

THE

# PARTICLE

Syed Babar Ali School of Science and Engineering's Magazine

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## MATHEMATICS IN SPOTLIGHT

برقی انقلاب

A WIN FOR PAKISTAN

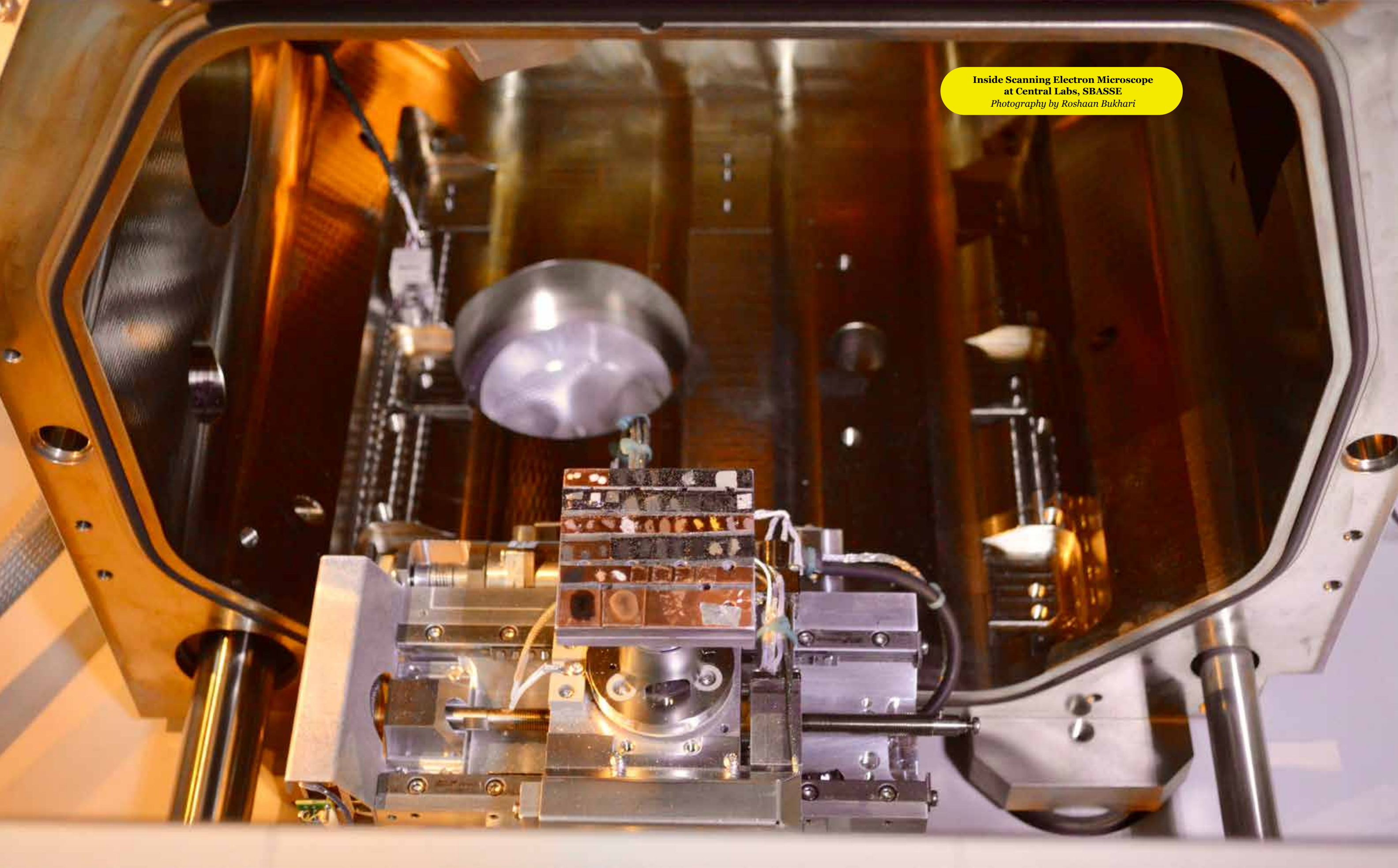
SHATTERING SPIRES



Syed Babar Ali  
School of Science and Engineering



**Inside Scanning Electron Microscope  
at Central Labs, SBASSE**  
*Photography by Roshaan Bukhari*





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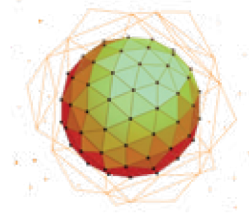
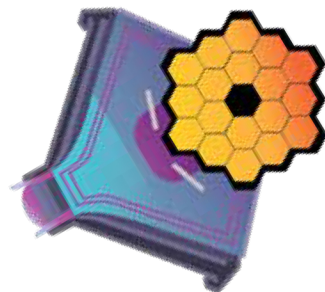
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## کھلے رہیں سب کے لیے...

لمز میں تعلیم بہت سے نوجوانوں کا خواب ہے۔ لیکن بہت سوں کے لیے یہ خواب ابھی بھی ادھورا رہ جاتا ہے۔ ہماری البتہ کوشش رہی ہے کہ یہ خواب ٹوٹنے نہ پائے۔ مالی حیثیت سے قطع نظر ملک (اور بیرون ملک) کے ہونہار ترین دماغ ہمارا خاص ہدف ہیں کہ وہ مکمل ذہنی سکون کے ساتھ لمز میں تعلیم حاصل کر سکیں۔

ہم اس مہم کو مختلف پیرایوں میں طے کرنے کی کوشش کر رہے ہیں۔ مثلاً سید بابر علی تحقیقی اعزازات، جو وظائف کی صورت فراہم کیے جاتے ہیں، کے ذریعے پی ایچ ڈی کے طلبہ بھی اپنی تحقیق کو منطقی انجام تک پہنچا رہے ہیں۔ میرے لیے یہ بات سب سے زیادہ خوشی کا باعث ہے کہ حال ہی میں ہم چوبیس (۲۴) طلبہ وظائف کے لیے نئے تعلیمی وظیفوں کا اجرا کر پائے ہیں جو ریاضی، کیمیا، طبیعیات اور حیاتیات کے شعبوں میں نمایاں کارکردگی دکھائیں گے۔ یہ وظائف چار نابغہ روزگار شخصیتوں کو سہاوتے ہیں اور ہمارے مشن کے لیے استعارہ کا کام دیتے ہیں۔ مصری سائنسدان ڈاکٹر احمد زویل نے فیمٹو کیمسٹری جیسے نئے میدان کی طرح ڈالی اور نوہیل انعام جیتا۔ اُن کے طفیل مصر میں کیمیا کا چلن عام ہو چکا ہے۔ ڈاکٹر چندر شیکر اگرچہ ہندوستانی نژاد تھے، مگر ہمارے شہر لاہور میں پیدا ہوئے اور بلیک ہول پر اپنی عہد ساز تحقیق کے ذریعے نوبل انعام یافتہ ہوئے۔ کراچی سے تعلق رکھنے والی ڈاکٹر بلقیس فاطمہ ماہر حشرات<sup>2</sup> تھیں جنہوں نے پاکستان میں پائے جانے والے بہت سی انواع کے کچھوں کی شناخت کی۔ آخر میں خواجہ دل محمد قیام پاکستان سے پہلے نمایاں ہونے والے ریاضی دان اور ریاضیات کی درسی کتابوں کے ہر دلعزیز مصنف تھے۔ میں نے اکثر بڑوں سے سنا کہ جنہیں دل محمد داحساب نہیں پڑھیا، انہیں حساب نہیں پڑھیا! شکر ہے خدا کا کہ اس نے ہمیں اپنی روایت، اپنے علاقے اور اپنی زرخیز مردم خیز زمینوں سے اٹھنے والے صاحب کمال لوگوں کو تحسین پیش کرنے کا موقع دیا۔

ساتھ ہی ساتھ ہم نے سرسید احمد خاں اور جیکب برونو<sup>3</sup> کی سے موسوم بہترین سائنسی اور تکنیکی لکھاریوں کے لیے بھی سالانہ انعامات کا آغاز کیا۔ اس سال ان انعاموں کے مستحق فزکس کے دو طلبہ عرفان جاوید اور محمد باسط ٹھہرے۔ ہمارا مقصد یہی ہے کہ ہمارے دروازے اور ہمارے دیدہ و دل سب کے لیے ہمیشہ کھلے رہیں۔ دی پارٹیکل کا اٹھارواں شمارہ اب آپ کے پاس ہے۔ پڑھیں اور ہمیں اپنی آرا سے ضرور نوازیں۔

محمد صبیح انور

1. femto chemistry  
2. entomologist  
3. Jacob Bronowski

# Academic Networking

## - a critical step in sustaining scientific research in Pakistan

**Dr. Muhammad Zaheer**

After joining LUMS back in 2014, the first and rather challenging task, was to train passionate undergraduate and graduate students. But before that, I needed the supplies, consumables, and analytical tools required for my research that centers on designing robust catalysts for renewable energy, green chemicals, and environmental remediation. Thankfully, LUMS provides a startup research grant to newly hired faculty at the rank of assistant professor, which significantly helps build a research group's foundation. I was lucky to win a competitive research grant, under National Research Program for Universities (NRPU) from the Higher Education Commission Pakistan (HEC) in 2015, which immensely helped us procure the equipment needed for our research. However, some additional analytical tools were still required to conduct quality research that could be communicated with the international scientific community. Building international collaborations across Europe, China, the USA, and the UK has proved highly effective in sustaining our research

The first research collaboration I started was with my PhD research adviser, Professor Rhett Kempe, in Bayreuth, Germany. Both institutes signed a memorandum of understanding to cooperate on research and exchange students and research staff. As a gesture of kindness, the University of Bayreuth also gifted a gas chromatograph (GC), equipped with Flame Ionization

Detector (FID), which significantly helps our group identify and quantify biomass valorization products—an area our research group focusses on. Professor Kempe also supported my short-term stays in Bayreuth, during which I supervised some master students in their research projects. Our mutual collaboration resulted in four research articles in reputed scientific journals.

In 2015, I applied for Phase 6 of the research grant under the Pakistan-US Science and Technology Cooperation program. Professor George Huber—one of the leading scientists in biomass conversion, kindly agreed to work as a co-principle investigator. Unfortunately, our project was not funded, but we received an encouraging review of our grant proposal. We again applied for phase 7, but the outcome was the same. However, these experiences brought the two research collaborators together. Our recent project with Professor Huber, as the short-term consultant has been approved for funding under National Research Program for Universities (NPU) funded by the Higher Education Commission of Pakistan (HEC). Professor Huber also gave a very interesting research talk on the valorization of polymeric materials into fuels, chemicals and materials to our students on September 30, 2021.

In 2018, I was awarded a Charles Wallace Fellowship to visit the University of Cambridge in the UK. The grant's objectives were to start new collaborations with scientists in the UK. In the Center of Atmospheric Sciences at

the Department of Chemistry, Professor Rod Jones kindly agreed to host my visit. During my stay, I gave a talk at the Department of Chemistry and attended the weekly group meetings of Professor Jones' research group. Moreover, I learned new data analysis skills and the development of low-cost sensors for ambient air quality monitoring.

My visit to Cambridge was very productive and led to a new research division in our group. Due to pressing atmospheric pollution, we decided to probe the chemical composition of particulate air pollution to find their potential sources. We wrote two research grants with Professor Rod on mitigating Lahore smog, by developing a hyperlocal network of low-cost air monitors. We proposed the establishment of a reference air monitoring station at LUMS and a network to validate the data collected from low-cost sensors mounted in the city. We submitted grants under Innovative and Collaborative Research Grant (ICRG)—jointly funded by the HEC and the British Council.

