

CERN-Korea Theory Collaboration

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(CERN Theory Department)

Nakwoo Kim
(KPS/Kyung Hee U.)

- ✓ Activities (Oct 2018 ~ Mar 2019)
- ✓ Plans for 2019/2020

24th CKC Meeting on 15 April (Mon), 2019 at CERN

Present Team

[17=6+1+10]

Nakwoo Kim	Kyung Hee	Steering/Chair	S
Hyun Min Lee	Chung-Ang	Steering	S
Deog-Ki Hong	Pusan	Steering	P, H
Su HOUNG Lee	Yonsei	Steering	H
Piljin Yi	KIAS	Steering	S
Hyung Do Kim	SNU	Steering	P
Jae Sik Lee	Chonnam	Steering/Ex-officio	P
Hang Bae Kim	Hanyang		C
Seok Kim	SNU		S
Sangmin Lee	SNU		S
Seong Chan Park	Yonsei		P
Seung J. Lee	Korea		P
Soonkeon Nam	Kyung Hee		S
Ki-Young Choi	SKKU		C
Seong Youl Choi	Chonbuk		P
Sungjay Lee	KIAS		S
Seongtae Cho	Kangwon		H

C: Cosmo, H: Hadron, P: Particle, S: String

Annual Budget

(For Mar 2018 ~ Feb 2019)

[1 CHF = 1132 KRW]

[500M KRW ~ 441,000 CHF]

Program	Budget
CERN Fellows Graduate Students TH Institutes	320 M KRW 40 M KRW 80 M KRW
Other activities/Overhead	60 M KRW
Total	500 M KRW

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10 CERN fellows alumni

Name	Period	Position	Current Position
Hyun Min Lee	2010. 1 ~ 2012. 5	Fellow	Chung-Ang (Faculty)
Chul Kim	2010. 2 ~ 2011. 1	Fellow	Seoultech (Faculty)
Jin Ouk Gong	2010.10 ~ 2012. 9	Fellow	KASI (Staff)
Myeonghun Park	2011.10 ~ 2013. 9	Fellow	Seoultech (Faculty)
Chan Beom Park	2012.10 ~ 2014. 9	Fellow	IBS (Research fellow)
Ian-Woo Kim	2013. 9 ~ 2015. 8	Fellow	UpHere, Inc. (Founder)
Hye-Sung Lee	2014. 8 ~ 2015. 7	Fellow	KAIST (Faculty)
Ji-Haeng Huh	2015.10~ 2017. 9	Fellow	
Hee Seok Chung	2016.04 ~ 2017. 8	Fellow	Humbolt Fellow (Munich)
Doojin Kim	2016.09 ~ 2018. 8	Fellow	Arizona U. (Postdoc)

10 visiting students alumni

Name	Period	Current Position
Jihun Kim	2010. 9 ~ 2011. 2	UpHere, Inc. (Researcher)
Doyoun Kim	2010. 9 ~ 2011. 2	IBS-CTPU (Research fellow)
Kwangwoo Kim	2011. 9 ~ 2012. 2	Jlab (Senior researcher)
Imtak Jeon	2011. 9 ~ 2012. 2	King's College London (Postdoc)
Sung Hak Im	2012.10 ~ 2013. 2	IBS-CTPU (Research fellow)
Do Young Mo	2014. 2 ~ 2014. 8	UpHere, Inc. (Researcher)
Dong Woo Kang	2015. 4 ~ 1015.10	Yonsei (Grad. Student)
Dongwook Ghim	2017.04 ~ 2017.09	KIAS (Postdoc)
Youngbin Yun	2017.04 ~ 2017.09	FN pricing (Employee)
Hyungjoo Kim	2018.03 ~ 2017.08	APCTP (Postdoc)

Activities (Oct 2018~Mar 2018)

2 CERN Fellows

- Seung-Joo Lee (17'~19')
- Yu-Seon Jeong (18'~20')



