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PHYSICISTS AND COMPUTER ENGINEERS DO COMMUTE.

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***Abstract*—** when two operators, which help us to measure the physical quantities e.g. Momentum, Energy and Position etc. of a system, commute Physicists say that both quantities can be measured or observed at same time. So the title of my paper implies that both Computer engineers and Physicists can be observed working together to solve many real life problems. A physicist needs a computer engineer and vice versa. Unfortunately students of computer engineering seem to be a little unaware of the fact and they don't devote much time to learning physics[4,5,6], they seem to believe that they will be a computer programmer and they won't need much physics in future. There may be other reasons for the ignorance of this subject.
Student's approach to understanding physics can highly influence their motivation and ultimately development of great computer programs using different languages and platforms. Learning physics can help them to develop programming skills that will solve many day to day life problems. The ultimate work of a programmer /engineer is to solve our daily life problems and build a sustainable world. Here I discuss for computer engineers the importance of learning physics at an introductory level and how it will help to be a good programmer.

***Keywords*—** *Quantum Physics, Virtual Lab, Spectroscopic.*

I .INTRODUCTION

Students in their early engineering years are very much ignorant of learning basic science, be it physics, chemistry or mathematics[8,9]. The reason for Ignorance may differ from student to student. The reason can be the lack of interest of a student for these subjects. It also depends on how much time a student devotes to learn these subjects. Sometimes computer engineering students don't seem to pay much attention to these subjects because they feel that their career is to be a programmer but not a physicist.
Another unfavorable attitude toward learning physics is that the current syllabus doesn't tell them how learning physics can help them to be a good programmer. Since the work of the programmer is to solve the problems which are there in this universe where we live, and physics is the subject which helps us to understand the laws of this universe. Here I try to emphasize that a good programmer needs to be a good physicist and vice versa.

II. Programmer can simulate the macroscopic and microscopic world :

There are many daily life problems that need to be studied repeatedly in different conditions to solve them. Best way to do it is to make a simulator of the same environment or conditions. A programmer can build such a simulator using a different programming language with the best GUI. Programming such a simulator required the knowledge of both computers and basic science. Without the knowledge of Physics students won't be able to understand the basic problem and the theories which predict or explain them.

Example: In order to study the strength of material, a programmer with given conditions can build a simulator to check the strength of materials without wasting the energy and affecting the environment of our beloved earth. Also a simulator can be created to study the frictions of different types of material with the road hence to build an effective vehicle tyre, battery or any accessories of industry without even fabricating these in the real, in fabrication for such different types of accessories will surely affect our environment and man power. There are many simulators which help us to do so.

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These are the basic motivations to learn programming and the basics of science. Without knowledge of basic science students can't understand the basics of friction, band gap of material or fission or fusion which are the ongoing research interest of current time and material properties and its fabrication process which indeed need knowledge of Physics, mathematics and chemistry.
Similarly to understand physics we need a large group of programmers who can help us to build great simulators using their programming skills. There are many simulators already available which have been coded by great computer engineers with very nice GUI. I am listing a few of them below which can help the engineering students to motivate them to learn programming and to enjoy the learning process of physics

A. Virtual Physics labs :

PHET and Amrita university lab - these two platforms are there which helped many students and faculty in covid period to learn and enjoy physics. We can perform a number of physics experiments using these two Virtual labs, thanks to computer engineers who were interested in physics.