Our grant application was successful in the initial phase but got rejected in the final round.

We submitted the same grant to the HEC's Grand Challenge Fund (GCF) with the same team. However, the project couldn't make its place on the list of awardees.

In 2019, one of my friends from Bayreuth—then a postdoctoral fellow in the UK—contacted me asking if I am interested in applying for a grant on biomass conversion. His supervisor was looking for a potential research partner in Pakistan to apply for a research grant under Tackling Global Development Challenges through Physical Sciences Research funded by the Grand Challenge Research Fund. I agreed happily, and it was the advent of collaboration with Professor Jianliang Xiao from the University of Liverpool. Since then, we have written grants under various grant calls such as ICRG-HEC.

I have attended the annual meetings of the American Chemical Society in 2018 and 2019 to present our research. During these meetings, I worked with several American scientists and researchers who share similar research interests. Professor Kevin Kittilstved, who attended one of my talks, took a great interest in our research, and we agreed to collaborate on areas of mutual interest.

Before the global pandemic hit the world, one of my PhD students visited the University of Nottingham under the International Research Support Initiative Program (IRSIP). Professor Andrea Laybourn had shown great interest in the microwave synthesis of metal-organic framework—highly crystalline nanoporous materials. This is how we started our research collaboration, which is still active. We have published one research article, and the other is ready to be submitted for publication. Professor Laybourn helps us get our materials characterized by methods, such as X-ray Photoelectron Spectroscopy (XPS) and Transmission Electron Microscopy (TEM).

Over the past seven years, our research

group has trained three PhD, fifteen MS, and ten BS students who are now pursuing higher education in the US or serving national institutes. Moreover, we have produced over sixteen research articles in reputed scientific journals. One of our research articles was the most downloaded research paper of the journal and was published as a “hot paper.”

**Our international collaborators** have played a significant role in the success of our research group. In my case, various grant calls, travel grants, and participation in international conferences opened new doors of collaboration for our research group. Such cooperation provides us with the tools that are not available in Pakistan and play a pivotal role in whatever little research progress we make at LUMS.

**Dr. Muhammad Zaheer is an Assistant Professor at the Department of Chemistry and Chemical Engineering**



میلوں نے تو ۲۰۰۹ء سے فلکیات کی عوامی ترویج کی راہ ہموار کر رکھی ہے۔ اب بے شمار تنظیمیں اور افراد ملک میں آسمانوں کی سیر کراتے ہیں، اور نظام شمسی اور مآورا کے ٹھکانوں کی تصویریں، ویڈیوز اور معلومات براہ راست پہنچاتے ہیں۔ ملک میں دوربینوں کی مانگ میں بھی اضافہ ہو گیا ہے۔

کاش ہمارے تعلیمی ادارے بھی لاپارگی، افسردگی اور غیر معیاری تعلیمی قابلیتوں کی تعلی کی خود فریبی کے گرداب سے نکل کے ہمارے طلبہ اور طالبات کو کائنات کی سب سے بڑی تجربہ گاہ یعنی آسمان کے قریب لاسکیں۔ ظاہر ہے نہ تو آسمان دیکھنے کی کوئی قیمت ہے، نہ اس میں زبان، قومیت یا برادری کی قید۔ آسمان تو سانجھا ہوتا ہے نا!

کالج سے چلے گئے۔ خوردبین یا دوربین سے دیکھنا کسی بچے کی فکری زندگی کو ہمیشہ کے لیے بدل سکتا ہے۔ یونیورسٹیاں ان فلکیاتی مشاہدات کے لیے نرسری کا کام کر دیتی ہیں۔ امید ہے اسلام آباد میں انسٹی ٹیوٹ برائے سپیس ٹیکنالوجی کی نئی قائم شدہ دوربین محققین کے لیے ایک جنت نگاہ ثابت ہو سکے گی۔ کراچی یونیورسٹی رصد گاہ کئی سالوں سے بے اعتنائی کا شکار کرتے کرتے ختم ہو گئی مگر اب کم از کم اس میں دو نئی دوربینیں آ موجود ہیں۔ حال ہی میں پاکستان سائنس فاؤنڈیشن نے شکر پڑیاں پہ ایک چھوٹی دوربین تعینات کرنے کا ارادہ بھی کیا ہے۔ اللہ بہت دے۔

ہاں، چند ہنرمند اور کبھی آرام سے نہ بیٹھنے والے نوجوانوں اور بزرگوں نے اپنی مدد آپ کے تحت قابل ذکر رصد گاہیں قائم کر رکھی ہیں جو آسمانوں کی سیر میں مشغول رہتی ہیں۔ مثلاً لاہور کے عمیر عاصم زیڈرصد گاہ میں سیاروں اور سیارچوں کی دریافت میں نئے رستے ہیں۔ کراچی، بلوچستان، لاہور اور اسلام آباد کی فلکیاتی انجمنیں دہائیوں سے تاریک مقامات میں پہنچ کر ستاروں اور کنکشاں کی جلوہ گری سے ہزاروں شائقین کی نظروں کو چند ہیاتی ہیں۔ بلوچستان میں سبیلہ میں تقویٰ رصد گاہ کائناتی مہم جوئی کے لیے زبردست جگہ ہے۔ خوارزمی سائنس سوسائٹی کے فلکیاتی

لیے مواد فراہم کرتی رہی۔ پنجاب یونیورسٹی کے سیمول لال نے اسی دوربین کے ذریعے ایک مجموعہ نجوم قیٹس<sup>3</sup> کے ایک ستارے کے بارے میں اپنے مشاہدات کو فلکیات کے مستند ترین بین الاقوامی جریدے میں شائع کیا۔ سن ۲۰۰۰ کے لگ بھگ یہ دوربین ٹوٹ پھوٹ کا شکار ہو چکی تھی اور آسمانی نقشے ردی کی زینت۔ چنانچہ اس دوربین کو ایک تاریخی ورثے کے طور پر محفوظ کرنے کی حسرت اب مکمل دم توڑ چکی ہے۔ اسی طرح ایف سی کالج میں ایک نوجوان محقق پیارا سنگھ گل کام کرتے تھے جنہوں نے شکار کو یونیورسٹی سے نوبل انعام یافتہ آر تھر کو میٹن کے ساتھ پی ایچ ڈی کی اور لاہور کے اس معروف کالج میں کائناتی شاعروں<sup>4</sup> میں موجود مویون<sup>5</sup> کی پیمائش سے منسلک ہو گئے۔ یہ مویون الیکٹرون سے ملتے جلتے بنیادی ذرات ہیں جو ہر جگہ سرایت کیے ہوئے ہیں اور ہمارے جسموں سے بے محابا ٹکراتے ہیں اور ہمیں ذرا محسوس بھی نہیں ہوتا۔ پیارا سنگھ گل نے ایف سی کالج میں شعبہ فزکس کی چھت پہ ٹین کی چادروں سے فلکی روزن بنایا اور اپنی خود ساختہ دوربین سے ان چھلاوے ذروں کی تلاش میں مگن ہو گئے۔ پنجاب یونیورسٹی کا رتبہ دیکھیں کی ان کے کام کو مالی مدد اسی یونیورسٹی نے فراہم کی۔ آزادی کے بعد پیارا سنگھ بھارت میں ایک نامور سائنس دان بن گئے اور ایف سی

عوام کی جس دلداد گئی فن فلکیات کی نذر کر سکے گا۔ میرے لیے یہ بات ہمیشہ باعث فخر بنی رہتی ہے کہ لاہور کی بھٹیوں میں تپنے والا ایک سائنسی آلہ صدیوں دنیا کے آسمان فن پہ جگمگ کرتا رہا۔ یقین مانیں پتیل تیار کرنا، اور اصطرلاب یا دھات کا بے عیب گرہ بنانا جو اندر سے خالی بھی ہو، آج بھی جدید مشینوں پہ بنانا ایک بڑی مہم ہے۔

آسمانوں اور اس پہ بکھرے اجرام سے الفت فطری ہے۔ دیہات میں ہمارے بڑے، ستاروں سے رستوں اور وقت کا اندازہ لگا سکتے ہیں۔ دینی مدرسوں کے نصابوں میں عہد رفتہ کی رومانوی یادیں علم التوقیت اور علم الہیئت سے جذباتی لگاؤ اب بھی موجود ہے مگر افسوس بیشتر یونیورسٹیاں اور کالج فلکیات کی تعلیم سے کوسوں دور ہیں۔ البتہ پاکستان بننے سے پہلے کے چند پچسپ حقائق آپ کے سامنے رکھنا چاہتا ہوں۔

سیکرٹریٹ کے سامنے پنجاب یونیورسٹی کے کھیل کے میدان ہیں جن کے ایک کونے میں ایک گنبد دکھائی دے سکتا ہے جو کسی مسجد یا مزار سے قطعاً منسلک نہیں۔ یہ گنبد دراصل گنبد افلاک کو دیکھنے کے لیے، انج کے عدسے کی دوربین کا کائنات کے لئے روزن ہے۔ یہ دوربین آئرلینڈ کی مشہور کمپنی گرب کی ہنرمندی کا شکار ہے اور کئی سالوں تک آسمانوں کے رسیا محققین کے



علاقے بالخصوص لاہور ہمیشہ ہی سے آسمانوں کی سیر کرانے کے لیے عجیب طریقوں سے دنیا کے شہروں میں معتبر رہے ہیں۔ چلیں دیکھتے ہیں کیسے۔ اصطراب ایک نہایت پیچیدہ مگر نیا ٹلا آلہ ہے جس سے ستاروں کی سمت اور زاویوں کا تعین کیا جاتا ہے۔ مغل بادشاہوں کے دور میں لاہور اصطراب سازی کا عالمی گڑھ تھا۔ غالباً اندرون شہر میں اب جو جگہ چوک دالگراں ہے اور لوہے، پتیل اور تانبے کی لوک صنعت کے گزرے عروج کا منظر پیش کرتا ہے، اس فنِ مہارت کی آماجگاہ تھا۔ آج یہ اصطراب لاہور اور کراچی کے قومی عجائب گھروں سمیت دنیا بھر کے سائنس گھروں کی زینت ہیں۔ اس آلے کے صناعتی میں ایک اللہ داد ہمایونی لاہوری کے خاندان کا نام سرفہرست ہے جو ظاہر ہے ہمایوں کے دربار میں علیک سلیک رکھتا تھا۔ اللہ داد اور ان کے بیٹے اور پوتے، عیسیٰ اور ضیا الدین اس فن کے عالمی ماہر تھے۔

دُنیا سے اس فن کی مہارت اب تقریباً ختم ہو چکی ہے۔ چنانچہ اب صرف گنتی کے چند ماہر ہی ان اصطرابوں کو سمجھتے ہیں۔ ان میں بالینڈ سے تعلق رکھنے والے یان پیٹر ہوجنڈانک<sup>2</sup> بھی ہیں جو ایک بار ہماری دعوت پر لاہور تشریف لائے اور کچھ شائقینِ بساطِ آفاق میں یہ علم منتقل کر سکے۔ امید ہے لاہور کا عجائب گھر اپنے مفصل اصطرابوں کو جلد

