OUR JOURNEY WITH THE CREDO PROJECT

SIOUFI PULSAR

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Participant Names

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I. Introduction

In April 2024, as students at SSCC Sioufi, we were given the incredible opportunity to participate in the Transglobal Citizen Science School Forum at CERN, organized by Good Gear. This experience was not just another school activity; it was a gateway to engaging with real-world scientific research far beyond the usual classroom boundaries.

Through the competition, we were involved in two exciting projects: the Globe at Night and Particle Hunters. Using our mobile devices, we embarked on a mission to explore the cosmos, tracking stars and searching for cosmic rays. These activities allowed us to contribute to significant environmental monitoring and scientific discoveries, empowering us as young scientists.

This journey deepened our understanding of complex scientific phenomena and enhanced our skills in data analysis and teamwork. Our report shares the challenges we faced, the creative solutions we discovered, and the invaluable insights we gained. As we navigated this unique learning experience, we realized the profound impact that young minds can have on the global scientific community.

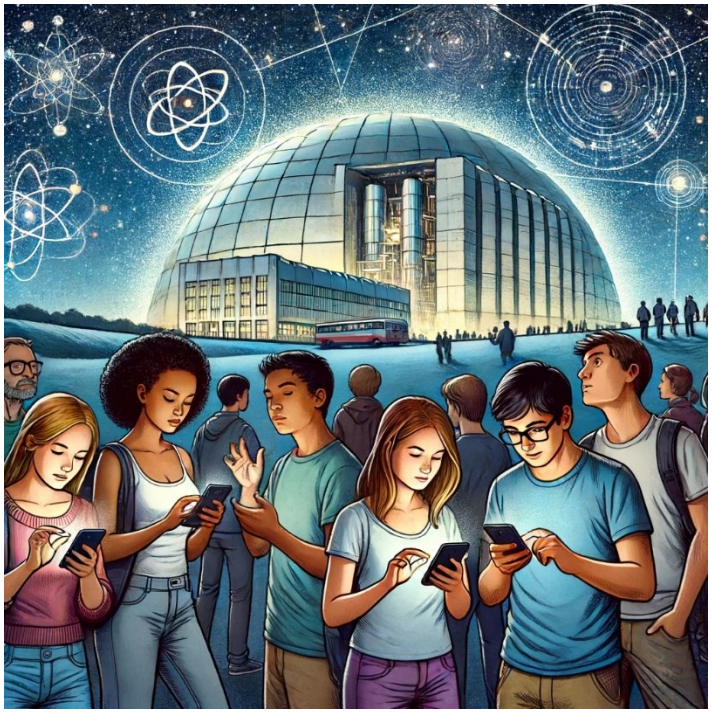

Figure 1: Exploring the Cosmos: Young Scientists at the Forefront of Citizen Science

II. Individual Experiences

Throughout the CREDO project at CERN, each of us embarked on a unique scientific journey that was both challenging and enlightening. As students with diverse backgrounds and interests, we approached the project with different perspectives and methods, which enriched our collective experience and deepened our understanding. Guided briefly by our physics teacher, Mr. Adel, we learned to navigate the complexities of citizen science effectively. Here, we share our personal stories of discovery, struggle, and success, each narrative shedding light on the distinct paths we took and the lessons we learned in the realm of scientific inquiry.

A. Charbel Abou Nader's Experience

It was tantalizing, mesmerizing; it sent an electrical wave through every limb of mine, passing through my brain where it waged a war between excitement and restraint, continuing its path until it reached my heart and exploded in a paradise of satisfaction. This is an understatement of how I felt when I learned about my opportunity to participate in such a breathtaking event as the CREDO project.

It all began on a normal school day at 12:30 pm, the lunch break bell had already rung its symphony while I was enjoying some fine gourmet sandwiches that my beautiful mother had prepared that morning. Suddenly, my friend Paul, yelling that it was the best day of his life, surprised me, and it quickly became mine too. Paul, me, and a few other students were selected by the school to participate in a rather prestigious project, the CREDO particle hunting campaign by CERN in collaboration with Transglobal Car Expedition. The final team wasn't chosen yet, and as my admiration and passion for the project grew, I started to fear losing this opportunity, not due to a lack of trust but because it sounded too good to be true. However, Mr. Adel quickly allayed my fears as he requested a private meeting with me and four other students. There we were - Paul, Aycha, Hiba, Rita, me, and of course, Mr. Adel, who, to our greatest surprise, quickly became the most skilled particle hunter in town.

