

Opening Comments

2018/02/03

Keisuke Fujii

WG Objectives

- On July 4, 2012, ATLAS and CMS announced the discovery of a Higgs-like boson with a mass of about 125GeV and the data that followed strongly indicates that it is a Higgs boson indeed. The world has changed since then. The discovery has vaulted the question of its properties on the top of the list of questions in HEP. The 125GeV boson is a window to BSM physics and ILC is the best machine to use it. So far no additional new particles or new phenomena have been found in the LHC Run 2, suggesting that there seem to be no easily discoverable new particles, which enhanced the importance of the precision measurements of H125 and loophole-less searches at ILC more than ever. There can be a zoo of new uncolored particles or new phenomena that are difficult to find at LHC but can be discovered and studied in detail at ILC.

We need to demonstrate that ILC will advance our understanding of particle physics qualitatively beyond the information that will be available from the results expected from the future stages of the LHC. The MEXT ILC Advisory Panel says "it is necessary to closely monitor, analyze and examine the development of LHC experiments". We did and proposed ILC250 as a JAHEP agreement on July 22, 2017.

- With the LCB and ICFA statements on the ILC250, together with the LCC physics case report on ILC250, The MEXT restarted its Physics and TDR working groups to review ILC250 physics case and cost/technological readiness. We need to support this process. The next target for us to show our activities at ALCW2017 on May. 28 to June 1, 2018 in Kyshu.

JAHEP Statement: July, 2017

To conclude, in light of the recent outcomes of LHC Run 2, JAHEP proposes to promptly construct ILC as a Higgs factory with the center-of-mass energy of 250 GeV in Japan.

LCB Statement: November 2017

“For these reasons, the Linear Collider Board strongly supports the JAHEP proposal [4] to construct the ILC at 250 GeV in Japan and encourages the Japanese government to give the proposal serious consideration for a timely decision.”

ICFA Statement: November 2017

“ICFA thus supports the conclusions of the Linear Collider Board (LCB) in their report presented at this meeting and very strongly encourages Japan to realize the ILC in a timely fashion as a Higgs boson factory with a center-of-mass energy of 250 GeV as an international project, led by Japanese initiative.”

The 1st Meeting of the Particle & Nuclear Physics WG happened on

January 18, 2018

Agenda:

- *General remark from the secretariat*
- *ILC project status (development since the last round of the WG)*
- *Development of LHC Experiments : K. Hanagaki*
- *Physics Case of the 250 GeV ILC : KF*
- *Plan for further discussions*
- *AOB*

Membership

Particle and Nuclear Physics WG

1. Takaaki Kajita (deputy chair) : Cosmic Ray Research
2. Sachio Komamiya : HEP
3. Hideyuki Sakai : Nuclear Physics
4. Seiji Tanabashi : HEP (theory)
5. Eiji Chin : Accelerator
6. Katsuo Tokushuku : HEP
7. Takeshi Nakano (chair) : Nuclear Physics
8. Tsuyoshi Nakaya : HEP
9. Tetsuo Hatsuta : Nuclear Physics (theory)
10. Ryugo Hayano : HEP
11. Shigeki Matsumoto : HEP (theory)
12. Taku Yamanaka : HEP
13. Hiromi Yokoyama : Scientific Communication

Members are mostly from HEP (theory/exp.), nuclear physics, and cosmic ray research

Main points made in Hanagaki's talk

- ***LHC Run II saw no indication of BSM physics: everything consistent with SM so far.***
- ***The most likely scenario is then scenario 3 of the interim report by the MEXT panel: no new particle found at 13 TeV LHC.***
- ***Most probably, there will be no further inputs to judge the new particle discovery potential of ILC.***
- ***ILC's performance and expected scientific outcome should be considered, assuming scenario 3.***

Physics Case for the 250 GeV Stage of ILC

- Based on the LCC Physics Working Group's report titled "Physics Case for the 250 GeV Stage of ILC" -

Co-convener of the LCC Physics Working Group

IPNS/KEK

Keisuke Fujii

Jan. 18, 2018

Main points made in KF's talk

- *Given the situation that LHC Run II saw no BSM signal so far, the importance of the precision Higgs measurements became further enhanced.*
- *Recent development (EFT) made it possible it **possible to measure absolute values of the Higgs couplings model-independently with 250 GeV data only.***
- *Through the precision Higgs coupling measurements, **the 250 GeV ILC will find the pattern of coupling deviations from the SM and decide the future direction of particle physics.***
- *Based on the results at 250 GeV and adding data at higher energies, we will be able to precisely measure top quark properties and the triple Higgs coupling, thereby further narrowing down the new physics possibilities.*
- *In this way, we will be able to pave the way to unified understanding of Nature. The 250 GeV ILC will be the first step.*