نندنہ کا تذکرہ تاریخی کتب میں ملتا ہے۔ اس پہاڑی پہ محمود غزنوی اور مقامی راجاؤں کے درمیان جنگ کا ذکر بھی ملتا ہے اور ایک مندر، قلعے اور معدوم مسجد کے نقش اب بھی موجود ہیں۔ ۱۹۰۴ء میں انگلستانی حکومت نے جہلم کے گزٹ میں بھی اس جگہ کا ذکر کیا۔ قیاس ہے کہ البیرونی نے اس مقام پر زمین کا قطر ناپا تھا، گو مجھے اس دعوے کا کوئی معتبر حوالہ نہیں مل سکا۔ مگر حقیقت حال جو بھی ہو، نندنہ اور البیرونی کے بارے میں حکومتی بیانات نے موجودہ ارضیات، مساحت اور فلکیات کے تاریخی حوالے کو ایک توانا شادابی بخش دی ہے۔ ایک پہاڑی پہ چڑھ کے اردگرد کے مناظر کو علم ہندسہ اور کروی مثلثیات کے سیاق و سباق میں جوڑ کر پوری زمین کا قطر معلوم کرنا اپنے اندر حیرت کا بے شمار سامان ہے۔ گویا چوٹی ایک پہاڑ پر چڑھ کے اردگرد کے چھوٹے چھوٹے کنکروں اور ان کے سایوں کو دیکھ کے پہاڑ کی بلندی معلوم کر لے۔ واہ! یہ علم ہندسہ اور ریاضی کی کامل دستگاہ کے بغیر ممکن نہیں۔ ابوالکلام آزاد نے بھی البیرونی اور جغرافیہ عالم نامی رسالے میں دل کھول کے اس دریافت کی تعریف کی ہے۔

البیرونی کا یہ کارنامہ کائنات کے آفاقی مظاہر کو سائنسی علوم کی دوربین سے دیکھنے کی ایک مثال ہے۔ پاک و ہند کے

محمود غزنوی کی شخصیت کو داغدار بنانے کی بہت کوشش کی گئی ہے اور جاری رہے گی۔ لیکن جو بھی ہو موجودہ افغانستان کے شہر غزنی سے اٹھنے والی غزنوی تحریک کے اس بانی حملہ آور نے جہاں ہندوستان اور لاہور کے کئی علاقوں کو روندا، وہاں اس کے کارناموں کا جھومر یہ ضرور ہے کہ اس نے ہندوستان کا علمی اور ثقافتی تعلق وسط ایشیا سے جوڑ دیا۔ محمود اور اس کے بیٹے مسعود کے ہمراہ کئی شاعر، مبلغ، صوفی، داعی اور بزرگ سرزمین گنج بخش بھی تھے جنہوں نے اسلامی تعلیمات کے روشنی میں دل کی صفائی کا درس دیا۔ ایک اور ہمہ جہت شخصیت ابورہمان البیرونی تھے جو فہم، ریاضی دان، مورخ، مہندس، مسافر، سیاح اور تذکرہ نگار، سب ایک ہی ذات میں مجتمع تھے۔ حسن اتفاق سے عمران خان کی حکومت نے البیرونی کی ذات کو عام پاکستانیوں سے متعارف کرا دیا کہ ضلع جہلم کی تحصیل پنڈادنگان کے ایک خوبصورت گاؤں باغانوالہ سے متصل ایک پہاڑی پہ موجود تاریخی آثار، وزیراعظم اور ان کے سابقہ سائنس کے وزیر، فواد چودھری، کی توجہ سے تاریخی سیاحت کے منصوبے کا ایک ناؤر ذریعہ بن گئے ہیں۔ یہ آثار نندنہ کے نام سے موسوم ہیں۔

# لاہور میں آسمانوں کی سیر

## ڈاکٹر محمد صبح انور



# Webbing Galaxies With A Golden Eye – *A new era of telescopes*

Yawar Abbas Bokharee



**Since the dawn of their evolution, human beings have tried to find answers to the unknown.**

The quest to see afar began in 1608 when a Dutch spectacle maker invented a telescope. Soon Galileo further improved it and pointed the device at the heavens, giving way to a whole new understanding of our universe. Being a professor at the University of Padua, Italy, Galileo contributed mainly to the field of astronomy, physics, and mathematics. However, his most significant contributions came through a low-powered telescope which helped discover Medicean Stars; Jupiter's four moons later known as The Galilean

Moons. He also observed the changing phases of Venus and sketched the rough, jagged and unchanging terrain of our Moon.

Years later, the founder of Space Astronomy Laboratory at the University of Madison, Arthur Code, proposed the first outer space telescope to measure the ultraviolet (UV) energy output of stars. From the surface of Earth, this measurement would have been limited by the ways of our turbulent atmosphere, which in part does a good job at absorbing most of these valuable ultraviolet photons which were to be delicately measured and recorded for this project. A space observatory was the only way to explore outer space. On December 7, 1968, NASA launched this idea successfully as the first space observatory known as Orbiting Astronomical Observatory OAO-2. This scientific payload, established to carry

the observatory instruments around the Earth, commenced the era of space observation bearing the Hubble, Spitzer, Chandra, and Compton telescopes, covering a vast swath of electromagnetic real estate.

The most effective among all these magnificent explorative instruments was the Hubble Space Telescope. NASA launched the Hubble Space Telescope in 1990; however, its origin story goes back to an earlier time. In 1946, Yale University professor and researcher Lyman Spitzer believed telescopes could provide exceptional benefits over terrestrial observatories. In one of his earlier articles titled *"The Astronomical Advantages of Extraterrestrial Observatories"*, he explained how the Earth's atmosphere blurs and distorts distant starlight. He described how our atmosphere impedes cosmic X-rays from terrestrial observatories, attenuating

important scientific information. These ideas lead to the conception, design and eventual launch of the Hubble Space Telescope, which proved to be monumental in our understanding of the cosmos, and our place in it.

In December 2021, NASA scientists managed to enter into a new era of high-performance telescopes by launching the James Webb Space Telescope. Named after NASA's ex-administrator James Edwin Webb (1960 to 1968), this telescope has been equipped with cutting edge technologies that were developed solely to see farther and deeper than its predecessor (the Hubble Space Telescope) could ever achieve. It has a primary mirror with 18 separate segments made of ultralightweight beryllium coated with a thin layer of gold. A tennis court-sized, five-layered Sun shield is also enclosed with the telescope. It will protect the telescope from sunlight and stray infrared sources.

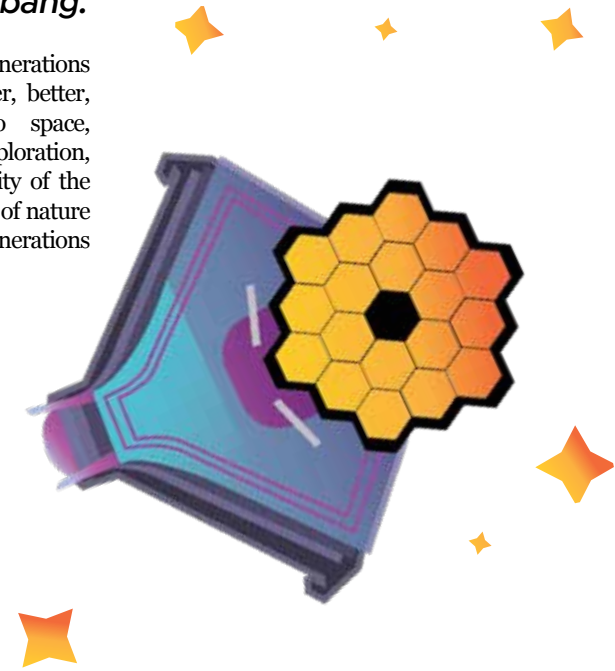
***The Webb Telescope will observe primarily in the infrared range of the electromagnetic spectrum with wavelength coverage from 0.6 to 28 microns.***

It will help scientists uncover and study stars and planets engulfed and caccooned in space dust. The primary mirror is around 6.5 meters in diameter, larger than the previous telescope, which has a smaller mirror of 2.4 meters. The Webb will orbit the Sun about 1.5 million kilometres away from the Earth, at a point behind our Moon known as L2. Previously, Hubble was orbiting Earth at only 570 km away from the surface.

***Through Webb, scientists expect to gain a clearer insight into the formation of the earliest galaxies in the Universe. Over billions of years, the light from these galaxies has been subject to what is known as cosmic***

***redshift; shifting their light from visible to infrared. The Webb is tuned to see in infrared, thus enabling us to focus in on the faintest, most distant and youngest galaxies that could have formed after the big bang.***

There is no doubt that future generations will witness the launch of bigger, better, more capable machines into space, continuing on this sojourn of exploration, one that is driven by the curiosity of the human mind, guided by the laws of nature and inspired by the work of generations that had preceeded us.



The Sombrero Galaxy - 31.1 million light years away.  
Captured by The Hubble Space Telescope



# Mathematics in Spotlight

Written by The Particle Team

**Closed shapes. Mystical geometry. Invigorating mathematics. All of this in just one big concept; the g-conjecture!**

The human brain is a pattern detecting, creativity-infusing and curiosity tackling machine that works pretty much all the time. In our eagerness to find and appreciate symmetry, balance, and patterns in nature, we have developed an affinity and romance for understanding and appreciating shapes since the beginning of recorded history. The study of closed shapes was the central objective of the Greeks' legacy developed mainly during the Babylonian times. We refer the readers to Geometric Problems of Antiquity, a mathematical pyramid of Giza, built by Greeks with simplicity, elegance and tenaciously held. It took over 2000 years to solve these simple looking mysteries. Another story is linked with generalizing polygons in 3-dimensions; namely classification of Platonic solids. The faith and math goes hand in hand, when you start exploring the historic footprints of platonic solids, well-articulated by Liliana Usvat in her article; Sacred Geometry and the Platonic Solids.

Visualizing geometry beyond the three-dimensional world has always been an oblivion paradigm of sciences, somehow. Further geometrical study is almost impossible without using algebra, topology, and combinatorics. It is the rise of the abstract world of mathematicians

and physicists, where you can only see geometric shapes through algebraic expressions, topological properties, and enumerative combinatorial patterns. Let us dive deeper into these elaborate terms and perform a thorough experiment, with some symbols and functions, which are not too hard to imagine.

Think of a unit circle centered at origin. You can draw it on the plane xy-plane and may study objectively the way Greeks did. Similarly, you can do the same for a 3-dimensional sphere. In mathematical language we put them in the same family of geometrical shapes, as they satisfy the same condition; all the points on these two shapes are equidistant from a single point (i.e, called its center). Moving forward, we need the algebraic equation to describe the shape in higher dimensions in the following manner.

$x^2+y^2=1$  describes the unit circle centered at origin in the 2-dimensional xy-plane.

$x^2+y^2+z^2=1$  describes the unit sphere centered at origin in the 3-dimensional xyz-space.

$x^{3/4} + x^{3/2} + x^{3/2} + x^{3/4}=1$  describes the unit sphere centered at origin in a 4-dimensional space.

$x^{1/2} + x^{3/2} + x^{3/2} + \dots + x^{3/4} = 1$  describes the unit sphere centered at origin in an n-dimensional space.

So much for a sphere or shape in three dimensions. Afterall, we live and breathe in a 3-dimensional universe. How about

visualizing a four-dimensional sphere? Can you do it? Try hard! Or better yet – let mathematics make things easier!

