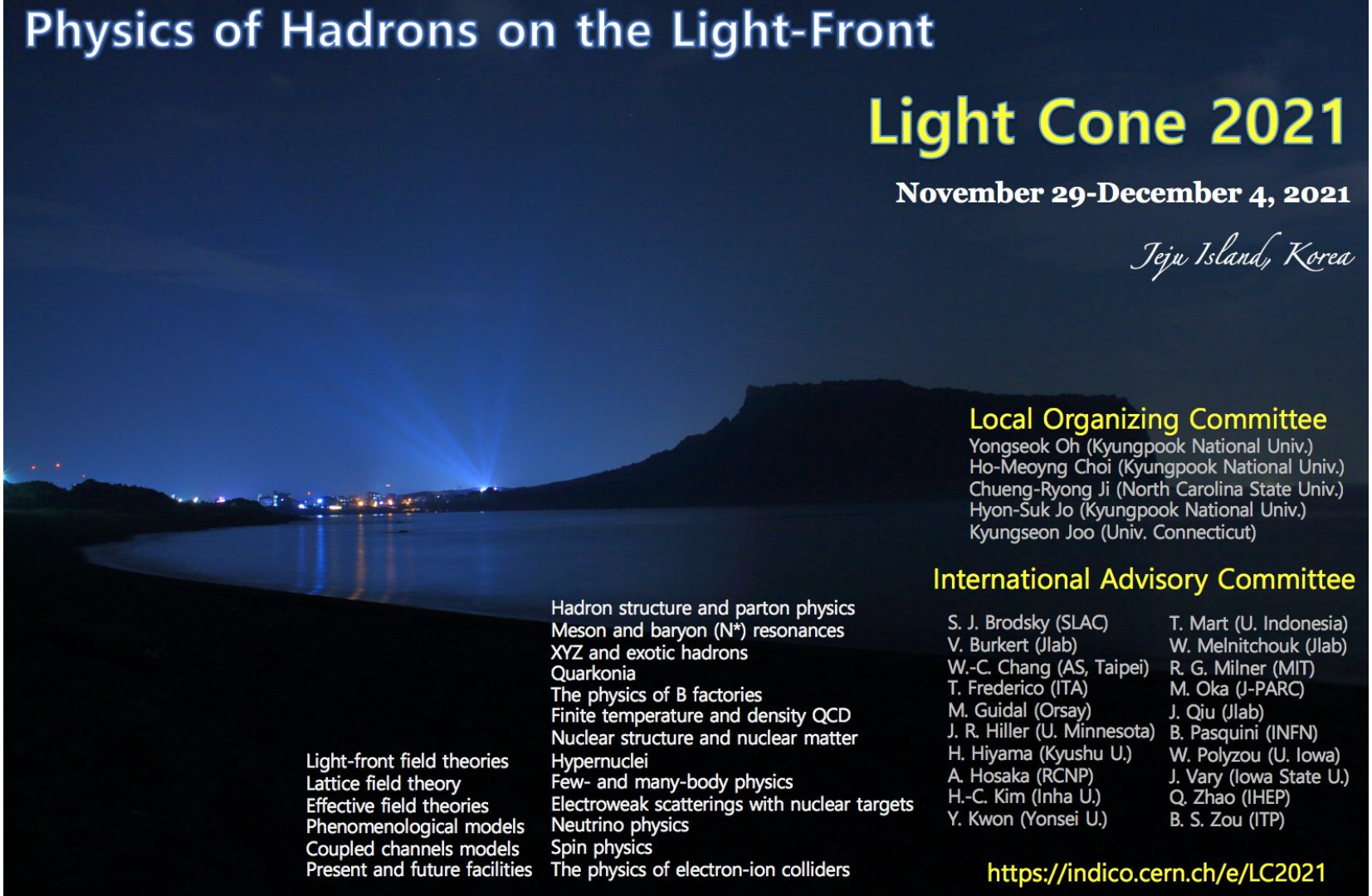


Physics of Hadrons on the Light-Front

Light Cone 2021

November 29-December 4, 2021

Jeju Island, Korea



Local Organizing Committee

Yongseok Oh (Kyungpook National Univ.)
Ho-Meoyng Choi (Kyungpook National Univ.)
Chueng-Ryong Ji (North Carolina State Univ.)
Hyon-Suk Jo (Kyungpook National Univ.)
Kyungseon Joo (Univ. Connecticut)

