FIVE QUESTIONS WITH
DAVID PAVEL JUÁREZ LÓPEZ

Photocathode: Electron production due to photoelectric effect

Electrons in particle accelerators are usually generated by thermionic or photoelectric emission. The electron production using **photocathodes** is explained by the photoelectric effect, proposed by Albert Einstein (who was awarded the Nobel prize due to this work), which is the emission of electrons when electromagnetic radiation (light) impacts a material [1].

Could you introduce yourself?

My name is *David Pavel Juarez Lopez*, I am a doctorate student from the University of Liverpool in the United Kingdom (UK) working on **photocathode** research at Daresbury Laboratory [2].

Figure 1. Pavel Juárez.

Could you tell me about your institute and research topic?

I joined the University of Liverpool in October 2016 and since then, I have been based at The Cockcroft Institute in Daresbury Lab. I am working at the **Photocathode** Preparation Facility (PPF), which was part of a planned upgrade to the existing ALICE **photocathode** electron gun. Specific on the Transverse Energy Spread Spectrometer (TESS) [3]. I do research into the semiconductor, multi-alkali and metal **photocathode** performance [4].

How or why did you choose that topic?

As an undergrad, I did my research on semiconductors and during my master I worked with particle accelerators. Working in **photocathodes was the natural step to make**, since it combines solid state physics and accelerator physics.

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

I would say: “Have the patience to work in a cross-functional experiment”. By this, I mean the performance of an electron accelerator is ultimately limited by the characteristics of its electron source, having experimental data that does not agree with the beam optics, vacuum systems, contamination of the samples, temperature fluctuations, etc., conditions could be frustrating. Being able to take a step back and analyse what could be wrong is always a challenge.

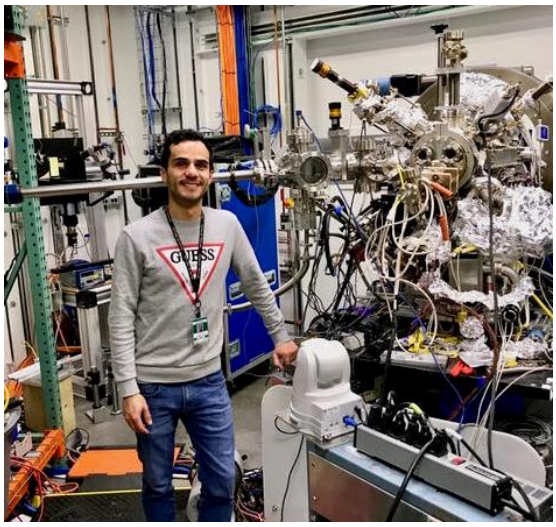

Figure 2. Pavel at the Brookhaven Lab photocathode system

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

In the future, **photocathode** research will continue to bring better quality beams to accelerators. There are different kinds of **photocathodes** that are suitable for different applications of each beam line, some accelerator’s requirements can be completely different than others; the generation of a high-quality beam with high brightness and low emittance requires a high-performance electron source

(**photocathodes**), keep researching for new **photocathodes** candidates is essential to aim for better beam quality.

References

[1] *Einstein, Albert* (1905). *"Über einen die Erzeugung und Verwandlung des Lichtes betreffenden heuristischen Gesichtspunkt"* [On a Heuristic Point of View about the Creation and Conversion of Light] *(PDF)*. Annalen der Physik (in German). **17** (6): 132–148.

[2] Daresbury Laboratory, main page https://stfc.ukri.org/about-us/where-we-work/daresbury-laboratory/

[3] L. B. Jones, et al, *The Commissioning of TESS: An Experimental Facility for Measuring the Electron Energy Distribution from Photocathodes,* in Proceedings of the 35th Int. Free-Electron Laser Conference (FEL 2003), New York, 26-30 August, 2013, Page 290.

[4] L. B. Jones, D. P. Juarez-Lopez, B. L. Militsyn, C. P. Welsh and T.C.Q. Noakes*, Transverse Energy Distribution Measurements for Polycrystalline and (100) Copper Photocathodes with known Levels of Surface Roughness,* in Proceedings of the 9th Int. Particle Accelerator Conference (IPAC'18), Vancouver, April 29 – May 4, 2018, Page 4438