A 4-dimensional sphere (or even higher dimension) is known as the generalized sphere in mathematics. Its geometrical and topological characterization has been a central question of study in mathematics. A renowned celebrated Swiss mathematician, Leonhard Euler, developed this study through a topological point of view. He introduced an important topological invariant namely; Euler's characteristic, that uses the technique of Polyhedral combinatorics in particular, the theory of simplicial complexes. Euler's approach not only provided a concrete answer

to these questions, but opened the gate to translate the problem in the enumerative combinatorics, lying in the field of polyhedral combinatorics. It further unearthed algebraic topology, a relatively new branch in mathematics; that allows mathematicians to translate this problem to even more generalized sense; namely the homological sphere. The definition of homology sphere required layers of sophisticated keywords which are too complex to describe in this short note. Simplicial sphere is a combinatorial analogue of homological sphere and allows one to use the tool from enumerative combinatorics to deal different problems, particularly the ones related to the characterizations and classifications.

The g-conjecture, formulated by McMullen in 1970, asks for a complete characterization of simplicial spheres. Partial answers were given by the g-theorem, proved in 1979 by Billera and Lee (existence) and Stanley (necessity). Richard P. Stanley is among the most

prominent mathematicians working in this area, he received Leroy P. Steele Prizes in 2021 for his for distinguished research work. This conjecture was ultimately proven by Karim Adiprasito in December 2018, but that is not the end of the story. In the epistemologies of research mathematicians, it is interesting to develop theories and techniques to find independent elegant proofs of already proven facts using novel techniques

Triangulations allow one to use enumerative combinatorics to attack the g-conjecture and there are infinite ways to triangulate a sphere. Subdivision of simplicial complexes is the Holy grail, as it provides the power for obtaining triangulations of spheres. Richard P. Stanley laid the foundation for the enumerative theory of subdivisions of simplicial complexes. His goal was to understand the behavior of face numbers under iterated subdivisions. The triangulation of simplicial complexes is a subdivision in which every face is simplex. Several

interesting problems related to the face numbers of simplicial complexes under various simplicial subdivisions. The Joy of barycentric subdivision by Bill Casselman in the AMS Featured Column, covered a boarder spectrum for general readers. In a recent paper by Dr Imran Anwar and Dr. Shaheen Nazir, from the Department of Mathematics attempt to prove g-conjecture via a combinatorial approach for interval subdivision of a simplicial complex. Their proof of g-conjecture is purely combinatorial and independent to the one adopted by Karim Adiprasito and previously existed versions.

We congratulate the team of Dr. Imran and Dr. Shaheen on having their paper published in 'communications in algebra'. We hope to see more of such beautiful work in mathematics!

Reference to the published paper:

Imran Anwar & Shaheen Nazir (2021) Combinatorial g-conjecture for interval subdivisions, Communications in Algebra, DOI: 10.1080/00927872.2021.1993236



# Same Icon, Less Footprint

## | Discover CAT's New Sustainable eColorado

**Plastic has become a dirty word. We all should have seen it coming, and its finally here.**

Sustainability is one of the key concerns for this generation, especially post Covid-19, as the younger generations want to be more responsible towards the environment for their future generations. According to First Insight's State of Consumer Spending Report, 75% of Gen Z and 61% of Millennials, prefer sustainability over brand name when making a purchase. Cat® is committed to working towards a more sustainable approach in all its products, and the eColorado is one of their first steps in this journey.

Workwear fashion has been a staple for years and Cat Footwear has been a leader in the space, offering durable, high-quality products for all. Most recently, they launched a new boot with this exact philosophy in mind — a product that is literally born from work, The eColorado. An instantly recognizable style, the iconic, Colorado represents a real piece of their heritage and a craftsmanship, honed over 150 years for superior durability.

The eColorado has been developed and created with a focus on eco-friendliness, through construction and materials, all without changing the outward appearance of the iconic classic.

The eColorado is built using high quality leather. Cat® knows that making their leather products as environmentally friendly as possible

### The Particle

is one of their biggest opportunities to reduce their overall environmental impact. That is why they have joined the Leather Working Group (LWG) to establish strong environmental stewardship practices in the production of their leather.

LWG is a non-profit organization that aims to ensure environmental best practices in leather production, and transparent and responsible sourcing.

Over the past decade LWG has worked to improve the leather manufacturing industry by creating alignment on environmental priorities, establishing best practices and providing guidelines for continuous improvement. By partnering with LWG certified manufacturers, Cat® hugely reduced its water and energy usage through the production of its leather.

*To further reduce waste, the outsole of the eColorado also contains partially recycled materials.*

The Colorado, originally released in the 90's, was a popular streetwear staple among artists and personalities. Now, the iconic style has made its return as the eColorado — an elevated version of a tried-and-true classic that checks all the boxes for today's tastemakers. It will be available in Pakistan from January 2022 onwards as first of the many sustainable shoes from Cat Footwear.

**CAT** **SAME ICON LESS FOOTPRINT**

**eCOLORADO**

**RESPONSIBLE LEATHER**  
Our leather products support responsible manufacturing via our partnership with the Leather Working Group.

**EFFICIENT MANUFACTURING**  
Reduced water and energy usage during production of the leather.

**RECYCLED MATERIALS**  
Outsole contains partially recycled rubber.

catfootwearpakistan catfootwearpk Catfootwear.com.pk



# BENEVOLENT GRANT



## Good news for humans – bad news for pathogens.

From the first therapeutic use of penicillin in 1941 to the advent of antibacterial drugs, each newly marketed antibiotic has invariably resulted in the emergence of resistant bacterial pathogens. The emergence and spread of these unwanted life forms that have evolved mechanisms of resistance to multiple antibiotics is becoming a major threat to public health in the 21st century. The seriousness of antibiotic resistance lies in the fact that today bacterial strains are not only resistant to commonly available antibacterial medication but also may have acquired greater virulence, meaning they may have become more sinister and deadly. Therefore, the discovery and development of new antibiotics is of crucial importance to counter the explosive growth of multidrug resistant pathogens; the threat to our society is simply too big to ignore the rise of multi-drug resistance.

Worry not! One of the tributaries to the river of healthcare solutions may sprout from within SBASSE! Here's the big idea – empowering drugs with Fluorine. One way to improve the efficiency of drugs is to introduce fluorine (or fluorinated groups) in the drug molecule. The incorporation

of fluorine into a drug molecule can lead to improved metabolic stability, bioavailability, as well as more efficient binding when compared to the non-fluorinated counterparts. Consequently, about a quarter of all pharmaceuticals on the market contain fluorine, and almost all new drug candidates have fluorine in them in one form or the other. Commonly used fluorinated drugs include ciprofloxacin (antibiotic) and fluconazole (antifungal), the former selling like hot cakes in the months leading to winter!

## In Pakistan, bacterial infection is very common and mortality rate is increasing.

Unfortunately, we are totally dependent on other countries for the solution of our health-related problems. There is dire need to develop international quality synthetic medicinal chemistry research infrastructure in Pakistan to come up with indigenous solutions to our health problems, and to remove our dependence on foreign countries. Sulfonamides (-SO<sub>2</sub>NH) containing compounds such as cyano benzene sulphonamide, and methylbenzene sulphonamide are synthetic

antibacterial compounds that are generally wide-spectrum drugs active against a range of Gram-positive and Gram-negative bacteria.

In this proposal, research teams from LUMS (Dr. Ghayoor Abbas and Dr. Shaper Mirza) and Shalimar institute of Health Sciences (Dr. Tariq) will investigate the use of novel fluorinated sulphonamides as potential antibiotics for killing resistant strains of uropathogenic *Escherichia coli* (UPEC) and *Staphylococcus aureus*. A series of novel sulfonamides will be synthesized via SuFEx chemistry route from sulfonyl fluorides and will be evaluated for their antimicrobial activity using in vitro antibacterial assays. Minimum inhibitory concentration (MIC) and the minimum bactericidal concentration (MBC) will also be determined.

## This was certainly a million-rupee idea – quite literally!

The Shahid Hussain Foundation has very generously awarded a fund of PKR 1.2 million for the development of this study. We congratulate all the researchers involved and wish them best of luck for their work. May the force of progress be with them!

SBARA  
AWARD  
2021

# Energizing Solar Cell Technology

Qurat ul Ain

## Enhanced thermal and moisture stability of the emerging Photovoltaics while using discotic liquid Crystals

### Supervisor

Dr. Ammar Ahmed Khan  
Department of Physics

How strange does 'flowing crystals' sound? It seems at the heart of key scientific discoveries lie nature's most well-kept secrets, tied up nicely with a bow of non-intuition; such is the existence of DLC i.e., discotic liquid crystals. Supervised by Dr. Ammar Ahmed Khan, Ms. Qurat ul Ain has worked with a next generation of materials that are more potent in catching and harnessing light to be converted into electricity, compared to contemporary technology. This leap of faith can be summed up into three words: **perovskite solar cells**.





# Uncovering protein structures

Kanzal Iman

## Investigating the role of proteins in disease and their treatment with drugs

### Supervisor

Dr. Safae Ullah Chaudhry  
Department of Biology

Trillions of cells need a multi-trillion economy of well-kept proteins, safe metabolic environments, and reliable understanding of their complex interactions with drugs.

Ms. Kanzal Iman, under supervision of Dr. Safae Ullah Chaudhry, proposes to uncover the structure of these important proteins, through developing better computer programs that do the heavy lifting, by bypassing the less efficient ways current software applications have in place. In other words, her project aims to develop software that works smarter, rather than harder. This will potentially unlock novel ways to understand disease prevalence and eventually the drug interactions involved in treatment.



# Cellular without speed limits

Mukhtiar Ahmad

## Designing the cellular core for ultra-low latency communication-based applications

### Supervisor

Dr. Zafar Ayyub Qazi  
Department of Computer Science

Can research rid the world of lag in communication technology? Mukhtiar Ahmad may have an answer! Supervised by Dr. Dr. Zafar Ayyub Qazi, Mr. Mukhtiar is working on thinking about cellular network systems from the ground up that can provide extremely low latency, enabling wide scale prevalence of mind-blowing technologies this may have a groundbreaking impact on many fields, ranging from medical science to online gaming.

These applications require higher reliability and ultra-low latency, in the order of 10 ms. Mr. Mukhtiar Ahmad aims to re-design the cellular networks to support low latency communication-based applications.





# The future of monitoring diabetes

Aminah Hina

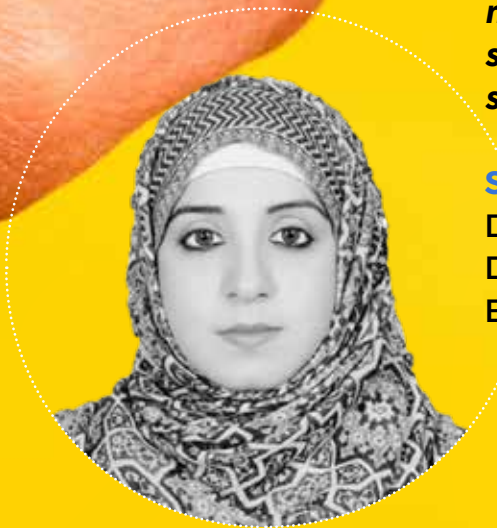


**Noninvasive blood glucose monitoring system using single wavelength NIR spectrometry**

**Supervisor**  
Dr. Wala Saadeh  
Department of Electrical Engineering

Imagine measuring blood sugar levels without pricking any part of the skin. Ms. Aminah Hina's project is all about developing a non-invasive blood glucose monitoring system. Although the product idea itself isn't new. The market is saturated with portable gluco-meters and few companies also offer wireless blood glucose monitoring support.