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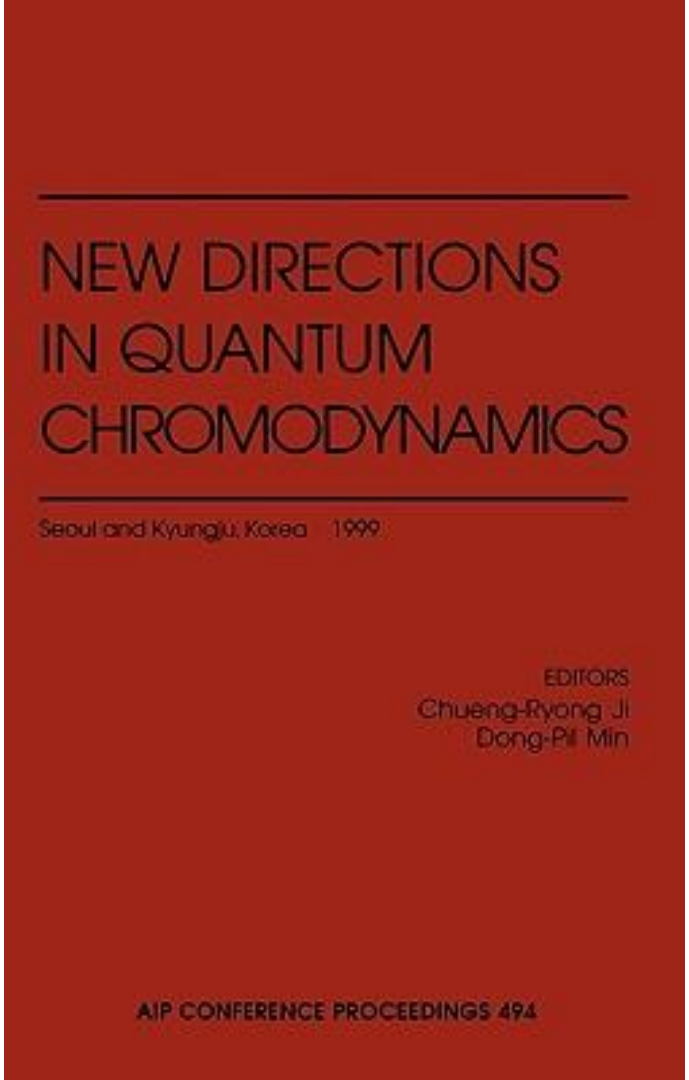
J. Vary (Iowa State U.)
Q. Zhao (IHEP)
B. S. Zou (ITP)

Hadron structure and parton physics
Meson and baryon (N*) resonances
XYZ and exotic hadrons
Quarkonia
The physics of B factories
Finite temperature and density QCD
Nuclear structure and nuclear matter
Hypernuclei
Few- and many-body physics
Electroweak scatterings with nuclear targets
Neutrino physics
Spin physics
The physics of electron-ion colliders

Light-front field theories
Lattice field theory
Effective field theories
Phenomenological models
Coupled channels models
Present and future facilities