CERN-Korea TH Institute

- $\int \frac{d^4k}{(2\pi)^4} \text{Tr} \left[\gamma_5 \not{a} \not{b} \not{c} \not{d} \right] \text{Tr} \left[\gamma_5 \not{e} \not{f} \not{g} \not{h} \right]$
 - $\int \frac{d^4k}{(2\pi)^4} \text{Tr} \left[\gamma_5 \not{a} \not{b} \not{c} \not{d} \right] \text{Tr} \left[\gamma_5 \not{e} \not{f} \not{g} \not{h} \right]$
 - $\int \frac{d^4k}{(2\pi)^4} \text{Tr} \left[\gamma_5 \not{a} \not{b} \not{c} \not{d} \right] \text{Tr} \left[\gamma_5 \not{e} \not{f} \not{g} \not{h} \right]$
 - $\int \frac{d^4k}{(2\pi)^4} \text{Tr} \left[\gamma_5 \not{a} \not{b} \not{c} \not{d} \right] \text{Tr} \left[\gamma_5 \not{e} \not{f} \not{g} \not{h} \right]$

Publication

6 papers
(3 by Fellows + 3 ack. TH institutes)

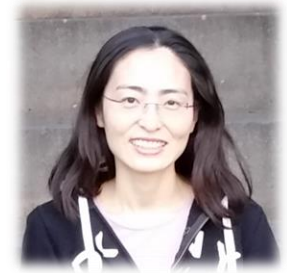
Activities (May 2018~Oct 2018)

❖ 2 graduate students currently visiting CERN

- Se-jin Kim (Pheno/String): host G. Giudice
- Yein Lee (GR) : host T. Weigand
- Feb ~ Aug 2019

❖ Selection of CERN fellow 2019

- Application deadline: 18 Oct 2018
- 6 applicants
- A Shortlist of 3 made on 13 Nov 2018
- Finally selected Sohyun Park (Cosmology, Czech academy of Sciences)



Plan (Apr 2019 ~ Feb 2020: 10 months)

❖ CERN-CKC TH Institute 2019

- Topological String Theory and Related topics (3 June ~ 14 June, 2 weeks)
- Axions in the Lab and in the Cosmos (15 Jul ~ 19 Jul, 1 week)

Scale invariance in particle physics and cosmology

28 January 2019 to 1 February 2019

CERN

Europe/Zurich timezone



Overview

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TH secretariat

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Short description

Theories with (classical or quantum) scale-invariance provide a dynamical origin of all mass scales and present a number of interesting aspects: they are an appealing framework to address the hierarchy problem and lead to naturally flat inflationary potentials and dark matter candidates. The aim of the meeting is to discuss scale invariance in particle physics and cosmology.

This theory institute is supported by the CERN-Korea collaboration program and the ERC grants NEO-NAT and NuBSM.

Organizers: A. Eichhorn, H. M. Lee, S. C. Park, J. Rubio, A. Salvio, S. Sibiryakov, M. Shaposhnikov, A. Strumia, C. Wetterich

Partial list of speakers:

- Fedor Bezrukov
- John Donoghue
- Astrid Eichhorn
- Dumitru Ghilencea
- Jinn-Ouk Gong

Topological String Theory and Related Topics

3-14 June 2019

CERN

Europe/Zurich timezone

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TH secretariat

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Short description

The first week of the Institute will primarily focus on non-perturbative topological string theory, refinement, exact quantisation and matrix models, while the second week will deal with B-type topological string theory, open-closed mirror symmetry and categories of matrix factorisations. One of the goals of the second week is to bring together researchers in both Mathematics and Physics.

This informal workshop will have just 2-3 talks per day to allow for extensive discussions and collaboration. It is supported jointly by CERN and by the Korean government under the **CERN-Korea** Collaboration agreement.

Organisers: Ahmad Zein Assi, Alba Grassi, Cheol-Hyun Cho, Calin Lazaroiu, Wolfgang Lerche, Marcos Marino, Nikita Nekrasov, Yong-Geun Oh and Johannes Walcher.

