FIVE QUESTIONS WITH M. SC. MARCO VALDIVIA

Monochromatization: a technique to increase the energy resolution in high-luminosity particle colliders

Monochromatization scheme was proposed by A. Renieri in the 70's to improve the energy resolution of the Adone in Italy [1]. By reducing the energy spread of the collider beam increase the productions of elementary particle such as the Higgs Bosons [2].

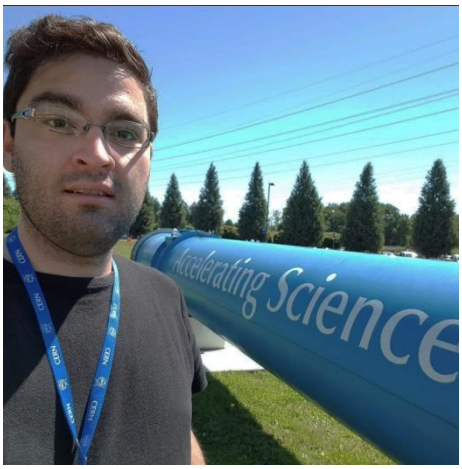

Figure 1. M. Sc. Marco Alan Valdivia García.

Could you introduce yourself?

My name is *Marco Alan Valdivia Garcia*, I am a PhD candidate in physics from the University of Guanajuato working at the European Organization of Nuclear Research (CERN) in Geneve, Switzerland. My interested are: the research, development and implementation of science and technology, specifically in high energy physics in the field of particle accelerators.

Could you tell me about your institute and research topic?

I am working **Monochromatization** scheme, which is a theoretical technique to reach resolution requirements at future particle colliders beyond LHC era where direct Higgs Bosons production is a possibility of particle accelerators and their sub-components.

In addition, I am founder of the project "This Charming Quark", which is an initiative where science and technology is communicated mainly through YouTube in form of audiovisual material where it is shown why knowledge and its applications matters.

How or why did you choose that topic?

Direct s-channel Higgs production in positron-electron (e+ e-) collisions is of interest if the center-of-mass energy spread can be reduced to be comparable to the width of the standard model Higgs boson. A **Monochromatization** principle, previously proposed for several earlier lower-energy colliders, could be employed in order to achieve the desired reduction, by introducing a nonzero horizontal dispersion of opposite sign for the two colliding beams at the interaction point (IP).

Right now, which is the biggest challenge of your work?

In high-energy high-luminosity circular colliders, beamstrahlung (the radiation from one beam of charge particle in an accelerator caused by its interaction with the electromagnetic field of the other beam) may increase the energy spread and bunch length. The horizontal emittance blows up (exponential growth of the horizontal phase space) due to beamstrahlung, a new effect which was not present in past **monochromatization** proposals, may degrade the performance, especially the luminosity. We study, for the Future Circular Collider (FCC) -ee at 62.5~GeV beam energy, how we can optimize the IP optics parameters, along with the number of particles per bunch so as to obtain maximum luminosity at a desired target value of the collision energy spread.

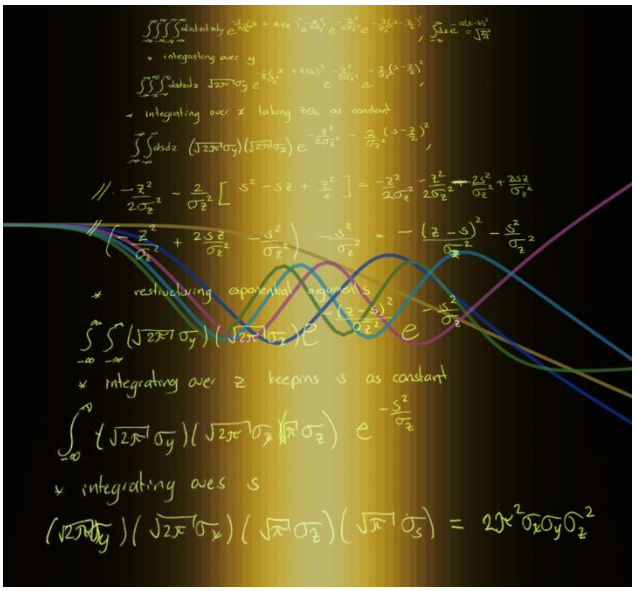

Figure 2. Estimation of the luminosity under the Monochromatization scheme.

What did you think that will be the future of you research area?

Artificial Intelligence is the future, even if we are unable to understand its implications. I always talked about its importance and sometimes they get involved on these topics and work together to develop interesting applications such designing accelerators.

In the context of the future Mexican light source, developing accelerator technology is mandatory. To this end, I am involved in the simulations and design of the different aspects of linear and circular.

Whether these future projects will happen or not is unclear. However, this it is always the risk when you work with the future but, at the same time, the most interesting thing about it.

[1] Renieri, A. (1975). "Possibility of Achieving Very High-Energy Resolution in electron-Positron Storage Rings" (PDF).

[2] Valdivia García, M.A; et al. (2016). "Towards A Monochromatization Scheme for Direct Higgs Production at FCC-ee" (PDF).