We embarked on this journey with no prior knowledge about particle hunting and were completely ignorant of the concept of citizen science, but we all shared one powerful tool in common: the love of science. As we dove deeper into the ocean of particle hunting, waves of technical issues began to hit our ship, seemingly drowning us in what appeared to be the end of our team but ultimately were just hurdles that we had to overcome to enhance our methods and strengthen our team bonds. Through obscure (yet extremely funny) particle attraction rituals and more elaborate material testing, our team did everything possible to maximize our detections.

I couldn’t be more satisfied with the work and dedication that we all invested in this project. From a pure scientific perspective, this project was the perfect occasion to explore the intricacies of quantum physics through a fun game of hide and seek, where we, motivated and passionate students, did our best to seek out those elusive particles. From changing locations and device settings to experimenting with different materials to

cover the device's camera, the team never stopped moving forward and remains highly invested in the particle detection world to this day. One memorable observation that will forever stay a private joke within the team is the incredibly efficient use of socks to cover the camera while detecting cosmic particles, or as we like to call it, "The sock method." Although it sounds funny at first, the sock method has actually been the catalyst that took our team's detections to the next level. Mr. Adel introduced it, and seeing the incredible results he achieved, you guessed it—we never looked at his socks the same way again! Back to serious matters, this journey has profoundly impacted my own scientific taste. Beyond a simple data collection task, the CREDO project has excelled at sparking my curiosity about the complex yet perfectly elegant art of physics. And as resourceful as this experience might have been, it certainly did not quench my thirst for knowledge. In fact, it made me much hungrier by opening my eyes to gigantic doors leading to endless, yet unbelievably charming, scientific horizons.

On another note, this journey taught us much more than just particle hunting. This whole hunt was more than a simple challenge. I personally had the chance to get to know more about some of my teammates who I never thought would have anything in common with me, but who ended up becoming quite good acquaintances and quickly entered my close circle. We humans sometimes underestimate the actual power of common interests - in our case, quantum physics - in the bonding of two souls. The particle hunt was the perfect occasion for us high schoolers to get a taste of actual mature and useful teamwork, which is quite different from the obligatory group work that any student might experience in their educational journey. As a group, we learned through the CREDO campaign to get the best out of each member to maximize efficiency. One important detail to remember is that our results never grew as much alone as they did when we were working together. The particles seemed to be far more present in our group detections! Guess they also like teamwork ;) . On a more serious note, our journey through CREDO proved to be so much more than just a physics project. It clearly taught us an important lesson by showing us the beauty of working as a team.

In the end, even after detecting particles for a couple of months, the CREDO journey felt like it started just yesterday. Whether it is from a scientific or social point of view, this project has touched each one of us in its own way. The moral lessons that were brought to us through elegant particle hunting tasks are most likely to stay forever engraved in each of our memories. Our particle journey may or may not come to an end but it's surely not the last one. We cannot possibly imagine a world where this project doesn't exist. At the end of the day nothing can stand in the way of the love of science.

B. Paul Abi Chakra's Experience

A few months ago, our school introduced us to a new scientific research project related to physics, which would also aid CERN's research efforts. Being a physics enthusiast, I already knew a bit about CERN and applied right away for this opportunity to help scientists as well as discover new things to enhance my personal development.

I was fortunate to be selected for a great team, and together with our teachers, we had a Zoom meeting with the people responsible for the project. They enlightened us about the project and introduced us to the Credo application. I downloaded the application onto my phone, a 2022 Samsung A23. My Android version is 14.0.00.12 and my One UI version is 6.0, so it met the requirements for detecting cosmic particles.

At that moment, we created our SSCC Sioufi team and were ready to perform. In the first few days, I tried many techniques: I placed the phone on my balcony around 9 PM. Here are the approximate coordinates I could find on Google Maps: 33°54'35.1"N 35°35'40.8"E. I initially used black tape on both the front and back cameras but didn't really get any results in the first two days, I suppose due to poor technique. Meanwhile, one of our teachers had successfully detected a few particles, and one of my friends had detected 1 or 2 particles as well using a different material to cover the camera. After that, I covered my camera using a card similar to a credit card (made of plastic) and kept my phone in my dark balcony for a few hours or overnight in one spot without moving it. The results improved: I detected some particles, but it wasn't consistent as some nights I might get about 5 detections, but on another, I could get none.