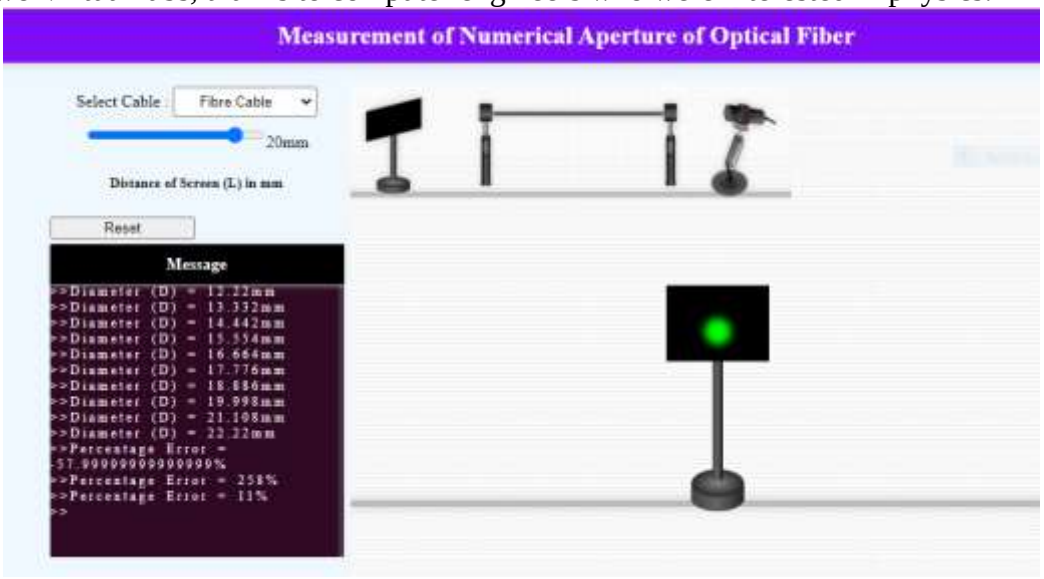

Fig : Measurement of Numerical aperture using Simulator .

The above simulator [1] helps students to understand the basics of optical fibre.
Here we used this simulator to find the numerical aperture of optical fiber.
This describes the range of angles within which light hence information that is incident on the fiber will be transmitted along it.
In Vlab and Phet we can perform many Physics experiments, like Experiments from Modern Physics, Classical Physics and many more.

Tracker[2] -: Tracker is a simulator which uses videos of real life and tools in it helps to get results.It is built in Java framework. It helps to study and understand Physics and many experiments.The development of the Open Source Physics Java framework and the free Tracker video analysis program can make spectral intensity measurements easy, cheaper and interactive. Students use a line profile, a tool in Tracker, to generate intensity of spectra and also give graphs of it of recorded video of spectra. A downloadable video spectroscopy library allows quantitative video spectroscopy to be used into introductory labs with local video camcorders.

The Open Source Physics framework is a set of Java software packages that can be used for curriculum development, physics education research and computational physics. It is designed to be used in introductory college physics practicals and lectures. Tracker and the video spectroscopy

library are available for download[2] .

This poster describes video spectroscopy experiments. Where were measured and analyzed the following spectra:
1. Thermal incandescence
2. Color filters
3. Gas lamps