https://indico.cern.ch/e/LC2021



PAST MEETINGS AND CONFERENCES

Place	Organizer	Number of Participants
LC2022 Online		136
Jeju Island, Korea (LC2021)	Oh	231
Ecole Polytechnique (LC2019)	Lorcé	111
Jefferson Lab (LC2018)	Melnitchouk	104
University of Mumbai (LC2017)	Misra	82
Universidade de Lisboa (LC2016)	Peña & Stadler	56
INFN Frascati (LC2015)	Pasquini & Salme	80
NCSU 2014	Ji	70
Skiathos 2013	Stefanis	56
Delhi 2012	Kulshreshtha	75
Cracow 2012	Broniowski	73
Dallas 2011	Dalley	about 50
Valencia 2010	Vento and Papavassiliou	about 80
São José dos Campos 2009	Frederico (Pictures)	about 80
Mulhouse 2008	Mathiot, Bakker & Dieh (Mulhouse Pictures 1, 2)	58
Columbus 2007	Pinsky & Vary	about 50
Minneapolis 2006	Hiller	41
Cairns 2005	Williams, Leinweber & von Smekal	48
Amsterdam 2004	Bakker, Boer & Mulders	49
Durham 2003	Stirling, Dalley & Wilkinson	54
Los Alamos 2002	Johnson, Kisslinger, Burkardt & Pate	about 50
Trento 2001	Bassetto, Griguolo, Nardelli & Vian	77
Heidelberg 2000	Pauli, Werner & Hollenberg	57
Adelaide99	Hollenberg, McKellar & Williams	55
Korea99	Ji & Min	80
Aspen99	Pinsky	


白頭大幹
백두대간선자령
해발고 : 1,157m
위 도 : 37° 43' 10"
경 도 : 128° 44' 50"

Quarter Century Ago…

- 11th International Light-Cone School and Workshop (LC1999) in Seoul (May 26 - June 18) and Kyungju (June 21-25), respectively, back in 1999, serving together for the local organizing committee.
- As a fresh PhD from SNU, he was a dedicated secretary of the local organizing committee doing all the chores for the successful meeting organization.
- I was so grateful to him for all of his dedicated works for the conference.
- The proceedings of this meeting got published as the AIP Conference Proceedings 494 (543 pages) entitled “New Directions in Quantum Chromodynamics".
- Light-Front Quark Model began with H.-M. Choi at NCSU, SURA Fellowship

오용석 교수

Ph.D.	1993	Seoul National University

기관명	기간	내역
Kyungpook National University	2010	Assistant Professor, Associate Professor, Professor
Korea Institute of Science and Technology Information	2009	Principal Project Researcher
Texas A&M University	2007	Visiting Associate Professor

Five Years Ago…

- I started co-advising his PhD student Yongwoo Choi in 2018. Due to this collaboration with his student, we had many opportunities to discuss physics as well as conferences.

- With Yongwoo, we collaborated on two papers published in
  - PRD103, 076002(2021) "Light-front dynamic analysis of the longitudinal charge density using the solvable scalar field model in (1+1) dimensions" and
  - PRD105, 096014(2022) "Analysis of virtual meson production in a (1+1)-dimensional scalar field model".

- Yongwoo graduated in December 2021 with his dissertation entitled "Benchmark 1+1 Dimensional Analysis of Virtual Meson Production and the Meson Form Factor in Light-Front Dynamics" and joined Inha University as a postdoc.

PHYSICAL REVIEW D **103,** 076002 (2021)

Light-front dynamic analysis of the longitudinal charge density using the solvable scalar field model in (1 + 1) dimensions

Yongwoo Choi,[1] Ho-Meoyng Choi,[2,*] Chueng-Ryong Ji,[3,†] and Yongseok Oh[1,4,‡]

[1]*Department of Physics, Kyungpook National University, Daegu 41566, Korea*
[2]*Department of Physics, Teachers College, Kyungpook National University, Daegu 41566, Korea*
[3]*Department of Physics, North Carolina State University, Raleigh, North Carolina 27695-8202, USA*
[4]*Asia Pacific Center for Theoretical Physics, Pohang, Gyeongbuk 37673, Korea*

PHYSICAL REVIEW D **105,** 096014 (2022)

Analysis of virtual meson production in a (1 + 1)-dimensional scalar field model

Yongwoo Choi,[1,*] Ho-Meoyng Choi,[2,†] Chueng-Ryong Ji,[3,‡] and Yongseok Oh[1,4,§]