However, the caviat is their price – these devices are expensive! Ms. Aminah Hina, along with Dr. Wala Saadeh, propose a cheaper alternate. Pakistan is amongst the list of countries with highest prevalence of diabetes. Approximately 19 million Pakistanis have been diagnosed with diabetes in the year 2020. The research project of Ms. Aminah is poised to address this large fraction of Pakistani adults, as well as some fraction of the Pakistani youth that suffers from both sub-types of the disease.



# Easy breathing for diabetics

Izaz Ahmad

**Evaluation of protective immune response induced by pneumococcal conjugate vaccines (PCV-10) in individuals with type 2 diabetes**

**Supervisor**  
Dr. Shaper Mirza  
Department of Biology

Diabetes is a systemic disease and can affect multiple organs at the same time. Patients suffering this terrible illness have an additional risk of running into frequent respiratory tract infections. Since the immune response of the body is already attenuated in diabetics, the risk posed by additional infections is much greater than in healthy individuals.

This is exactly where Mr. Izaz Ahmad's proposal sprouts hope. Izaz Ahmad is studying the effects of a potent vaccine made for the bacterial culprit responsible for such respiratory disease – bacteria *Streptococcus pneumoniae*. His study will measure impact of the body's immune response to PCV10 (the vaccine under investigation) in individuals with type 2-diabetes and figure out whether these responses are comparable between individuals with

and without type 2-diabetes. The study will be the first to demonstrate efficacy and immunogenicity of pneumococcal conjugate vaccine in those with type 2-diabetes in Pakistani population.





# HELLO FROM CAMBRIDGE

Written by The Particle Team

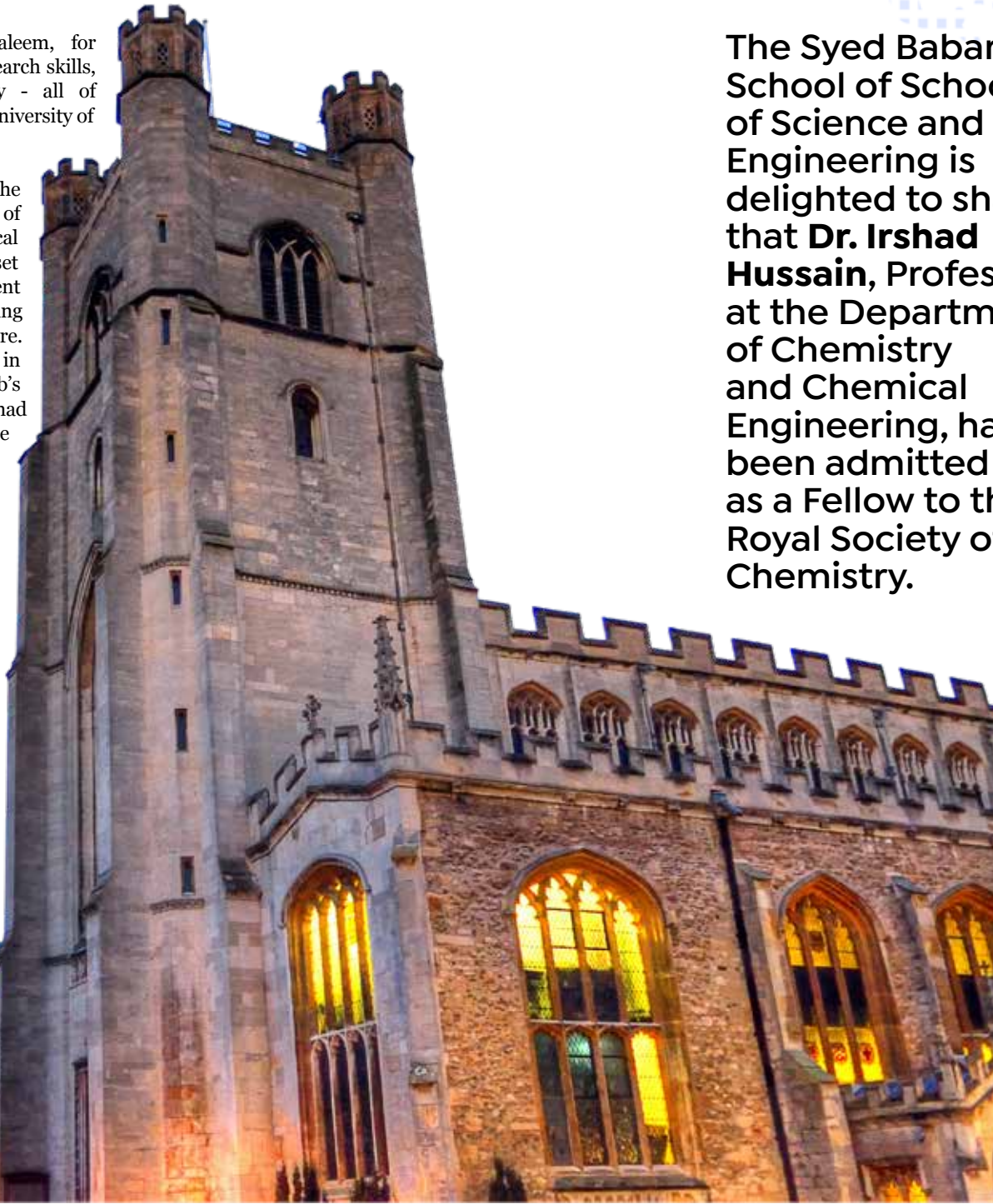
**Rimsha Irfan, a 2019 SBASSE Chemistry graduate, has won the Harding Distinguished Postgraduate Scholars Leverage Scholarship to join the University of Cambridge!**

The dream of many ambitious students is knitted with the hope of learning from the very best that the world of education and academics has to offer. Rimsha, while studying at the Syed Babar Ali School of Science and Engineering, found the first glimmer of that hope with Dr. Rahman Shah Zaib Saleem, who played a big role in inspiring her intellect to pursue greater things and soar even higher. "I am extremely grateful to Dr.

Rahman Shah Zaib Saleem, for instilling in me good research skills, discipline, and integrity - all of which has led me here [University of Cambridge]."

Rimsha also thanked the entire Department of Chemistry and Chemical Engineering in helping set a conducive environment for thorough learning throughout her tenure. Rimsha has worked in Dr. Rahman Shah Zaib's group for her SProj and had managed to publish one article as the first author, before graduating in 2019.

Rimsha Irfan has started her MPhil program in Chemistry at the University of Cambridge (Fitzwilliam College). This will be a fully funded program. We extend our hearty congratulations to her and wish her success in all her future endeavors.



# Another Feather in the Cap

Dr. Irshad Hussain, Professor at the Department of Chemistry and Chemical Engineering has been admitted as a Fellow to the Royal Society of Chemistry

**The Syed Babar Ali School of Science and Engineering is delighted to share that Dr. Irshad Hussain, Professor at the Department of Chemistry and Chemical Engineering, has been admitted as a Fellow to the Royal Society of Chemistry.**

We congratulate one of the Pakistan's most active and celebrated scientists for his induction to the Royal Society of Chemistry. The Royal Society of Chemistry is the world's leading chemistry community, advancing excellence in the chemical sciences. With 49,000 members and a knowledge business that spans the globe, it is the UK's professional body for chemical scientists; a not-for-profit organisation with 170 years of history and an international vision for the future.

Dr. Irshad's work is primarily focused on functional nanomaterials. His group specializes in the synthesis of metal/metal oxide nanoparticles with decent control over their size and surface chemistry. Functionalised nanoparticles and their composites have been used for applications in biomedical sciences, energy technologies and environmental remediation. His work sees the applications of smaller metal nanoparticles (less than 2 nm), generally known as nanoclusters, to address a grave healthcare challenge i.e., multidrug resistance (MDR). In this regard, Dr. Irshad's group has designed and prepared highly stable atomically monodisperse silver (and other metals) nanoclusters to kill bacteria that are resistant to many antibiotics. These nanoclusters can also be encapsulated in tiny capsules (nanocapsules) with other antibiotics to enhance their antimicrobial properties by synergistic effect.

***Dr. Irshad Hussain, has also been elected as a Fellow of Pakistan Academy of Sciences!***

We congratulate Dr. Irshad Hussain on this momentous recognition and wish him more success!

Written by The Particle Team





A researcher watering plants inside one of the plant rooms in the Department of Biology

## BETTER HEALTH THROUGH PARTNERSHIP

LUMS  
X  
UNIVERSITY  
OF BERGEN

Cooperation between humans has spawned great things in the past. This optimism is deeply rooted in the nature of collaborative work.

One such opportunity has been the NORPART - Norwegian Partnership Programme for Global Academic Cooperation. Out of a total of 150 proposals that were submitted, 26 were accepted for funding, including Dr. Shaper's proposal, which aims to greatly enhance the internationalization efforts that are already underway at the Syed Babar Ali School of Science and Engineering.

**The project is titled 'Better health through partnership in higher education and bilateral student mobility: collaboration between Pakistan and Norway'.**

The offerings of this proposal are really exciting! Students from Norway will be offered courses at the LUMS campus.

The two courses that have been selected for these international students are Health Systems Management and Entrepreneurship and Innovation in Health Care. Alongside these courses they will also be offered a six-month internship for which the project offers two streams; Lab based Internship and Field based Internship. *"To enable field based internship, we are partnering up with Indus Hospital, Institute of Public Health (with whom LUMS had already signed an MoU), Gulab Devi Hospital and Institute of Public Health, Baluchistan."*, says Dr. Shaper Mirza. Speaking about additional aims of the project, Dr. Shaper said that the project is to develop two courses in collaboration with Institute of Global Health University of Bergen Disease Surveillance in low resource countries and infection prevention and control in low resource countries.

We wish Dr. Shaper Mirza and her team heartiest congratulations, and the best of luck for pulling off this promising project.

The NORPART aims to enhance the quality of higher education in Norway and selected partner countries in the Global South, through academic cooperation and mutual student mobility. The programme is funded by the Ministry of Education and Research and the Ministry of Foreign Affairs of Norway.

Written by The Particle Team

For more information on the list of proposals, including the one selected from SBASSE, please visit:





# A WIN FOR PAKISTAN

**Infuse cutting-edge technology with an ambition of saving our forests, and we have a winner!**

For the first time ever, a team from Pakistan have won the Knowledge Management and Intellectual Capital Excellence Awards Competition. The winning team consists of undergraduate students from the Department of Computer Science at the Syed Babar Ali School of Science and Engineering. Our heartiest congratulations to the amazing team of Dilkasha Tarannum, Muhammad Waseem, and Shahrukh Nawaz!

***The case study presented was titled, “Knowledge Data Engineering for Forest Management Information Systems,” and reports the work the team conducted as part of their final-year project under the supervision of Dr. Mian Muhammad Awais.***

The proposal focuses on incredibly efficient yet simple tools for extracting valuable data from something as mundane as the width of a tree trunk.

***The technology is at the union of augmented reality, machine learning, digital image processing, data mining and big data analysis.***

When asked to comment on the achievement, the three team members sent back interesting responses. Ms Dilkasha commented, “I started from sketching innovative ideas. Perseverance then took me to this project that, I hope, will go a long way in contributing to the green environment mission”.

Muhammad Waseem summed up the achievement in a one-liner, “Don’t cry because it’s over. Smile because it happened.”. Shahrukh Nawaz expressed his renewed sense of motivation, “It doesn’t get easier, you get stronger.”