***The 2nd Meeting of the Particle & Nuclear
Physics WG will happen on***

February 5, 2018

Our Group's Activities

Status & Next Step

Symmetry Breaking & Mass Generation Physics

- ZH : $H \rightarrow bb, cc, gg \rightarrow$ EPJ C (2013) 73:2343, now working on $m_h=125$ GeV case: Ono+Miyamoto
 $H \rightarrow WW^*$ anomalous coupling: publication: Takubo \rightarrow P.R.D88,013010(2013)
 $\rightarrow H \rightarrow WW^*$ to be reexamined: Liao Libo, Mila
 $H \rightarrow$ other modes (AA, $\mu^+\mu^-$) + Kawada/Tanabe/Suehara/Daniel, $(\tau^+\tau^-) \rightarrow$ publication \rightarrow EPJC (2015) 75:617., $H \rightarrow Z \gamma$: Kazuki Fujii
Recoil mass: Jacqueline \rightarrow P.R.D94,113002(2016), Suehara (qq), CP mixing in $h \rightarrow \tau^+\tau^-$: Daniel \rightarrow draft being reviewed by ILD, HVV couplings: Ogawa, Yumi Aoki (Hgamma)
EFT: Junping , direct mH reconstruction: Junping
- ZHH : full simulation of the $H \rightarrow bb \& Z \rightarrow$ all modes, fast simulation of $n\nu HH$: finished: Junping + Takubo (Ph.D thesis: done) \rightarrow New analysis with improved analysis tools: Junping + Claude + Suehara + Tanabe, Jet-clustering: Kurata, Shaofeng Ge, LCFIPlus: Suehara, Yonamine
New analysis: $ZHH \rightarrow ZbbWW^*$: dE/dx: Kurata, Systematic Error: Tim, EFT: Junping, ZHH paper draft: Junping, Masakazu, Claude
- nnHH : full simulation @ 1TeV, done for DBD: Junping \rightarrow publication
- nnH, eeH : precision measurements of HVV couplings, $m_h=125$ GeV: Junping
BR measurements: Ono, Christian
- TTH : quick simulation studies with NRQCD corrections
 \rightarrow P.R.D84,014033(2011) \rightarrow full sim. @ 0.5 & 1 TeV: (Yonamine left) Tanabe + Sudo
- TT Threshold : Top Yukawa measurement: Horiguchi + Ishikawa + Tanabe, Theory: Kiyo + Sumino \rightarrow publication? (cf. a recent significant theoretical development!): Ozawa \rightarrow Eda
- W mass (m_W) : Koya Tsuchimoto \rightarrow Kotera (controlling systematic uncertainties) \rightarrow Kotera
- AA \rightarrow HH : quick simulation studies, so far $H \rightarrow bb$ and WW BG
 \rightarrow P.R.D85,113009(2012) : Kawada, Theory: Harada

Status & Next Step

Beyond the Standard Model

- SUSY : full simulation studies for LOI → publication
 - **EWkino** (Compressed Spectrum Case): Jacqueline→Tomohiko →analysis to be finished soon?
- Extra U(1) (Z' tail), Compositeness, Extra Dimensions, etc.
 - **TT** : full simulation studies for LOI → **New study with MELA: Yo Sato**
 - tau tau : full simulation studies for LOI → ditto
 - **2f: full simulation study: Hiroaki Yamashiro**
- Hidden Sector / XD : **P.R.D78, 015008 (2008)**
- LHT : **P.R.D79, 075013 (2009)**
- Model discrimination: Saito + Suehara .. : **P.R.D84, 115003 (2011)**
- R-handed neutrinos: Saito : **P.R.D82, 093004 (2010)**
- LHT: Kato (exp) + Harigaya (th): ZHZH finished, working on eHeH, nHnH, ..: Draft (n-1)?
- Very light gravitino: Katayama (Master's thesis), Tanabe (exp) + Matsumoto (th)
--> 1st Draft --> Takuaki Mori (Tokyo) → ?
- Quasi stable stau: Yamaura (Master's thesis) + Kotera + Kasama → reactivated?
- **Higgs portal/h→Invisible**: Honda → Yamamoto → Ishikawa, Ogawa, Junping → **Yu Kato** (Tokyo)
- W-H+/W+H-: (Shinzaki), Ishikawa (exp) + Kanemura, yagyu (th)
- **Generic DM search**: Tanabe
- New projects?
 - AMSB: Tanabe
 - Heavier Higgs bosons?: Yokoya, (Abhinav) → Christian Drews
 - X(750) : Junping → published in PRD (**Phys.Rev. D94 (2016) no.9, 095015**)
 - Correlation btw h→gamma gamma & h→gg in mSUGRA: Hidaka
 - m_nu, DM, baryogenesis: Machida

Short Term Schedule

- Weekly Meeting
 - Every Fri. at 14:00 (conf. ID: to be announced)
- General Meeting
 - 10:30 on **Sat. April 14, 2018** (KEK MCU2 conf. ID:XXX)
- **AWLC 2018, Kyushu, May 28 - June 1**