



## VIDEO OF THE WEEK



## Lyn Evans in conversation with Peter Higgs

The discovery of the Higgs was announced exactly ten years ago and we're very proud to present some exclusive content to you: two giants of the Higgs particle discovery in conversation about initially refused papers, why Peter Higgs ended up in theoretical physics rather than in engineering, and more.

## FEATURE

## Quantum Diaries: Special Edition for Higgs@10

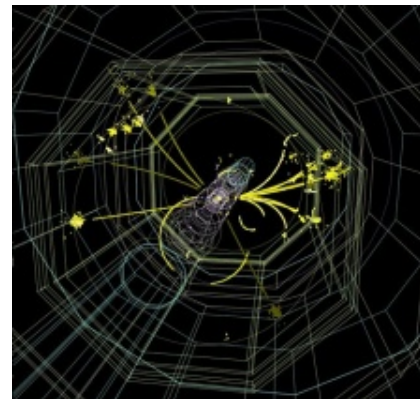


Daniel Jeans, a particle physicist based at KEK and active blogger, looks back on what it was like witnessing the discovery as a young researcher.

## SPECIAL ISSUE

## 10th anniversary of Higgs discovery!

Posted July 2012, written by Barry Barish, Jonathan Bagger, and Sakue Yamada



4 July 2022 marks the 10th anniversary of one of the most celebrated scientific breakthroughs of the 21st century - the discovery of the Higgs boson at CERN's Large Hadron Collider. ILC NewsLine presents our 10th anniversary of the Higgs discovery with our Higgs boson stories written 10 years ago.

## IN THE NEWS

**from *The Wire Science***

3 July 2022

**10 Years of the Higgs Boson: How Far Have We Come, and What Next?**

The third major contender is the International Linear Collider (ILC), put together by an international collaboration. It will consist of an approximately 30-km-long tube that will accelerate two kinds of particles from the two ends in a straight line, and smash them into each other. It was expected to be located in Japan before scientists there raised concerns about how the government would split the cost of building and running the machine with other countries.

**from *Yahoo news***

23 June 2022

**ドイツからの留学生 ILCを学ぶ 県の情報発信拠点を訪問**

岩手県が誘致を進める ILC 国際リニアコライダーについての情報発信拠点となっている盛岡市の施設を 6 月 21 日、ドイツからの留学生たちが訪問した。(On June 21, international students from Germany visited a facility in Morioka City, which is a base for disseminating information about the ILC International Linear Collider, which Iwate Prefecture is promoting.)

**from *Symmetry***

21 June 2022

**Reverberations of the Higgs**

That interest carried her through her studies all the way to her current PhD program. She is working on research related to the International Linear Collider, a proposed particle accelerator designed to be a “Higgs factory.” It would produce massive amounts of the particle that inspired Nakajima so that scientists can measure it to new levels of precision.

**from *Iwate Nippo***

18 June 2022

**国際分担の態勢整備重要 仙台で東京大・横山氏が講演**

東京大カブリ数物連携宇宙研究機構の横山広美副機構長（46）は、巨大科学を推進するには「国際分担の態勢をどのように整えるかが重要だ」と強調した。(Hiromi Yokoyama, Deputy Director of the Kavli Institute for the Physics and Mathematics of the Universe, the University of Tokyo, emphasized that “how to prepare for international sharing is important” in order to promote big science.)

**from *Yahoo news***

16 June 2022

**ILC「オープンラボ」一般公開 加速器など実験への理解深める**

ILC 国際リニアコライダーを学ぶ岩手県盛岡市の施設「オープンラボ」が 6 月 16 日に一般公開された。(The facility “Open Lab” in Morioka City, Iwate Prefecture, where students study the ILC International Linear Collider, was opened to the public on June 16.)

**from *Iwate Nippo***

16 June 2022

**多面的なメリット⑥ 科学技術立国の好機に、ILC 東北誘致**

「科学技術立国」や「デジタル田園都市国家構想」を掲げる岸田政権。ILC はその実現に大きく貢献する有望な国際プロジェクトだ。千載一遇の好機をものにするのか、それとも尻込みを続けて逃すのか、世界が注視している。(The Kishida administration advocates a “science and technology nation” and a “digital rural city national concept”. The ILC is a promising international project that will greatly contribute to its realization. The world is paying close attention to whether it will be a good opportunity for a thousand times, or whether it will continue to be shy.)