[1]*Department of Physics, Kyungpook National University, Daegu 41566, Korea*
[2]*Department of Physics Education, Teachers College, Kyungpook National University, Daegu 41566, Korea*
[3]*Department of Physics, North Carolina State University, Raleigh, North Carolina 27695-8202, USA*
[4]*Asia Pacific Center for Theoretical Physics, Pohang, Gyeongbuk 37673, Korea*

Benchmark 1+1 Dimensional Analysis of Virtual Meson Production and the Meson Form Factor in Light-Front Dynamics

Yongwoo Choi

Department of Physics, Major in Hadron Physics
The Graduate School

Supervised by Professor Yongseok Oh

Approved as a qualified thesis of Yongwoo Choi
for the degree of Ph.D. by the Evaluation Committee

December 2021

Chairman Prof. Ho-Meoyng Choi

Prof. Chueng-Ryong Ji

Prof. Seung-il Nam

Prof. Hyon-Suk Jo

Prof. Yongseok Oh

The Graduate School Council
Kyungpook National University

제 한물 2020-320호

우수발표상

구두 부문

CHOI Yongwoo (Kyungpook National University)

귀하는 본 학회에서 주최한 2020년 가을학술논문발표회에서 우수한 연구 내용을 담고 있는 탁월한 구두 발표를 하였기에 우수발표상을 드립니다.

논문제목: Electromagnetic Form Factor Analysis in 1+1 Dimension: Light-front Dynamics vs. Instant Form Dynamics

저 자 명: OH Yongseok*[1], CHOI Yongwoo[1], CHOI Ho-Meoyng[1], JI Chueng-Ryong[2] ([1]Kyungpook National University, [2]North Carolina State University)

2020년 11월 17일

사단법인 한국물리학회 회장 이 범 훈

PHYSICAL REVIEW D **106,** 014009 (2022)

Mixing effects on 1*S* and 2*S* state heavy mesons in the light-front quark model

Ahmad Jafar Arifi,[1,*] Ho-Meoyng Choi,[2,†] Chueng-Ryong Ji,[3,‡] and Yongseok Oh[4,1,§]

[1]*Asia Pacific Center for Theoretical Physics, Pohang, Gyeongbuk 37673, Korea*
[2]*Department of Physics Education, Teachers College, Kyungpook National University, Daegu 41566, Korea*
[3]*Department of Physics, North Carolina State University, Raleigh, North Carolina 27695-8202, USA*
[4]*Department of Physics, Kyungpook National University, Daegu 41566, Korea*

PHYSICAL REVIEW D **107,** 053003 (2023)

Independence of current components, polarization vectors, and reference frames in the light-front quark model analysis of meson decay constants