Furthermore, I've heard that the model of the Android we are using could affect the number of detections. I thought that maybe newer phones would mistake the particles for camera defaults and their newer technology would ignore them, so I tried downloading the CREDO app on an old Samsung Galaxy S6. I placed my newer personal phone and the old S6 next to each other and covered them with the same type of plastic cards. To my surprise, even though the phones were next to each other and exposed to the same conditions, it was the A23 that detected more particles.

Also, on school days, my team and I decided to gather our phones and put them in a dark room all day long at school to detect particles, but we wouldn't get the same number of particles detected using the same techniques. This confirmed that the model of the phone could greatly impact the number of detections.

I continued detecting cosmic particles on school days and at night but was nowhere near the thousands of detections other teams were getting or the few hundred one of our teachers could detect. So, we decided to have a meeting with him where he could give us some tips and to ask the WhatsApp group for some help, which was a game changer.

We discovered new techniques to detect particles more efficiently: I would put a black piece of cloth (typically my sock) over the camera, which could potentially let particles be detected more easily by my camera, and would be moving around my balcony or outside for a bit of time. This has considerably increased the number of detections, even though it came with a cost: a portion of them were not real detections but rather false positives caused by light, but it was still worthwhile as some of the detections were indeed genuine.

I’m still using this technique, which has allowed me to log a few hundred detections. However, due to my official exams, I haven't yet explored the subtle differences like using the back or front camera or the new technique on my older Galaxy S6 phone, or even taken note of the weather's influence on the detections. But I plan to do this soon to find the best solution to help scientists in their studies and to better understand how the app works and how particles behave.

Additionally, this project has enhanced my teamwork skills, as collaborating with my team and others globally has significantly aided our discoveries. The research has deepened my interest in topics I've explored, such as the fascinating story of Fridtjof Nansen, who aided scientists in their quest to understand our Earth.

I am really grateful.

C. Aycha Beydoun’s Experience

Overcome by a syphilitic disease of the nervous system, writer Guy de Maupassant expressed in his ‘Letter of a Madman’ the very remnants of his logic condensed in the idea of “Truth on Earth, error beyond, from which I conclude that barely glimpsed mysteries (…) only remain concealed from us because nature has not endowed us with the organ or organs necessary to comprehend them.” Should I consider particle detectors a new “organ” to my body, I cannot say that it has enlightened much of the Universe ahead of me, for I still need to inherit the knowledge acquired in that domain. However, I can assure you that it has led me down a path of research, curiosity, and eagerness to unveil the mysteries glimpsed in our sky.

Our introduction to CREDO took place on April 29, 2024, while we attended our first-ever Zoom meeting with the Transglobal Car Expedition team. During this meeting, we met Mr. Cedric Noujaim and Dr. Maxim Artamonov, who explained muon detections, the stakes of light pollution, and Good Gear’s projects.

We were filled with excitement, and as we finished reading all the protocols and articles, we immediately tried to create our CREDO accounts. Still, we were brought back to reality by the absurd quantity of lags we experienced trying to use the application, and even that seemed impossible. Eventually, we were provided with an old version of the app that had to be downloaded first before updating it via the Play Store.

Thus began our journey of particle detection, a daily routine of covering my phone’s camera with black cardboard, letting the application run the whole night, and waking up excited to see how many particles I detected. My teammates and I also decided to repeat the steps at school from 7:30 am to 2:20 pm, placing our phones in a dark, soundproof room near no working electrical devices. ***(GPS: 33.8863 N, 35.5257 E)***

A few weeks went by, and few to no particles were detected on those phones, even though all the requirements were met. Hence, we pled our case on the WhatsApp group dedicated to The Transglobal Car Expedition team and were advised to vary CREDO’s settings. It was also noted that older Android models were more prone to particle detections.