This coveted award only recognizes the highest quality work in knowledge management and intellectual capital that can lead to considerable improvements in organizational efficiency and effectiveness. The award competition was run alongside the 22nd European Conference on Knowledge Management (ECKM 2021). There were over 100 case studies presented by the corporate sector, and mainly PhD students from 25 countries.

Many congratulations to Dilkasha Tarannum, Muhammad Waseem, Shahrukh Nawaz and their supervisor Dr. Mian Muhammad Awais, on winning this award!



**Shahrukh Nawaz**



**Dilkasha Tarannum**



**Muhammad Waseem**

**Written by The Particle Team**

**For more information on the awards, please scan the following:**





# Energy at loss? Energy at profit!

**Remember that one day in 2021 (January 10, 2021 to be exact), when a massive power outage plunged the entire nation into darkness?**

Social media was quick to react, and “Apocalypse” started trending on Twitter. People were asking around to check whether this dark surprise was shared by others outside of a given city. After the darkness faded, it was realized the outage was due to a large grid fault. While it was received with good humor on social media, the interruption in daily activities and routine operational work caused considerable economic loss for many. Electricity is the obvious red line that runs between drivers of our country’s economy, industry, agriculture, small business and private enterprises. A jolt in it is bound to affect millions, nationwide.

In an effort to endow the work of these businesses and frontline economy drivers, the Government of Pakistan has increased its electricity generation. The providence is a welcomed gesture but comes at a high opportunity cost. Unless of course, it could be stored and used at a time of power outage. However, this would require an excess energy storage system that is remarkably more efficient in its storing capacity and is economically viable enough to be used by hundreds of millions of people.

Fortunately, an interesting solution to this problem has emerged from within the depths of SBASSE, in the Department of Computer Science. Dr. Nasir Mehmood, with his supervisor, Dr. Naveed Arshad, has created an energy storage solution that might just be the breakthrough we are all looking for.

What is the hype all about? Well, Dr. Mehmood submitted the idea as his PhD

thesis on a large-scale energy storage system. This system is made from many small consumer batteries, orchestrated by a single central controller. He proposed that the charging and discharging of the batteries will be handled by this central feature. It ought to charge and discharge batteries based on their weight and state of charge. Current energy storage systems (ESS) lose energy while charging/discharging, due to a lack of well mediated, controlling mechanisms. Moreover, this way the system can conserve the life of each battery, making each unit an efficient, dependable and long-lasting part of the entire array.

However, technical efficiency may not always be equal to reduced costs of storing energy. What if it is more expensive to store energy than to produce it in the first place? Thus, the need of the hour called for a much more robust system in terms of energy efficiency and cost efficiency. Dr. Mehmood also analyzed the system to gauge whether it offers economic feasibility for energy distributors. He evaluated the costs for energy distributors who will be storing energy, given an excess supply. Dr. Mehmood also input electricity prices and estimated their profits in the model and deduced that this ESS would be a desirable idea not only for distributors but for consumers as well.

Dr. Mehmood’s work can prove an important intervention for Pakistan’s frail energy condition. If researchers like Dr. Mehmood and important stakeholders from the industry, policy makers and the government at large coalesce, one can imagine what the future of our current energy deprivation may look like. Thus, one can hope that in the not-so-distant-future, no one will have to suffer from the expense of days like January 10, 2021.

**Written by Hira Shariq**  
Intern, Carl Sagan Write for  
Science Internship Program



# SHATTERING SPIRES OF ALZHEIMER'S DISEASE

**The world still awaits a breakthrough in treating Alzheimer's disease. How long until we run out of patience? Well, continue reading and you may see a glimmer of hope.**

Researchers from the Department of Chemistry and Chemical Engineering at the Syed Babar Ali School of Science and Engineering, under the supervision of Dr. Rahman Shah Zaib Saleem (Associate Professor), have been keeping busy exploring compounds that may help with how we think about treating Alzheimer's disease.

The clockwork that it is, our body responds to certain chemicals in a very specific and predictable way. The rut of the mill method, in pharmacological interventions, has been to design and deploy compounds in the body that stabilize and sequester A $\beta$  (amyloid-beta peptide). The pathogenesis of Alzheimer's disease is believed to be driven by the production and deposition of amyloid-beta peptide, or A $\beta$ , in the form of long, slender fibers, as the result of a process known as fibrillization. If an intervention can maneuver around this problem, then the pathway to treating Alzheimer can at least be scouted. In short – this compound is a target of interest!

The team of Dr. Ghayoor Abbas, Dr. Rahman Shah Zaib Saleem and his M.S students Umme Kalsoom and Syed Usama, have synthesized a library of selenadiazole-based compounds, that can prevent the fibrillization of A $\beta$  in the

neurological tissues, thereby shattering these long, slender molecular spires and preventing fibrillization. This synthesis saw collaboration with Dr. Ghayoor Abbas, who has worked extensively on the applications of iridium-catalyzed aromatic C-H borylation in organic synthesis in the past. The selenadiazole compounds arrest the A $\beta$  molecule in its monomeric form and prevent the 'graduation' into oligomerization. This effect was confirmed using a suite of instruments such as ThT assay, CD spectrophotometry, and TEM imaging.

In this research, other compounds were also studied that affected A $\beta$  fibrillization in different ways, by docking differently to A $\beta$ . For example, some completely inhibit the 'molecular spires or fibrils from forming, leading to A $\beta$  toxicity that can creep into the blood-brain barrier as well, while others only partially inhibit the process. It turns out that compounds that stabilize the A $\beta$

monomers seem to work best, compared to partial and noninhibitors. The results encourage preclinical development of these 'magical' selenadiazole compounds for a potential therapy of Alzheimer's disease. We wish the best of luck to Dr. Rahman Shah Zaib and his group for the future prospects of this research work.

Written by the Particle Team

## Reference:

Kalsoom, U., Alazmi, M., Farrukh, H., Chung, K., Alshammari, N., Kakinen, A., Chotana, G., Javed, I., Davis, T. & Saleem, R. Structure Dependent Differential Modulation of A $\beta$  Fibrillization by Selenadiazole-Based Inhibitors. ACS Chemical Neuroscience.





# A New Way to Search for Diamonds

Written by the Particle Team

**The Syed Babar Ali School of Science and Engineering is all set to replace the standardised subject test with a completely new way to gauge its future students; A SCIENCE APTITUDE TEST.**

Humans are extraordinary creatures. Our ability to mix creativity with empirical knowledge and objectively verifiable truths can lead to stunning, inspiring new insights into nature. This submission begs the admittance

and appreciation of our individualistic uniqueness. A vibrant combination of introspection, deep thinking, creative prowess and the love for the scientific methodology is a concoction similar to snowflakes and fingerprints; no two are exactly the same. Any standardized test to gauge such diversity in intellect and capability will lead to quantum loss of 'data'; data that is crucial in giving each one of us our own unique ability to solve problems, recognize patterns and come up with creative solutions, all of which is an integral part of a larger group of characteristics that ensure academic and professional success in the future.

Let this not take away from the importance of students' academic

credentials. They offer an important metric in helping decision-makers review applications; however, it is important to recalibrate the testing scheme by introducing a way to measure scientific proficiency (alongside conventional academic capabilities). In order to accomplish this, a scientific aptitude test is being piloted. Research indicates that scientific literacy and aptitude is an intuitive predictor of student success in courses that are progressively predicated on scientific thinking. Can an individual interpret data and appreciate trends of certain topic like climate change or the science behind pandemics and their biomedical management?

*The aptitude test will also offer a new way to scrutinize applicants as well as introduce greater sense of fairness of the entire application process in the minds of the applicants.*

For example, a student might have excellent academic credentials and/or a high score on the standardized test but ends up performing poorly on the science Aptitude Test. In such a scenario, the applicant could be flagged for a follow-up interview, to get more clarity on this discrepancy and deliberate over the candidate's suitability for admission. The test will be a set to multiple choice questions, that focuses on general knowledge and needs not have the applicant prepare rigorously through curriculum-based text.

It is time to celebrate the diversity and unique competitive characteristics in our future pool of students, researchers behind potential breakthroughs of tomorrow!

Find out more:

LUMS Admissions homepage: <https://admission.lums.edu.pk/>

Example of science aptitude test abroad:







# SWINGING LIGHT TO REVEAL QUANTUM SECRETS

*Internet in the palm of your hands; augmented reality to connect loved ones holographically; trucks without an engine. What's next? A nano-camera? You guessed it!*

There are many reasons to collect light. We can't touch and grab a distant galaxy to take a closer look inside its blindingly bright and ludicrously bright core, nor can we see the labyrinthine nature of the microcosm with our

naked eyes. We require the cooperation and manipulation of captured light to do great things. One exciting prospect of this requirement is what makes up the recently published paper in the journal Applied Physics Letters. The first author is SBASSE's own **Shahzad Akhtar Ali**, a student of Dr. Ata Ul Haq from the Department of Physics.

Nature speaks in mysterious ways. Shine a light on a crystal, carefully observe the light coming out the other end, deduce how photons toss and turn, spin and swivel as a result. Such berserk response from light can

reveal plenty about the nature of the crystal. In other words, the way you react to situations tells a lot about who you are and what your nature could be like - an eerie similarity! Shahzad Akhtar Ali and his team of researchers studied the characteristics of crystals of molybdenum trioxide ( $\text{MoO}_3$ ), also called alpha-molybdenum trioxide. Not just that, they studied layered crystals, which host a combination of hexaboron nitride together with  $\text{MeO}_3$ .

Their work, as intricate and complex as the materials they were working with, has to do with observing the twisting,

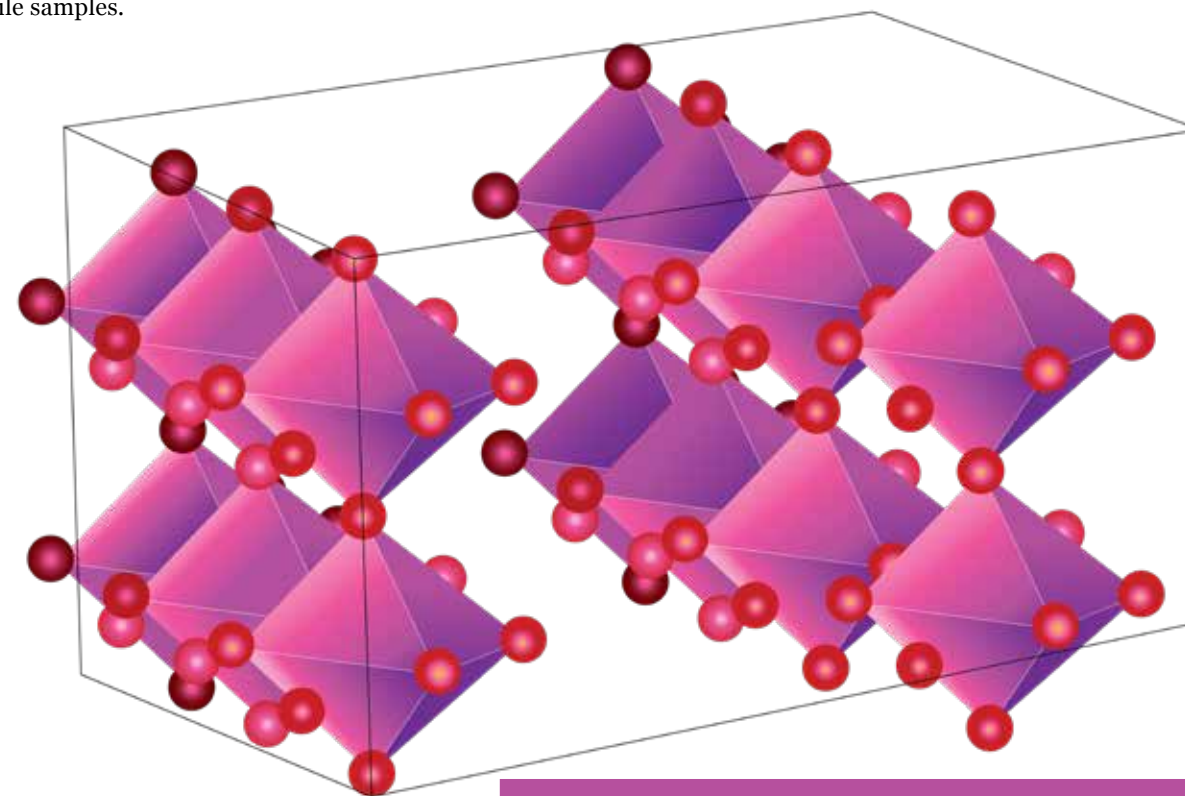
turning, spinning and swiveling (helicity) of photons as they came out the other end of these layered crystals called 2D materials.