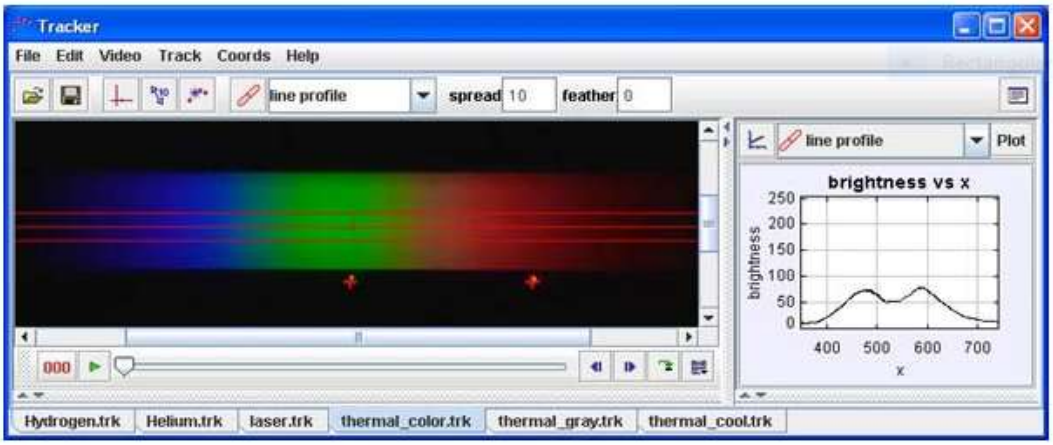

Figure 1

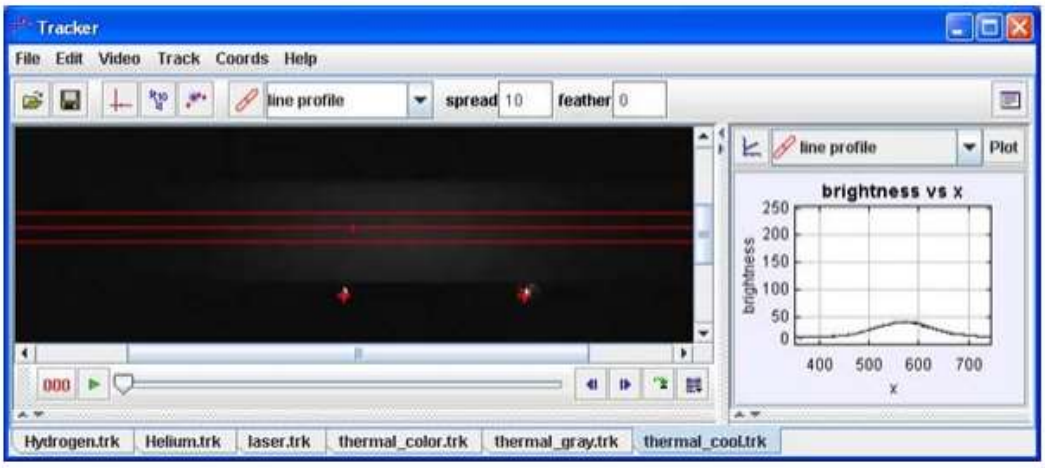

Figure 2 Thermal Spectra: Color, Grayscale, Cool

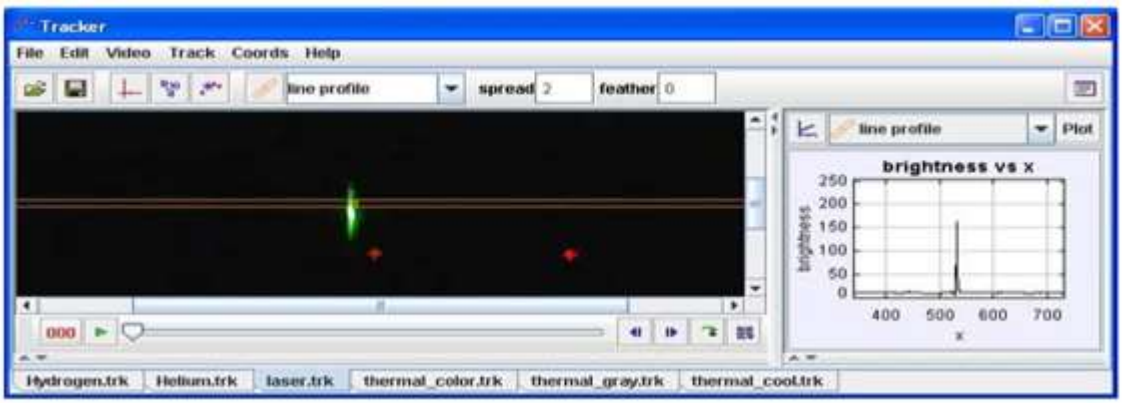

Figure 3 Line Profile of laser beam.