Accordingly, I experimented with the application's settings, assorting the many options: the used camera ***(main back cam/selfie cam)***, the video resolution ***(320*240 /352*288 /640*480 /960*720 /1088*1088)***, and the Max factor ***(60/80)***; however, progress stagnated whether it was using black cardboard to cover the camera or a magnet. ***(my phone's model: Samsung A33, Android version: 14, GPS: 35.5049 33.8856)***

Soon enough, most of my teammates had detected a few particles while I still couldn't detect a single one after almost a month. As a result of lacking particles and declining motivation, I ceased operating the detector for a few days. That was until Mr. Elie Noujaim reached out and suggested we use a synthetic fabric to cover the camera, and so we did. The method worked wonderfully on Mr. Adel Tarraf's side, while my draining phone battery only flooded me with frustration.

Everything changed when the team decided to meet one night to try particle detection together. Our teacher, Mr. Adel, pointed out that he had been holding his phone towards the sky and stretching the fabric. I followed along and suddenly started detecting an obscene number of particles: more than one hundred in a few minutes! To say I was euphoric is an understatement; we were finally back on our feet! Although some of the detections showed bad traces of artifacts, a considerable amount showed good traces of artifacts. To minimize the distortion of our results, we pointed our phones towards the black sky, avoiding any city light. While it took some time for CREDO's site to register our results, we soon were able to proudly look at the numbers next to our names.

The day after, we met with Mr. Elie Noujaim on Zoom, and after reporting all the work we'd done, he announced that we were invited to CERN in Geneva, encouraging us to continue detecting particles and deepen our research.

At last, my journey alongside the CREDO detector has helped me deepen my relationships with my teammates and teachers while continuously pushing my personal boundaries farther every step of the way, filling my mind with a strange clarity and an aspiration to learn about and discover the "organs" that science reaps for a better understanding of our world's "barely glimpsed mysteries."

I am most grateful for the opportunities that CERN, the Transglobal Car Expedition, and our school have offered us along this path of discovery. We eagerly await the new openings it holds for us in the future, as our journey of particle discovery grows and proliferates.

D. Hiba Housseiny's Experience

On a random Thursday, I was surprised to be selected by our school to participate in the CERN competition. Initially, it took some time for the organizers to explain and provide us with further information. During that period, I attempted to communicate with some former CERN employees and astrophysicists. Eventually, they explained how the CERN laboratory investigates the origins of the world, including various entities.

A couple of days later, I was introduced to CREDO, an application that captures particles. I attempted to download the app on my iPhone, while my teammates had already installed it on their Android devices. Everything went smoothly during the download, yet to my surprise, I noticed that my welcome page was indeed different from those of my friends - not only in design but also in the tasks and information displayed. Additionally, our physics teacher, Mr. Adel, introduced us to another version of the app; however, this workaround also failed on my phone since it was an Apple device. So, as days passed, I tried to figure it out but ended up using my dad's Android phone.

It was quite late, around 12 PM, when I first tried it in my living room. It took about 20 minutes to capture only 4 particles. I wasn't satisfied with my results, as I was quite behind compared to my friends. But surprisingly, when my dad's phone rang and he stepped out to the balcony, the situation changed dramatically. It was very dark outside in Beirut. Once he handed me back the phone, I was astonished to find that I had captured 50 particles during the 5-minute call. I tried to replicate his movements, and to my surprise, I noticed that the phone started capturing particles rapidly once I fixed it to the aluminum of my balcony's black door. I captured around 1000 particles in 20 minutes. From that day on, I mostly used this method daily (since it was my dad's phone), and consistently achieved similar results. I certainly noticed that the darker and later it was, the more efficient the method became. My average practice time was 30 minutes a day.

Sadly, these findings were not mentioned on the website's boards. I also experimented with the black sock theory on my balcony, which yielded successful results but was not as efficient as my method. Additionally, I tried it in my village in Jbeil, and the results were better; in 15 minutes, I captured 1000 particles. My results were kind of shocking compared to my teammates. Thus, I started to doubt them since they also weren't mentioned on the boards. However, I saw the particles, albeit fewer than what I got, and they still weren't acknowledged there. I still don't understand the real reason behind this discrepancy.

Finally, despite the fact that the experiment became repetitive with no further advancements, we were extremely happy once we were informed that we had won the competition. This news was initially conveyed during a meeting intended to inform us more about our problems. I am eagerly looking forward to our meeting in Switzerland and to meeting the team in person. I will always remain passionate about science so that I can contribute to humanity.