In this beautiful piece of work, it was revealed that alpha-molybdenum trioxide demonstrated very strong in-plane hyperbolicity, making it a strong candidate for possible nanophotonic applications, especially those requiring polarization control of photons. A prime method used in this study was Raman spectroscopy, which is an analysis technique that provides detailed information about chemical structure, phase and polymorphy, crystallinity and molecular interactions. On top of revealing so much about a compound, it is a non-destructive technique, making it the technique of choice when it comes to dealing with fragile samples.

Helicity is a thing of beauty. Almost complete helicity switching under Raman scattering points to strong phonon chirality around the high symmetry points in the Brillouin zone of the  $\text{MoO}_3$  crystal, mentions the paper. The hyperbolic nature of flakes of  $\alpha\text{-MoO}_3$  makes them ideal candidates for nano-photonics applications apart from the highly rich physics of in-plane anisotropic phonon polariton. The chiral nature of the highly anisotropic phonons in this material system can play a crucial role in proposals, which combine this hyperbolicity with spin-orbit coupling resulting in novel surface plasmon modes. Thus, this makes it possible to fabricate nanometer-scale compact photonic devices! Consequently, these materials exhibit very high photon density of states, which enables the use

of Purcell enhancement, which is at the heart of many schemes for interfacing quantum states of light and matter.

We congratulate Shahzad Akhtar Ali and his team who got their paper published in such a well reputed journal. We would also like to point out that all of the work by the first author was done using Dr. Ata Ul Haq's lab, in the School. We wish them all the best for all their future work!



Written by the Particle Team

Reference: Shahzad Akhtar Ali, Abdullah Irfan, Aishani Mazumder, Sivacarendran Balendhran, Taimur Ahmed, Sumeet Walia, and Ata Ulhaq "Helicity-selective Raman scattering from in-plane anisotropic  $\alpha\text{-MoO}_3$ ", Appl. Phys. Lett. 119, 193104 (2021)





# The Paradox of Efficient Irrigation

The Centre for Water Informatics & Technology (WIT) gets published in the *Water Resources Research*, one of the prestigious journal in its domain.

**Water conservation is a pressing issue and the dominant global narrative advocates conserving water.**

The narrative is even stronger for conserving agricultural water use as it accounts for 70% consumption of freshwater resources around the globe. Research conducted by the Centre for Water Informatics & Technology has argued that this narrative is incomplete and possibly misleading.

The intuitive understanding is that increased on-farm Irrigation Efficiency leads to an increase in water availability

at the basin. However, instances have been observed where an increase in on-farm Irrigation Efficiency had an opposite effect on the water availability at the basin scale. This phenomenon is commonly known as the '**Irrigation Efficiency Paradox**.'

In a paper titled "**A Dynamic Socio-Hydrological Model of the Irrigation Efficiency Paradox**" published in the prestigious *Water Resources Research*, Ph.D. scholar Mr. Ansir Ilyas, Dr. Talha Manzoor, and Dr. Abubakr Muhammad (Director WIT) have highlighted Irrigation Efficiency Paradox and presented a dynamic systems model for it. The model combines a simple mass-balance description of the water flows with the rent-seeking behavior of consumers. Through the socio-hydrological model, a parametric characterization of the paradox is given using following three attributes:

- **maximum short-term benefit enjoyed after improvement in Irrigation Efficiency**
- **time duration after which the paradox occurs**
- **escalation of the paradox once it occurs.**

Using global datasets, the study presented global maps to identify regions most susceptible to the escalation in Irrigation Efficiency Paradox.

Mr. Mohammad Sohail, Sr. GIS Analyst at the NCRA-Agricultural Robotics Lab, contributed to the study and helped create these maps. The maps showed that regions with poor irrigation efficiency are more susceptible to the paradox.

The paper discussed the seemingly counter-intuitive role of evaporation and recharge properties of the basin and how it ties in with contemporary policy narratives, as the policy implications of the findings contrast the dominant narrative that seeks to reduce evaporation and increase recharge. Instead, it is found that the paradox in basins with lower evaporation and higher recharge is more pronounced.

The findings are critical for Pakistan as the government - with the aid of international donor agencies - has been encouraging and investing in High-Efficiency Irrigation Systems to conserve water in the agriculture sector.

The paper strongly advises caution while introducing efficient irrigation technologies in the identified regions, that include Pakistan, to avoid paradoxical effects to as much extent as possible.

Submitted by the Centre of Water & Informatics & Technology (WIT)

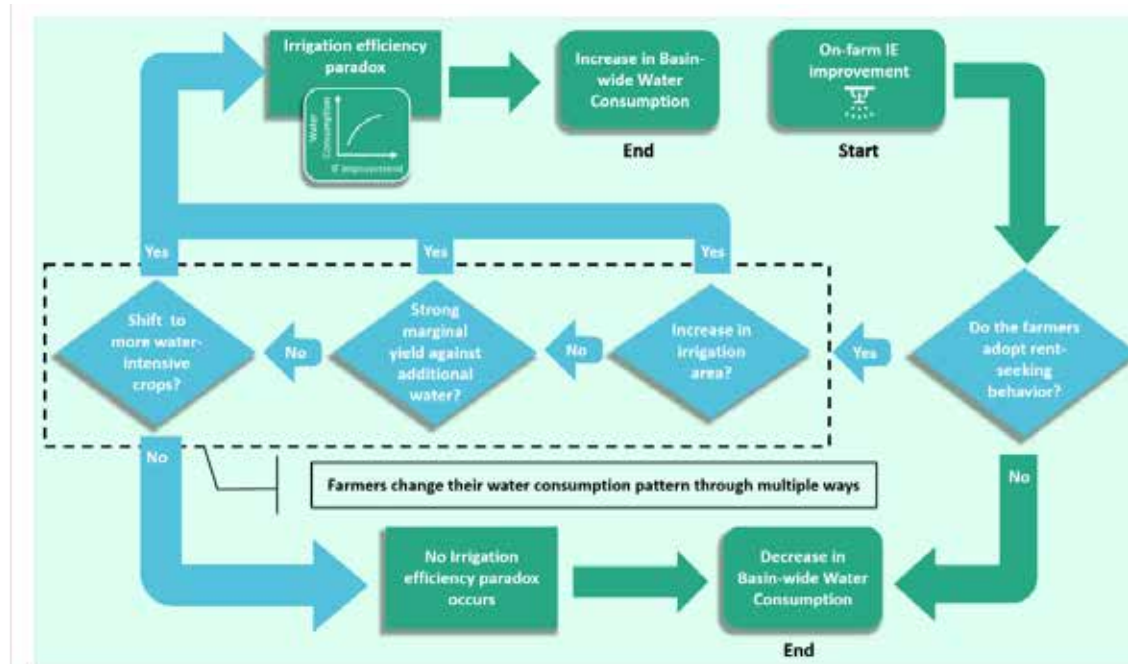


Fig 01: Blue color represents the consumer's behavior and the factors that strongly influence paradox

To begin with, from the starting point, the farmers adopted more efficient irrigation technologies that reduce the water consumption at the farm scale. At the same time, we ask the first level question; do the farmers adopt rent-seeking behavior after efficiency improvement? If the answer is yes, then the farmers change their water

consumption patterns in multiple ways. Furthermore, we ask the second level questions to assess how the farmers change their water consumption patterns.

If all or anyone's answer is true, the Irrigation Efficiency Paradox will occur. This co-evolution process ends with the increase in basin-wide water

consumption. On the other hand, if the answer to first or all second-level questions is no, no Irrigation Efficiency Paradox occurs. This co-evolution process ends with a decrease in basin-wide water consumption after the improvement in Irrigation Efficiency. The concept of the figure is inspired by Paul et al. (2019).

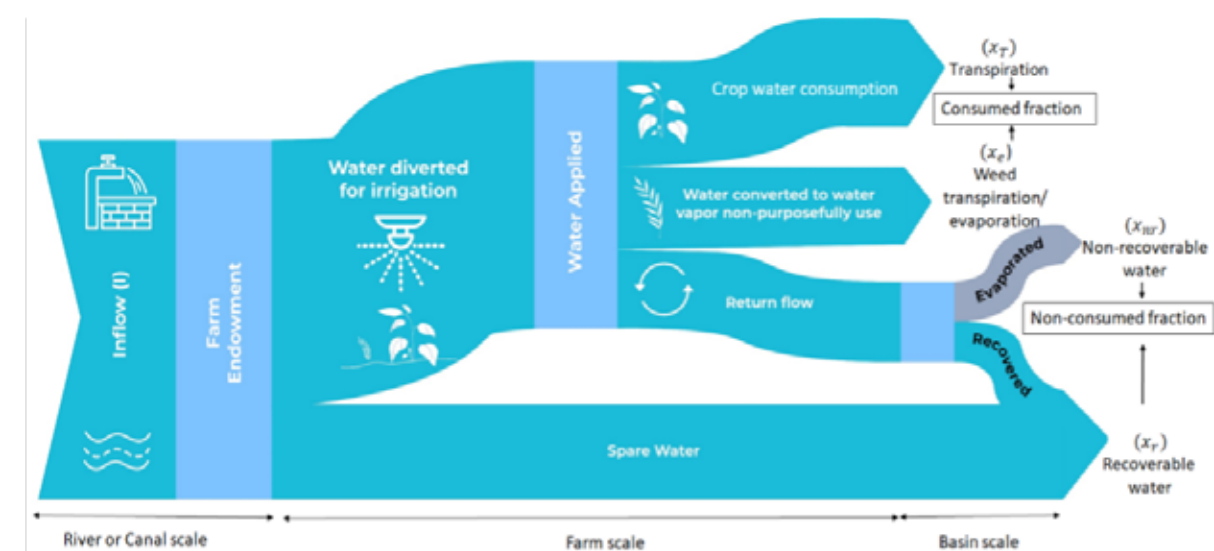


Fig 02: Water flow balance for irrigation water withdrawals used in our dynamical modeling framework.



# Honorific Fellowships

A giant leap in recognising academic brilliance

The entire community at Syed Babar Ali School of Science and Engineering is a family of passionate and dedicated people who are fervent pursuers of knowledge, that never shy away from offering support and expressing encouragement wherever and whenever needed.