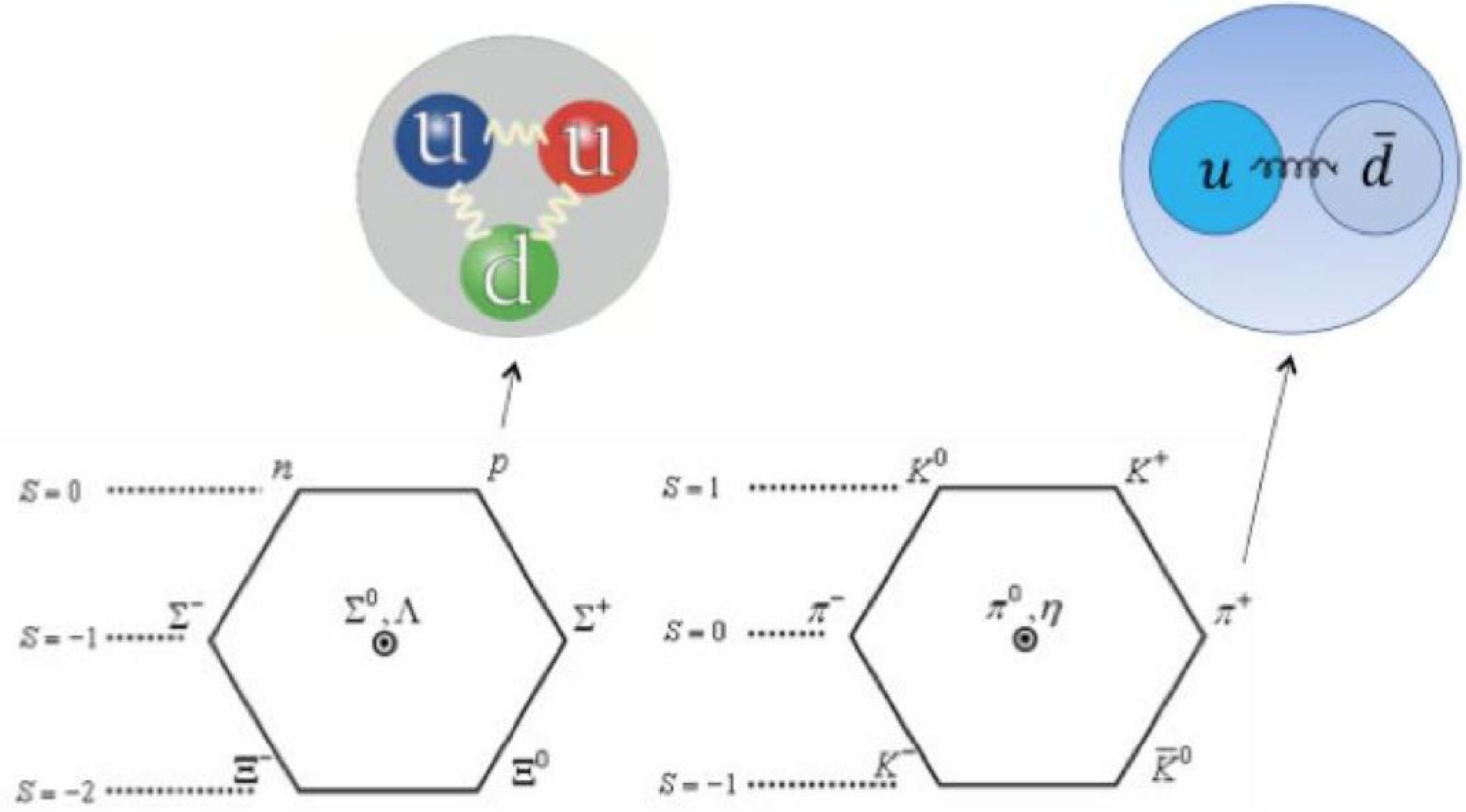
Ahmad Jafar Arifi,[1,*] Ho-Meoyng Choi,[2,†] Chueng-Ryong Ji,[3,‡] and Yongseok Oh[4,1,§]