E. Rita Loutfi's Experience

My adventure with the project launched by CERN started on a random Thursday at school when our physics teacher suggested a group of students participate in this exciting venture. Five of us accepted the challenge, myself included. I was particularly thrilled to be part of this journey, especially because physics has always been my favorite subject. To be honest, although I had a vague idea that CERN specialized in nuclear research, I didn't know much about its specific work. The step I took automatically motivated me to learn more about its

projects and goals. The more I read and watched about it, the more I was excited about the possibility of one day seeing all this in real life.

Our first challenge was particle hunting using the CREDO detector application on our mobiles. My four classmates, our two teachers, and I encountered many difficulties during the downloading process. Fortunately, we were provided with the newest version of the app, which we all managed to download easily. Afterward, we created email accounts for each one of us and chose a name for the Sioufi Lebanon Team, “Sioufi Pulsar.” After reading the documents sent by the organizers of the project, we all started to experiment with various methods to begin our particle detection. Unfortunately, we weren’t familiar enough with the detector: despite trying many techniques, such as covering the camera with different materials, changing our phones’ placements, playing with location settings, and alternating between the inside and the outside, we couldn’t detect a single particle. We remained in this state for several days until suddenly, our physics teacher detected our very first particle. We quickly adapted our phone settings to his, heeding his advice and his detection attempts. Consequently, we began to detect many more particles, albeit slowly, remaining in a range of ten to twenty particles per person. We were glad to have started our detection, yet sometimes we lost motivation when we saw our teammates from other countries detecting thousands of particles in a very limited amount of time. Personally, my technique was to place my phone in a dark room with a black opaque tissue covering the camera. For nearly a week, I could detect some particles, but not more than one or two per hour. Each of my classmates, employing their own methods, tried to detect the maximum number of particles, but the attempt wasn’t really successful. Here, I would like to thank the CREDO team for answering all our questions on the WhatsApp group. Although we sometimes demanded a lot of extra information, they always assisted us with their advice and supplementary documents. After a few days, my four teammates and I decided to meet at school to try to find a solution to this problem. We agreed to place all our phones in the same location for the same amount of time. And that’s what we did: every morning, before going to our first class, we set our phones in a little dark room next to the school library. We picked them up before going to our homes, and to our surprise, we discovered significant differences in the detections on every phone each day. For instance, one day, I could detect up to 60 particles during the 8-hour school day, while one of my friends remained at zero for a very long time, even though we both used the same setup. Day after day, we repeated this process; it helped us to maximize our detections even though we weren’t at our homes and it also allowed us to study the variation in detection according to our phone settings. We discovered that the phone version played a significant role in detection efficiency, prompting us to begin using older phones borrowed from our family members. Yet another problem occurred: our detections on our phones weren’t synchronized with our detections on the results table. For example, I reached 90 particles on the CREDO app, while on the site, next to my name, it was written that I could only detect 8 particles. My data was stuck on 8 particles for more than a week, and my classmates also encountered the same issue. After a few days, our physics teacher organized a meeting at school and asked us

for updates on our detections. We explained everything related to that—the positive aspects as well as the negative ones. She suggested that we request a meeting with someone from the CREDO team. And that's what happened: we scheduled an online meeting on Zoom via the Transglobal Expedition WhatsApp group, and we prepared a list of all the questions we needed answered to progress in our work. This meeting was extremely helpful: we got answers to all our questions, learned more details about the expedition itself, and much more. This online meeting also highlighted the possibility of detecting fake particles and the necessity of always checking the photos of our detections, which may be the reason for the discrepancies we noticed between the app and the site. During this time, we noticed that our other physics teacher could detect more than five thousand particles! It was astonishing for us because I personally couldn't exceed a hundred particles at most.

We asked him to show us his wonderful technique, and we arranged a face-to-face meeting with him as soon as possible, even during our final exams revisions. In fact, I used to cover my camera with a piece of tissue, another person used black tape, another cardboard... but nobody thought of the "sock" alternative! He showed us how he used a black sock to cover his camera: the little pores in the fabric allowed light to pass through more efficiently, without triggering the camera cover warning. We immediately went, the same night, to our school's roof to help each other detect a huge number of particles. The process of moving continuously with the phone, using a sock fabric, and detecting particles in an open area optimized our detections: we could nearly detect hundreds of particles in one night! That was simply extraordinary. After we returned to our homes, we continued with this amazing technique, and we saw our detection numbers rapidly increase: I was at 90-100 detections before that night, and I quickly reached more than 700 detections. I adopted the habit of detecting on the rooftop of our house every two or three days using the sock technique, and I am now at more than a thousand particles. The fact that we knew after some time that we were invited to CERN in Switzerland didn't stop us from our detections. Although we were overjoyed with this announcement, we didn't give up and are still trying to detect as many particles as possible to this day.

