Lectures on Standard Model and Beyond

Harald Fritzsch
LMU Munich

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Professor Harald Fritzsch at Ilia State University

This is a great pleasure for me to welcome and introduce you Professor Harald Fritzsch from Ludwig-Maximilians University in Munich, Chair of Arnold Sommerfeld Center for Theoretical Physics. I will not be too long since everyone knows Professor Fritzsch quite well for his great contributions into elementary particle physics, first of all, for his pioneering works on quantum chromodynamics, grand unification and flavor mixing of quarks and leptons.

I think that all of us, working physicists, believe that what we do has some relation to a physical reality, at least to some discrete points of this reality, so to speak, that could be somehow involved later into the whole picture. However, fortunately, there also are, though only a few people in a century, who can see much bigger parts of this reality, and sometimes even the whole picture. Harald Fritzsch certainly belongs to them.

Quantum chromodynamics whose 40^{th} anniversary is widely marked now (just in this year 2012) by physical community around the World is maybe the best example of his enormous intuition and fantasy. Together with Murray Gell-Mann and later also with Bill Bardeen and Heiri Leutwyler he comes to the QCD which is now recognized as the only possible microscopic theory of strong interaction and which is, at the same time, a fundamental basis for the Standard Model of elementary particles.

But it is not the end of the story. In the next year or two after QCD, again in 70-ies, he together with Peter Minkowski made another crucial step in understanding particle physics. It is the grand unification of all gauge forces in terms of their celebrated SO(10) model having been developed simultaneously (or even a bit earlier) with the prototype SU(5) model by Georgi and Glashow. Principally, the grand unification can only answer the fundamental question: why together with electron and neutrino, there should exist quarks, unusual particles with fractional electric charges, or roughly speaking, why electric charge is so specifically quantized?

In this connection, one could say, if QCD is in some sense the whole “portrait” of physical reality for strong interactions of quarks and hadrons that seems to remain in physics forever, the grand unification, bringing us up from the electroweak scale almost to the Planck scale, is an essential part of this reality as well, which in a certain (presumably quantum-gravity corrected) form also has good chance to survive in physics.

And the third and long line of Harald’s great activity, which I would like to also emphasize here, is the flavor mixing of quarks and leptons which, being more phenomenological but equally important, approaches us to the next big part of still unknown reality named flavor physics.

Remarkably, Professor Fritzsch will lecture here about all three directions mentioned above and, therefore, you have a good chance to have all that at first hand rather than from an experienced mediator as is usually happened. I believe that you will enjoy these lectures very much since Harald is an excellent teacher and science writer, the author of many popular books one of which titled “Quarks” had been translated into 28 languages.

And finally, I am so pleased to tell you that in this QCD jubilee year when Professor Fritzsch is very welcome everywhere in the World he comes just here to Tbilisi for a whole month to speak about the most fundamental problems in elementary particle physics.

Thank you!

Prof. Jon Chkareuli
Ilia State University

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