**from *Iwate Nippo***

15 June 2022

**候補地の今⑥ 受け入れ準備着々進む、ILC 東北誘致**

「この 10 年間の蓄積で住民理解はだいぶ進んだ。大きなプロジェクトを動かすには民意の力が重要になる。関係自治体と一層連携し、取り組みを進める」と佐藤善仁一関市長。社会が「ウィズコロナ」へ移行しつつあり、誘致のタイムリミットも迫るここからが頑張りどころだ。(“The accumulation of the past 10 years has greatly improved the understanding of the residents. The power of the people’s will is important for moving a big project. We will further cooperate with the relevant local governments and proceed with the efforts,” said Mayor Yoshihito Sato. The society is shifting to “with corona”, and the time limit for attracting is approaching.)

**from *Physics Today***

14 June 2022

**W-boson mass hints at physics beyond the standard model**

Future W-boson measurements could also happen at proposed electron–positron colliders, such as the International Linear Collider in Japan, the Future Circular Collider at CERN, and the Circular Electron Positron Collider in China

**from *The Hindu***

10 May 2022

**The standard model of particle physics gets a jolt**

(Paid article) International Linear Collider in Japan, the Compact Linear Collider and Future Circular Collider in CERN, the Circular Electron-Positron Collider in China, etc.

**from *Interactions***

11 April 2022

**ICFA Statement Regarding Higgs Factory Development and the ILC**

ICFA reconfirms the international consensus on the importance of a Higgs Factory as the highest priority for realizing the scientific goals of particle physics. This view has only strengthened over time based on results from the world's particle physics facilities.

**from *Science***

7 April 2022

**An upset to the standard model**

Several proposals for electron-positron colliders—such as the International Linear Collider in Japan, the Compact Linear Collider, the Future Circular Collider (FCC-ee) at CERN, and the Circular Electron Positron Collider in China (8)—are under consideration in the ongoing discussions for the future of particle physics.

## PREPRINTS

## ARXIV PREPRINTS

2206.13745

Heavy Neutral Leptons at Beam Dump Experiments of Future Lepton Colliders

2206.13523

First Evaluation of Meson and  $\tau$  lepton Spectra and Search for Heavy Neutral Leptons at ILC Beam Dump

2206.12676

Chiral  $Z'$  in FASER, FASER2, DUNE, and ILC beam dump experiments

2206.01214

Semi-dark Higgs decays: sweeping the Higgs neutrino floor

2205.15971

Non-Gaussianity constraints from Planck spectral distortion cross-correlations

2205.12160

Double-hit separation and  $dE/dx$  resolution of a time projection chamber with GEM readout

2205.11766

Leptophilic Gauge Bosons at Lepton Beam Dump Experiments

2205.10304

Dark Z at the International Linear Collider

2205.03736

Proposal for a Damping-Ring-Free Electron Injector for Future Linear Colliders

2204.13627

New physics searches with the ILD detector at the ILC

2204.13245

Positron Sources for Future High Energy Physics Colliders

2204.10315

CDF II  $W$ -mass anomaly faces first-order electroweak phase transition

2204.10265

Experimentally distinguishable origin for electroweak symmetry breaking

2204.08473

Full Electroweak  $O(\alpha)$  corrections to Higgs boson production processes with the beam polarization at the International Linear Collider

2203.15729

Evaluating the ILC SUSY reach in the most challenging scenario:  $\tau^-$  NLSP, low  $\Delta M$ , lowest cross-section

2203.15710

Interdependence of the new "MUON G-2" Result and the  $W$ -Boson Mass



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## VIDEO OF THE WEEK

# Lyn Evans in conversation with Peter Higgs

[4 July 2022](#)

The discovery of the Higgs was announced exactly ten years ago and we're very proud to present some exclusive content to you: two giants of the Higgs particle discovery in conversation about initially refused papers, why Peter Higgs ended up in theoretical physics rather than in engineering, and more. Lyn Evans, former Director of the Linear Collider Collaboration, was the LHC project manager during the construction and commissioning phase, talks to Peter Higgs.

These four videos were recorded for the ILC promotion international symposium "Higgs Boson and ILC" held in Tokyo on 8 February 8 2020.

## WHAT WAS IT LIKE HAVING TO WAIT 50 YEARS?

What was it like having to wait 50 years? Peter Higg...



## HOW DO YOU THINK ABOUT COMPLEX IDEAS?

How do you think about complex ideas?" Peter Higgs talks with Lyn Evans 匕...



WHAT GOT YOU INTERESTED IN PARTICLE PHYSICS?