In conclusion, although the particle detection adventure didn't immediately go well, we didn't give up and we always helped each other to optimize our detection techniques. From trying to detect at school to each of us trying alone, we overcame all the difficulties thanks to the support from all your teams, the innovative ideas of our teachers, but most importantly, thanks to our love for physics and our motivation to always try our best in everything we do.

F. Adel Tarraf's Experience (Physics Teacher)

As a physics teacher leading a group of enthusiastic students in cosmic-ray detection, I embarked on an exploratory journey that employed various methodologies to enhance our observational capabilities. Initially, we started with the CREDO detector application available on the Play Store, which we found to be exceedingly slow for our research purposes. Fortunately, we were provided with a special link to download a more advanced

version of the app. After updating the app via the Play Store following this new installation, we experienced significant improvements in performance, which allowed us to conduct our experiments more effectively.

My initial experiments began in the controlled environment of a dark room, where I covered the camera of my smartphone with thick black cardboard and positioned the device toward the sky. This setup allowed me to detect my first cosmic-ray particle after 7 to 10 minutes, marking an exciting breakthrough. Throughout that first night, I recorded a total of seven particles. To be honest, I didn't sleep at all; I was continuously trying from different windows of my house. This was a modest start that made me feel somewhat disheartened, especially when compared to international teams that reported thousands of detections in mere minutes.

In my continuous effort to improve detection rates and assist my students in observing the maximum number of particles, I adapted our experiments to include mobile detection while driving at night. Using the same black cardboard to cover the camera, I conducted detections during drives all over Lebanon, exploring different environments and conditions for particle detection, from Beirut to the darker regions in the north of Lebanon. This setup, although challenging, yielded about ten particles per day and became a part of our routine, extending to various daily activities and locations. After that, nighttime was not enough for me. I started covering the camera with two black cardboards and began my detections during the day too: while driving in the morning to school, while in class by placing my phone on the window, during tutoring sessions, and on my way home again. I became addicted to detecting particles, but it remained very challenging to capture even a single particle.

A significant advancement in our methodology occurred when I experimented with using dark, slightly porous socks instead of cardboard. This was the breakthrough moment: this innovative approach proved to be more effective, allowing a controlled amount of light to reach the sensor and significantly increasing our detection efficiency. However, it required a very dark environment to avoid the app instructing me to cover the camera. When detections didn't occur quickly, the porous nature of the socks allowed for minor adjustments in light exposure by stretching the fabric, which further optimized the detection process. With this method, I was detecting particles continuously, especially in Beirut where we are surrounded by these particles.

Despite these methodological advancements, we faced significant challenges with the CREDO platform itself. The particle counts displayed on the website often remained unchanged, and updates were either delayed or incomplete, sometimes taking up to 24 hours. This issue was particularly frustrating as it affected our ability to track progress in real-time and gauge the effectiveness of our experimental modifications.

My journey with the CREDO detector, fueled by a commitment to my students and the field of physics, has been both rewarding and challenging. Through persistent experimentation and innovative approaches, such as the use of socks for camera covering, we have significantly enhanced our understanding and success in

detecting cosmic rays using mobile technology. However, the challenges with real-time data reporting on the CREDO platform underscore the complexities of conducting scientific research with mobile applications. Despite these obstacles, this experience has deepened our appreciation for hands-on scientific inquiry and highlighted the importance of creative problem-solving in educational settings.

III. Team Collaboration and Project Impact

A. Team Dynamics and Collaboration

Our project with CERN through the CREDO application brought together five students and our physics teacher in a unique collaborative environment. Each team member brought their own strengths to the table, which enhanced our collective ability to tackle challenges. For example, some were better at technical troubleshooting, while others excelled in theoretical aspects, creating a balanced team dynamic. Noteworthy is the session where we brainstormed to overcome the issue of inconsistent particle detection, demonstrating how diverse perspectives can lead to creative solutions. Our teacher played a pivotal role, not only as a mentor but also as a coordinator, ensuring that each student's voice was heard and valued.