Key speakers:

1st week: A. Klemm, K. S. Narain, R. Schiappa and C. Vafa*.

2nd week: N. Carqueville*, C.-H. Cho, J.-S. Park and J. Solomon.

**To be confirmed.*

Axions in the Lab and in the Cosmos

15-19 July 2019

CERN

Europe/Zurich timezone



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This week-long **CERN-Korea** TH Institute will concentrate on recent progress and open questions in axion physics.

Topics to be covered include:

- (1) The QCD axion: couplings, laboratory/astro/cosmo constraints.
- (2) Axion cosmology: thermal and non-thermal production, axion dark matter, structure formation. Topological defects.
- (3) Theoretical ideas on axion detection: from stellar probes to lab-based proposals for axion detection, highlighting new ideas.
- (4) Ultra-light axion-like particles and cosmological implications.

Organizers: Kfir Blum, Babette Dobrich, Deog Ki Hong, Seung J. Lee, Matthew McCullough, Hyun Min Lee, Benjamin Safdi



Starts 15 Jul 2019, 08:00

Ends 19 Jul 2019, 18:00

Europe/Zurich



CERN

[4-3-006 - TH Conference Room](#)

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Research Publications

No	Title	Authors	Date	Journal/arXiv
1	Searching for boosted dark matter at ProtoDune	J. Yu, A. Chatterjee, A. De Roeck, D. Kim, Z. Moghaddam, J.C. Park, C.S. Shin, L. Whitehead	Oct 2018	Phys. Rev. D 98 arXiv:1803.03264 [hep-ph]
2	6d SCFTs and U(1) Flavour Symmetries	S.-J. Lee, D. Regalado, T. Weigand	Nov 2018	JHEP 1811 (2018) 147 arXiv:1803.07998 [hep-th]
3	The dS swampland conjecture with the electroweak symmetry and QCD chiral symmetry breaking	K. Choi, D. Chway, C.S. Shin	Nov 2018	JHEP (18) 2018 arXiv:1809.01475 [hep-th]
4	Z-boson polarization as a model-discrimination analyzer	S. Y. Choi	Dec 2018	Phys. Rev. D 98 arXiv:1809.07334 [hep-ph]
5	Higgs Inflation and the Refined dS conjecture	D. Y. Cheong, S.C. Park, S.M. Lee	Dec 2018	Phys. Lett. B 789 arXiv:1811.03622 [hep-ph]
6	A Stringy Test of the Scalar Weak Gravity conjecture	S.-J. Lee, W. Lerche, T. Weigand	Jan 2019	Nucl. Phys. B 938 arXiv:1810.05169 [hep-th]

One agendum

- ❖ Dr. Seung-Joo Lee, one of current CERN-CKC fellows, was given an offer of 1 year extension (thus until Aug 2020) and accepted it.
 - CKC originally agreed to share the salary of Dr. Hee-Seok Chung (Apr 2016 ~ Aug 2017, 16 months): Korean money pays 12 months, and CERN pays the rest.
 - Dr. Chung's salary however was taken out from CKC account, until Aug 2017
 - We agree that, by extending Dr. S-J Lee's contract to another year, the issue of Dr. Chung's salary compensation is settled.

Future Plan

- ❖ Continue monitoring CERN-CKC fellow and grad-student programs with the aim of ensuring their impact on Korean science in the future, and optimizing this impact if possible.
- ❖ Organize 1 CERN-CKC TH Institute in Korea every 3 years
 - Next one being planned in 2020 on BSM physics
- ❖ Proposing to host Gauge/Gravity annual conference at CERN in 2020 and financially support from CKC fund
- ❖ Promote active collaborations with Korean experimental groups (KCMS and KoALICE) and active participations of other Korean particle theorists in TH institutes

Conclusion

- ▶ The CERN-Korea theory collaboration program have provided/ will provide Korean young researchers with great opportunities for accelerating their careers.
- ▶ We keep promoting close collaborations between Korean participating members (and other Korean particle physics theorists) with CERN staffs for world-class HEP researches.