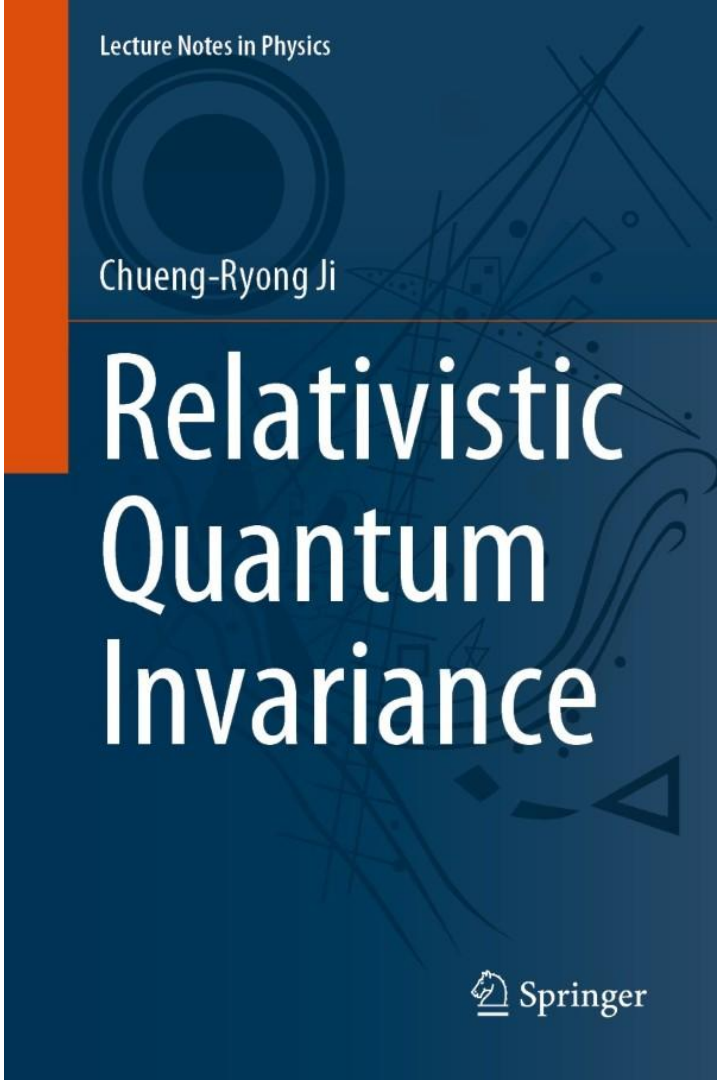
[1]*Asia Pacific Center for Theoretical Physics, Pohang, Gyeongbuk 37673, Korea*
[2]*Department of Physics Education, Teachers College, Kyungpook National University, Daegu 41566, Korea*
[3]*Department of Physics, North Carolina State University, Raleigh, North Carolina 27695-8202, USA*
[4]*Department of Physics, Kyungpook National University, Daegu 41566, Korea*

Three Years Ago…

- Our collaboration grew and more recently involved a YST at APCTP Ahmad "Jafar" Arifi for two more papers published in
  - PRD106, 014009(2002) "Mixing effects on 1S and 2S state heavy mesons in the light-front quark model" and
  - PRD107, 053003(2023) "Independence of current components, polarization vectors, and reference frames in the light-front quark model analysis of meson decay constants".
- The excitement of this research progress was shared by all involved to continue further collaborations together.
- Prof. Yongseok Oh was highly instrumental in our collaboration efforts.
- In all of these collaborations, we all enjoyed very much discussing not only the subject matters but also the broader perspectives of the research efforts relevant to the hadron physics.
- His KNU colleague Prof. H.-M. Choi was the former NCSU PhD in 1999 with dissertation “Light-Front Quark Model Analysis of Electroweak Decays of Pseudoscalar and Vector Mesons”

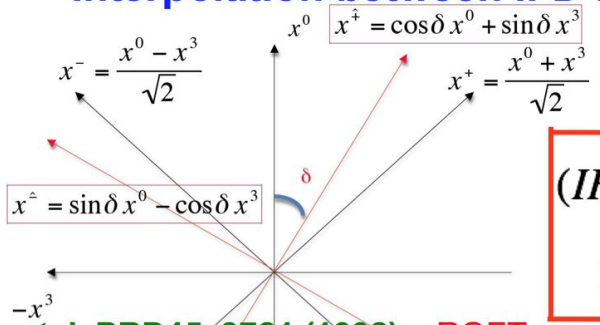
How do we understand the Quark Model in Quantum Chromodynamics?