B. Technological Engagement with CREDO

Engaging with the CREDO app was a cornerstone of our project, allowing us to interact directly with advanced scientific tools. Initially, navigating the app was challenging due to its complex features and the nuances of particle detection. However, as we familiarized ourselves with its functionalities, it became an invaluable resource. The app enabled us to visualize data in real-time, offering a practical learning experience that textbooks could not match. This hands-on approach helped cement our understanding of theoretical concepts, making abstract physics more tangible and exciting.

C. Interaction with CERN

Our interactions with CERN were instrumental in enhancing our understanding and engagement with the project. These interactions included webinars and direct communications with distinguished scientists such as Mr. Cedric Noujaim, Dr. Maxim Artamonov, and Mr. Elie Noujaim. Each expert provided invaluable insights into the practical applications of particle physics and shared real-world challenges faced by researchers in the field. These sessions not only deepened our understanding but also served as a powerful source of inspiration, demonstrating the tangible impact of scientific work on global issues. The encouragement and guidance we received from these CERN experts during our interactions significantly bolstered our confidence and aspirations, fueling our desire to pursue careers in scientific research.

D. Broader Educational and Scientific Impact

Participating in this project has had a profound impact on our academic journeys and personal development. It has sparked a greater interest in STEM among us and our peers, highlighting the relevance and excitement of scientific inquiry. For many of us, this project has become a defining moment, potentially guiding future educational and career choices towards scientific research. The skills we developed - critical thinking, data analysis, and collaborative problem-solving - are universally applicable and highly valued in any academic or professional setting.

E. Reflections on Citizen Science

The concept of citizen science, as demonstrated by our project, plays a crucial role in democratizing scientific research. It empowers students and ordinary citizens to contribute to real scientific endeavors, breaking down the barriers between professional scientists and the public. This project showed us that science is not just for scientists - it's a field accessible to anyone with curiosity and dedication. Engaging in citizen science has not only educated us but also allowed us to contribute to meaningful environmental research, such as studying light pollution and its effects.

IV. Conclusion

As we reflect on our journey through the CREDO project at CERN, it becomes evident that this experience was more than just an academic exercise; it was a transformative adventure that has significantly shaped our perspectives on science and its applications in the real world. Each step of this project, from the initial struggles with technology to the thrilling breakthroughs in particle detection, taught us valuable lessons about perseverance, curiosity, and the power of collaboration.

We have gained not only a deeper appreciation for the complexities of particle physics but also practical skills in research methodology and data analysis that will serve us well in any future scientific endeavors. This project has also reinforced our commitment to pursuing careers in STEM fields, inspired by the hands-on experiences and the real-world impact of our work.

We are particularly grateful for the robust support system that surrounded us throughout this project. A heartfelt thank you to Sister Hélène Richa, the principal of our school, whose support was instrumental in facilitating this opportunity. Sister Hélène's encouragement and belief in our potential were vital in navigating the challenges of this complex project.

We would also like to extend our profound gratitude to Mrs. Cynthia Fenergi and Mrs. Carine Banna for their unwavering support and guidance. Their insights and advice were crucial in helping us understand the intricacies of the experiments and in making critical decisions that enhanced our research outcomes.

Moreover, our interactions with experts at CERN, including Mr. Cedric Noujaim, Dr. Maxim Artamonov, and Mr. Elie Noujaim, enriched our experience immensely. Their willingness to share their knowledge and expertise not only helped us in our scientific work but also motivated us to strive for excellence and to contribute meaningfully to the scientific community.

In closing, this project has not only advanced our knowledge and skills but also ignited a passion for exploration and discovery that we will carry forward into our future studies and careers. The lessons learned here, the friendships forged, and the professional relationships established have laid a solid foundation for our future endeavors.

As we look ahead, we are eager to explore new opportunities and challenges, inspired by the knowledge that with passion, teamwork, and dedication, we can achieve great things. This is not the end for our project; we will never stop hunting for new particles, and we are eagerly awaiting more challenges to come. Thank you again to everyone who played a part in this incredible journey. Your support has been a beacon of inspiration and a reminder of what we can accomplish when we come together in the pursuit of knowledge and innovation.