What got you interested in particle physics? Peter H...



YOUR PAPER WAS REFUSED?!

## "Your paper was refused?!" Peter Higgs talks with L...



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## FEATURE

## Quantum Diaries: Special Edition for Higgs@10

[4 July 2022](#)

*Quantum diaries is a blog published by Interactions collaboration, the collaboration of communication specialists in particle physics across all borders. Originally operated from 2005 to 2016, scientists from particle physics institutions around the world shared their research, views and lives.*

*To mark the decade since the announcement of the Higgs discovery, the Interactions collaboration is publishing a new version of Quantum Diaries – with some original bloggers, and some newer physicists inspired by the historic discovery, and some of ILC scientists are participating as bloggers.*

### A roller-coaster ride

by Daniel Jeans

I'm a researcher in the Institute of Particle and Nuclear Studies at KEK, Japan. I was born and brought up in the UK, but if you go back a few generations many of my roots spread across central Europe. I remember always being interested in science – I come from a pretty scientific family, and was regularly shown things through microscopes – and got interested in physics during high school, thanks to a combination of several inspiring teachers and my inability – or probably rather unwillingness – to memorise too many facts, names, or reactions. At university my undergraduate advisor was a particle physicist, and I suppose his enthusiasm for particles somehow infused into me.

When I started as a doctoral student, around the turn of the century, I chose to do my research as part of the DELPHI collaboration, which operated a detector at the LEP collider at CERN. I was fortunate to spend two years stationed at CERN, where I enjoyed the international “CERN spirit” and the excitement of data flowing from the detector. The thrill of being deep underground, climbing around the detector to check on “my” muon detectors while particles were colliding just a few metres away stays with me to this day. Precision measurements being made at LEP were telling us that the Higgs boson was just around the corner, with a mass close to the limit of what was in reach at LEP. The accelerator physicists were pushing the energy as high as possible, to give us the best chance to glimpse this Higgs boson. My research was on W bosons, which are closely intertwined with the Higgs, so I was watching closely. As new candidate Higgs events arrived in the various detectors, rumours would spread like wildfire through the coffee rooms and cafeteria across the CERN site!



[Daniel Jeans](#)

Particle Physicist, Institute of Particle and Nuclear Studies at KEK

In hindsight it turned out that LEP did not have sufficient energy to produce Higgs bosons, and that these candidate events were actually due to other processes... So although LEP had over many years made fantastic precision measurements of many processes, it felt pretty sad and anti-climactic when LEP was turned off for the last time without having discovered the Higgs, in order to make space for installation of the Large Hadron Collider.

As a newly minted doctor in physics, it was time to look for a new experiment, maybe also a new environment? I settled on Italy's INFN section in Rome (Sapienza), and the CDF experiment at Fermilab. I'd never visited Italy before, but it looked nice and I got on well with the many Italians in DELPHI! I remember the shock of summer heat as I stepped onto the tarmac. The Tevatron collider was in full swing, producing copious top quarks which were being used to make ever more precise measurements of this heaviest SM particle. I got involved in developing tools for the identification of b-jets, which are produced in almost all top quark decays, and were also expected to dominate the decays of the Higgs boson. It turns out that during my 5 years at CDF, thousands of Higgs bosons were produced in the experiment, however they could not be cleanly identified because of the "messy" environment of hadron collisions.

After the Higgs boson discovery at LHC, and long after I had left the collaboration, CDF published "evidence" for Higgs production; the analysis made some use of the b-tagging tools I had earlier developed, so I made some contribution to confirmation of the Higgs discovery, although it's rather small and tenuous!

Having been present close to the end of large collider experiments DELPHI and CDF, I thought it was time to see the other end of such big endeavours; and thanks to my then-future spouse, I wanted to see Japan. At this time [2006] there was lots of excitement about the International Linear Collider, a proposed high energy electron-positron collider. Several competing groups working on different accelerating technologies around the world had just agreed to pool their resources into a single project, the ILC. Japan was one of the main players, so it was a great match to what I was looking for. I showed my partner a list of institutes working on ILC R&D, and she chose Kobe as the best place to live – so we ended up there. It turned out to be a great choice in many ways. I was working on the development of calorimeter technology for future experiments at the ILC with the CALICE collaboration, as well as trying to understand how well ILC would be able to measure the Higgs boson's properties. Constructing a prototype detector, taking it to a test beam and trying to get it to work was a new experience for me, and very satisfying when it eventually came together. (It should be said that any such successes were entirely due to my colleagues, and usually in spite of my best efforts!)

