

Daily Newsletter – Saturday, 25 July

In the boiling heat of Vienna we keep going on with the EPS conference, exciting talks and results. Here are today's highlights.

Flavour Physics and Fundamental Symmetries

The Standard Model has a very specific flavour structure describing the interactions of quarks and leptons. We will hear about direct measurements of the unitarity triangle angle γ/ϕ_3 , the least constrained quark mixing parameter. Then, we will have theoretical contributions on extending the gauge group, supersymmetric models and searching for New Physics using so-called unitarity triangle fits. Future experiments will be presented, as well as new physics signatures at very low energies: permanent electric dipole moments of leptons and hadrons, precision studies of neutron decay, hyperfine splitting in antihydrogen, neutron-antineutron oscillations.

Higgs and New Physics

New particles may show up as resonant enhancement in production or decay. Several talks are devoted to this subject within different models for new physics. An example is searches for resonant production of pairs of W/Z bosons, which have recently attracted the attention of researchers. The "Hierarchy Problem" plays a key role in our field. A new solution for this will be shown, extending the standard model in a very minimal way. In the last block prospects for the next phase of LHC experiments, for the proposed future linear colliders and a circular collider with focus on Higgs physics and physics beyond the standard model are presented.

Top and Electroweak Physics

The first morning session discusses recent measurements of top quark couplings to other elementary particles, its polarization properties and also subtle issues such as how the top quark is sensitive to color flow effects of the strong nuclear force. The unique capabilities of the LHCb experiment to make measurements of jets containing heavy quarks in the forward direction are also discussed. The second session gives an exciting overview on physics prospects with future colliders. A new circular collider with a 100 km ring located close to Geneva, a new collider using the tunnel of the LHC and a new Linear Collider that could be constructed in Japan are some of the possibilities under discussion.

Detector R&D and Data Handling

Among others, LHCb will show its upgrade plans and its high-level trigger. Belle II is presenting its trigger and DAQ system and its Track Fitting software framework.

Accelerator R&D

Higher energy circular and linear colliders require continuous development for technologies of high field superconducting magnets, accelerating cavities and high flux positron sources. New methods involving beams and plasmas will be explored at the AWAKE experiment at CERN. At lower energies, advanced accelerator physics and technology can be the key for high precision measurements.

On Sunday, the Steering Committee of the Future Circular Collider study (FCC) will convene to discuss the progress. The FCC study is a global conceptual design study for options for a circular collider with approximately 100 km circumference.

Non-Perturbative Field Theory and String Theory

There will be a variety of string theory talks that discuss how to construct Standard Model like gauge theories in string theory. String theory also provides new methods for describing strongly interacting systems like the quark-gluon plasma produced in heavy-ion collisions. Progress in studying thermalization in the latter is presented in the talks before the coffee break. Several talks discuss lattice calculations for non-abelian gauge theories.

Outreach & Education

Education and Outreach is a key part of our work as particle physicists. It is our “end product”: sharing our discoveries with policy makers, educators, students and the general public. This session aims at providing you with ideas and resources so that everybody can participate in this rewarding and crucial activity. Kate Shaw will describe her work in developing countries, which was recognised by the award of an EPS price. The involvement of other communities through challenge and cooperation will be discussed, and a panel discussion will allow interactions on many other initiatives.

Joint ECFA/EPS Meeting

This traditional event is used to discuss scientific and strategic developments in

our field. This time, the theme will be ‘Connecting scales: bridging the infinities’. It refers to the link between particle physics and cosmology, in particular the vast difference between energy and mass scales. We will review the possible role of the Higgs boson in the early universe, the prospects for understanding neutrino masses, the future of gravitational waves and dark energy research, as well as innovative ideas in accelerator R&D. The meeting is open to everyone. Please come and discuss!

Public Events

Not to be missed is the public talk by CERN’s Director General Rolf Heuer. The public will discover Art@CMS and photo exhibits on their way to free a public screening of “Particle Fever” starting 21:00 at Altes AKH, room C1.

“We shall not cease from exploration”

Following the movie, a short discussion session will be held with physicists and protagonists of the film David Kaplan, also the producer, and Fabiola Gianotti. We met up with Kaplan before the event and talked about the film and physics. Excerpts:



What prompted you to want to make the film?

As a physicist, you are part of this amazing community of people and ideas. I cannot believe that I am a part of it! I think they are heroes and everyone should know about them and the work they are doing. When the LHC was starting, the need to make the film was strong and somebody had to do it. I felt I had to do it. Everyone thought it was a great idea but a bit too crazy.

What do you think of the response Particle Fever has received?

It is surprising and rewarding. People picked up on subtleties. We wanted it to talk about physics in a way that wasn't teacherly but the way we talk about it among ourselves. We wanted it to be a personal and emotional film, which it is and I credit the film's editor, Walter Murch, who carved the story. People have said that it should be a film every young person should see because it shows science as an interesting pursuit. After a screening, lots of people come up to me and ask questions about the Higgs, multiverse and supersymmetry. A month ago, someone came up to me in a restaurant and said that he had switched from computer science to physics because he was inspired by the film. What has it been like for you working in the film world and in the physics world? I am not a movie star, I am a physicist who was in a movie. After Particle Fever, returning to physics was scary as I doubted I had the tenacity it requires after such a long break. I gave myself 18 months for recovery, to return to the theoretical physics way of thinking. Students at Stanford kept inviting me to work with them and finally, I did. Physics takes a level of dedication and you feel like an idiot most of the time because you work on something and you don't really

understand what it is. Last year we published something and now I feel like I'm back.

Particle Fever has changed the way the public view physics. Has the film changed the way you view physics?

The film has changed my approach to physics and life. I feel differently but I cannot yet say exactly how. I feel a lot less anxiety now. Making the film was a bit like being in a play -- I was watching myself, my friends and colleagues as characters in a play. Was it a tragedy or a comedy? No idea. But I have become better at deciding what's important and what's not important to me. To quote T.S. Eliot, "We shall not cease from exploration, and the end of all our exploring will be to arrive where we started and know the place for the first time."

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