The Link between the QCD and the Light-Front Quark Model

Interpolation between IFD and LFD



$$(IFD) \quad 0 \le \delta \le \frac{\pi}{4} \quad (LFD)$$

$$1 \ge \quad C \equiv \cos(2\delta) \quad \ge 0$$

K. Hornbostel, PRD45, 3781 (1992) – RQFT
C.Ji and S.Rey, PRD53,5815(1996) – Chiral Anomaly
C.Ji and C. Mitchell, PRD64,085013 (2001) – Poincare Algebra
C.Ji and A. Suzuki, PRD87,065015 (2013) – Scattering Amps
C.Ji, Z. Li and A. Suzuki, PRD91, 065020 (2015) – EM Gauges
Z.Li, M. An and C.Ji, PRD92, 105014 (2015) – Spinors
C.Ji, Z.Li, B.Ma and A.Suzuki, PRD98, 036017(2018) – QED
B.Ma and C.Ji, PRD194,036004(2021) – QCD_{1+1}


THE SUITES HOTEL
APCTP Workshop on Nuclear Physics 2022
Physics of Excited Hadrons in the Present and Future Facilities
July 11 - 16 / Jeju Suites Hotel / Sponsors: apctp , CHEP@KNU
The APCTP is supported by the Korean Government through the Science and Technology Promotion Fund and Lottery Fund and strives to maximise social value through its various activities.
아시아태평양 이론물리센터는 정부의 과학기술진흥기금 및 복권기금 지원으로 사회적 가치 제고에 힘쓰고 있습니다.

2nd Precision Studies on QCD @ Electron Ion Collider

Report from the Companion Meeting

(APCTP Focus Program: Science Opportunities with QCD)

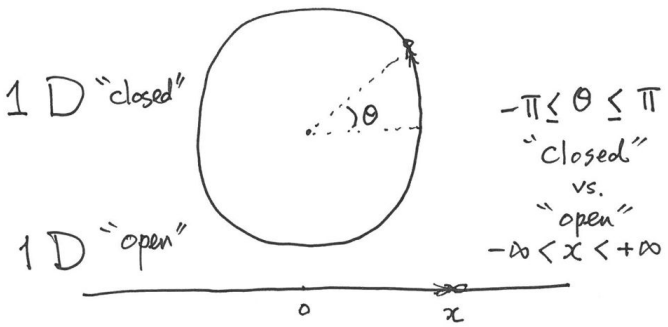
YONGSEOK OH
(KYUNGPOOK NATIONAL UNIVERSITY)


CHARLES B. WANG CENTER
Welcome to the
Electron-Ion Collider
Resource Review Board
Meeting
April 3-4, 2023

Closed vs. Open Spacetime and Homogeneous vs. Inhomogeneous Spacetime Transformations

April 7, 2023

In memory of Prof. Yongseok Oh



6 (Homogeneous) + 4 (Inhomogeneous) in 4D may be understood as 10 (Homogeneous) in 5D with an appropriate scaling.

i.e. $\underbrace{{}_5C_2}_{\text{Homogeneous}} = 10 = \underbrace{{}_4C_2}_{\text{Homogeneous}} + \underbrace{{}_4C_1}_{\text{Inhomogeneous}}$

5D De Sitter Space ($\Lambda > 0$)

Anti-de Sitter Space ($\Lambda < 0$)

$$x'^{\alpha} = \Gamma^{\alpha}_{\beta}\, x^{\beta} \quad (\alpha, \beta = 0, 1, 2, 3, 4)$$

↓

4D ($\Lambda = 0$) Poincaré Minkowski Space

$$x'^{\mu} = \Lambda^{\mu}_{\nu}\, x^{\nu} + a^{\mu} \quad (\mu, \nu = 0, 1, 2, 3)$$

바위 앞에 석녀가 아이를 안고 재우고 있구나

도림 법전 스님 임종게

山色水聲演實相(산색수성연실상)
曼求東西西來意(만구동서서래의)
若人問我西來意(약인문아서래의)
巖前石女抱兒眠(암전석녀포아면)

산빛과 물소리가 그대로 실상을 펼친 것인데
부질없이 사방으로 서래의를 구하려 하는구나
만약 어떤 사람이 나에게 서래의를 묻는다면
바위 앞에 석녀가 아이를 안고 재우고 있구나

Stone Woman

Light of mountain and sound of water provide the reality as they are, (nevertheless)

People are trying to seek the truth everywhere in vain,

If someone asks me the truth, (I will answer)

Stone woman in front of the rock is holding her child to sleep….

Peace be with you all…