After my fellowship in Japan was over, I continued working on calorimeters and Higgs physics in my next position, at the Laboratoire Leprince Ringuet near Paris. The ILC group has a long history in  $e^+e^-$  experiments and had made seminal contributions to "particle flow" calorimetry; it also benefited enormously from the lab's strong professional in-house engineering groups. This was around the time that the LHC was starting up, and the next group along the LLR corridor was working on LHC's CMS experiment. Excitement was building, and some of it rubbed off on us during the communal coffee breaks. We heard many rumours, especially about Higgs, but were never sure how much to believe: colleagues were always rather ambiguous when asked directly!

The official announcement of the Higgs boson discovery arrived in 2012, just as I was preparing to move back to Japan, to the University of Tokyo. Even though it wasn't a complete surprise (!), it was super exciting, with Particle Physics splashed across the news media. Now that we knew that the Higgs boson really existed, we wanted to be able to measure it as precisely as possible. The ILC, whose design was already rather advanced, would provide a supreme experiment in which these precise investigations of the Higgs boson could be



made. High energy physicists in Japan soon expressed their wish to realise the ILC in Japan, and in 2013 went on to select the most suitable site, in the Kitakami mountains. Proposals were made to the Japanese government to host the ILC.

Mounting a multi-billion-\$ international science project is an enormous task which requires a delicate mix of conditions among scientists, industries, local and national government, the general public, both domestically and internationally, to come together into a real project. One of my (French) colleagues memorably likened it to hand-making mayonnaise. We are now somewhere in this phase, trying to get it to emulsify. My senses of optimism and frustration wax and wane with the arrival of various ILC review reports, politician's speeches, prioritisations by particle physics communities, government Ministers' declarations, and local government actions. It often feels like a roller-coaster ride! In addition, several rival Higgs factory projects are making great progress, providing an extra frisson of competition.

One thing remains constant during all this: the ability of an electron-positron collider such as the ILC to make wonderful measurements of the Higgs boson and its interactions, and the fundamental importance that these will have to better understand the workings of our universe. This goal helps keep me focused on my day-to-day activities developing seemingly small corners of the ILC ecosystem, working with my colleagues young and old to push our dream towards reality.

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SPECIAL ISSUE

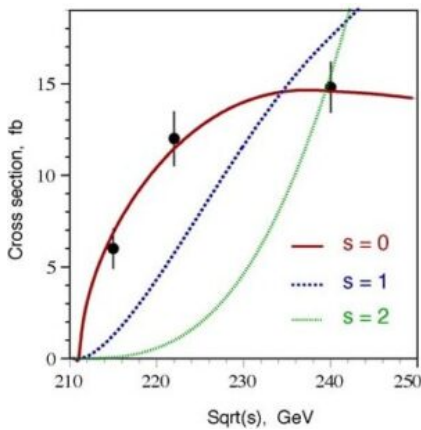
## 10th anniversary of Higgs discovery!

Posted July 2012, written by Barry Barish, Jonathan Bagger, and Sakue Yamada

[4 July 2022](#)

4 July 2022 marks the 10<sup>th</sup> anniversary of one of the most celebrated scientific breakthroughs of the 21st century – the discovery of the Higgs boson at CERN's Large Hadron Collider.

ILC NewsLine presents our 10<sup>th</sup> anniversary of the Higgs discovery with our Higgs boson stories written 10 years ago.



### [THE HIGGS AND THE ILC](#) BY BARRY BARISH (5 JULY 2012)

*The Higgs mechanism is a completely new phenomenon in particle physics and its discovery will open up a totally new and very important area of research. To illustrate the potential power of the ILC to study Higgs physics, I give two examples of how the ILC can shed light on this new physics. ([Read full story](#))*



### [THE HIGGS IS DIFFERENT](#) BY JONATHAN BAGGER (5 JULY 2012)

*But the Higgs does much more. Its discovery will mark a triumph of physics, and as with any discovery, it will open the door to a whole new range of questions. ([Read full story](#))*



## IN FRONT OF THE DOOR TO A NEW WORLD BY SAKUE YAMADA (26 JULY 2012)

*Knowing the mass of the Higgs-like particle helps us decide where to set the ILC energy to study the new world. The discovery excites us not only because it may fill the last hole of the particle chart of the Standard Model but because of this possibility. [The Higgs particle is totally different](#) from other members and opens the door to the next development. The mass tells where the door is. ([Read full story](#))*

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