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Exoplanet-spotting with tracker

We can detect exoplanets by detecting small, periodic drops in the intensity of light as the exoplanet passes by. We can build a star and planet prototype using a light bulb and globe and a Spherical ball which is hanging from a certain height, which may act as a Pendulum, a conical pendulum. To get a large period of the orbit we can use a long string. The light intensity of our star can be measured using datalogger attached with the light sensor. When an exoplanet passes through the star, the light intensity decreases, this we can detect using line profile menu of the tracker to detect the presence of the exoplanet. We can easily draw the distance vs intensity graph (Shown below Figure 4) and may predict exoplanet position.

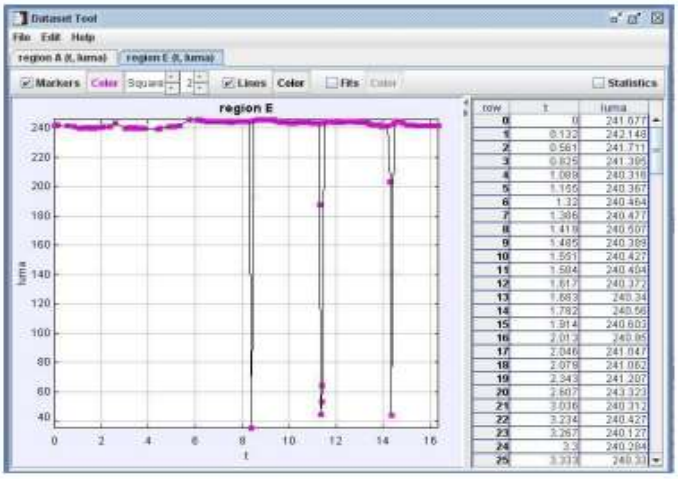

Figure 4 The distance vs intensity graph.

Quantum espresso:

It is one of the best creations of both Physicist and Computer engineering . This particular software is currently the best available option to physicists to study many properties of materials based on the theory.

We can study many Physical properties of materials directly from the basic physical quantities such e.g mass, charge , coulomb force of an electrons , based on quantum Physics.

We can study electronic properties charge density , energy dispersion, band structure, frequency of oscillations of atoms in crystals , Phonon angular frequencies , Phonon-electron interaction which play very important role to understand the electrical conductivity, superconductivity and temperature dependent of energy band of atoms or molecules.

Here we have calculated the band gap energy of MGO molecules. Using Quantum espresso scientists are able to predict the promising and current value of band gap energy which is 7.4 eV which earlier other simulators was predicting 3.4 eV Figure 5 .

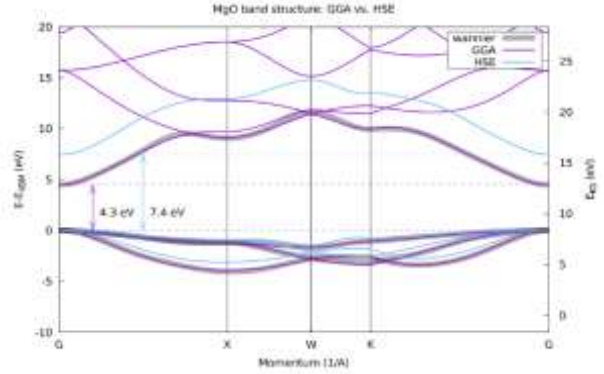

Figure 5 Band gap energy MGO molecules .

Conclusion: This paper clearly shows that a computer programmer can help their career and may

work on many emerging fields and contribute to various science projects. Computer engineers are a very important asset to a physicist. By researching little about Quantum espresso, anyone can understand the importance of computer programmers who understand physics in great detail.
Quantum espresso is solving and predicting many results which were unknown to material scientists. I can say that a computer engineer who programmed Quantum espresso must have studied physics, especially quantum Physics. Getting the solution of the Schrodinger equation for many body systems is now a cup of tea by using quantum espresso.
Students of Computer engineering should pay more attention in studying Physics in their first year of college so they will have the foundation of Physics on which they can learn more advanced physics for their future projects and may create many simulators or software that will have impact in the field of STEM.

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