It is the extension of this spirit to recognise and appreciate hard work that we feel pleased to announce the creation of **twenty four (24) Fellowships for undergraduates in the basic sciences (biology, chemistry, physics and mathematics)**. These Fellowships are named after distinguished academics, teachers, practitioners, and scientists who have made distinct contributions to the learning of science and maths, or who have made revolutionary discoveries describing our universe.

These Fellowships are created from a generous donation received from Packages Limited honouring the 90th birthday of the Founder of the School, Syed Babar Ali. **The Fellowships are aimed to bolster interest in fundamental science and to incentivize students to major in basic sciences ((biology, chemistry, physics and mathematics)).** The creation of these Fellowships will draw more students towards their genuine passion.

*This programme will pilot for three years starting from the 2021-22 academic sessions.*

For more details, scan this QR code:



**Chandrasekhar  
Fellowship**

Physics

Born in Lahore, Professor Dr. Chandrasekhar was a world-renowned Nobel Laureate in Physics, whose work untangled some of the most fascinating mysteries of our universe, from white dwarfs to black holes.



**Dil Muhammad  
Fellowship**

Mathematics

Professor Khawaja Dil Muhammad was a renowned Pakistani Mathematician that authored many books on the subject that stand widely praised to this day.



**Ahmed H. Zewail  
Fellowship**

Chemistry

Professor Dr Ahmed H. Zewail, who was an Egyptian Nobel Laureate, celebrated for his ground-breaking work in femto-chemistry. He is regarded as the founder of the field.



**Bilqees Mujeeb  
Fellowship**

Biology

Professor Dr. Bilqees Mujeeb is a Pakistani Parasitologist with numerous awards and honours, and considered by many as a pioneer of the field.



# An opera from outer space,

choreographed by the force of gravity;  
observed and enjoyed by complex  
biology!

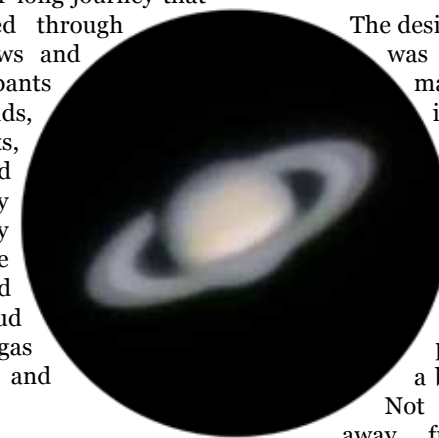
Written by  
Syed Roshaan Bukhari

**It was 5:30pm. Two people carrying a strange, black and white piece of equipment, exited from the main doors of the SSE building. They struggled to keep a straight gait as the momentum of the machine contested their balance. This was followed by a three-legged contraption that housed a blue and white tube on top. Things looked strangely curious. What was going on?**

It was 12th of October and the time was 6pm; the invitation was open for all – it was time to see valleys, mountains and craters of the Moon up close! This was the beginning of a 1-hour-long turned 3-hour-long journey that ebbed and flowed through the valley of wows and awes. Participants ranged from kids, students, parents, staff members and faculty! Everybody was there to enjoy the sights of the lunar surface and distant, frigid cloud tops of the outer gas giants; Jupiter and Saturn!

Penetrating through the hazy, smokey sky of Lahore, the two reflecting telescopes (also known as Newtonians – pretty plainly named!) were these big light buckets, capturing distant

photons of the Moon and planets. The dance of this faint, alien light inside the telescope tube eventually results in a magnified image that we see through an eyepiece.



The design of both telescopes was the same; the only major difference being in their 'bucket size' i.e., aperture. One telescope had a 10-inch wide aperture, while the smaller one was just 4.5" across. Imagine seeing an entire planet and its rings, a billion (yes – billion. Not million!) kilometers away, from something as

small as just 10 inches across! The result was enough to stir emotional responses from almost everyone who let it all sink in during the brief time they had with the eyepiece.







SkyWatcher 254mm Dobsonian reflector, f/4.7, 8mm eyepiece, magnification ~150 X

The telescopes were pointing towards the Moon at first. The beautiful, young crescent that was barely 40-odd degrees above the horizon, discoloured by the smokey sky, yet alluring still with its magnificent contrast in the late twilight sky. There were two bright specks in the sky, about a hand's width to the left of the Moon, and to each other. The brighter of these two was Jupiter, and Saturn was the dimmer one.

***“What! Is this real!?”, shrieked a participant in disbelief when seeing the Moon up close through the bigger telescope.***

“Are you sure this isn't a picture inside the telescope?”, another one asked, casting doubt to the authenticity of the whole exercise! But these are responses stemmed deep from within the realm of wonder and fascination. They are as pure in their intent as they are abrupt.

The surface of the Moon was littered with craters – circular depressions created after an extremely violent event of a high-speed space rock (called Asteroids) coming to an abrupt and

explosive stop as they collided with the Moon, sometime in the past 4.5 billion years! The impacts were so powerful and devastating that their scars can be seen through a telescope to this day!

Soon, the queues grew longer, as the telescope teetered away from the Moon and an announcement followed “Who wants to see Saturn?”.



The response, in unison, was unanimous; everyone! Thus, the wait and excitement began. Planet Saturn, the jewel of the solar system, decorated with its own set of rings! Indeed, it was a sight to behold!

“Unbelievable. It really looks like that!”, another keen observer commented, with their eye glued to the eyepiece. Saturn appeared quite small but still blew everyone away with its unique shape and an unearthly ability to squash whatever expectation one goes in with before actually seeing the planet through the eyepiece. Many people noticed the shadow of its globe cast on a small fraction of its rings. Some could even see one of its biggest moons, Titan!

***As the event came to a close, the organizing team took a parting look at the mighty Jupiter. The orange-yellow bands of hydrogen, contained within white bands of ammonia were very conspicuous.***

A much brighter, bigger and different world than Saturn, Jupiter's main attraction was its fleet of moons, appearing as bright, shimmering points of light, arranged neatly in a straight line around the gas giant.

This observation event at SSE was a huge success! We hope that participants took home not only a new view of nature but wonder for what's out there that is still to be seen, touched and explored.

We would like to thank the dedicated team of the Office of the Dean, SBASSE, who diligently attended the telescopes, took photographs, and offered assistance to every single participant where and when needed. This event would not have been possible without the help and collaboration of every single one involved.

Looking forward to the next journey into space with SBASSE!

Explore Scientific 114mm reflector, f/4.3, 25mm eyepiece with 2x barlow







# Making the NMR Machine Cool Again!

Written by the Particle Team

Liquid Helium and liquid Nitrogen are just cool – way too cool! They are used not only in maintaining temperatures inside high-tech equipment in research centers across the globe but are favorites when it comes to maintaining pressure and temperature requisites for rockets also!

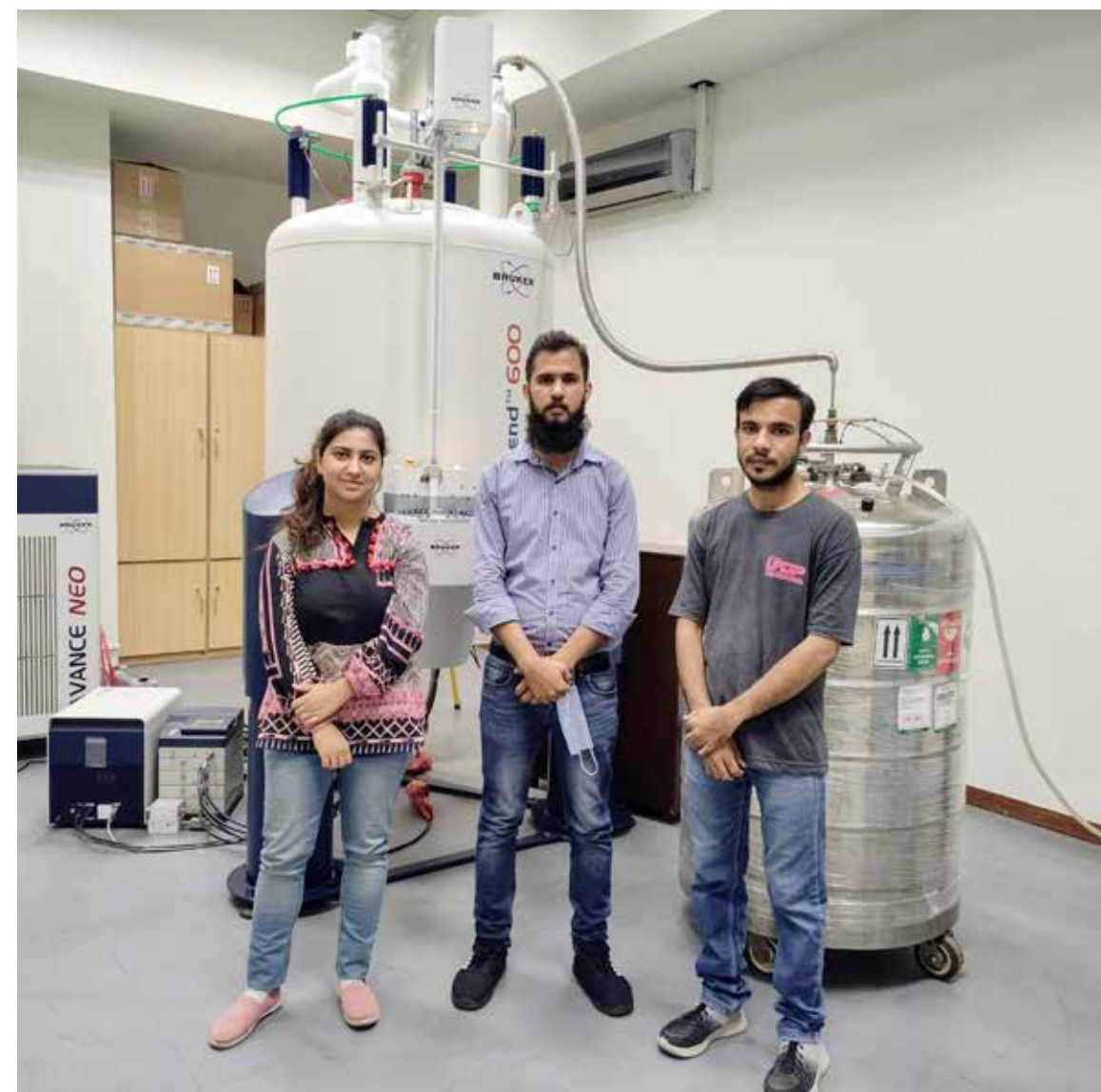
Over time, the liquid helium used to keep a NMR machine working, boils off. To keep the NMR machine working properly, its magnets need to be dipped in and chilled with liquid Helium regularly. One such refilling exercise was recently conducted. Here's what two of the students who oversaw the operation had to say about this exercise.

The exercise of filling of liquid helium in NMR Setup was a very good experience and very informative. Very hard job to do and require good background knowledge, experience, and precise control to handle things correctly but it was a very nice experience for us. Thank you so much for this great exercise.

**Mudassir Naeem**

Observing the liquid helium refill operation on the NMR equipment proved to be a highly informative and enjoyable experience for us. Handling and transporting liquid helium require technical background, precise control, and constant precautionary measures. Thanks to the team for this enlightening session.

**Warda Mahmood**





# MS Electrical Engineering Orientation Session

New students from the Department of Electrical Engineering's Masters program attended an orientation session, which was a meet and greet between students and faculty members. The event also welcomed ten NECOP Fellows.

An informal discussion session on the basics of thesis writing preceded refreshments and the subsequent demonstration of a blood glucose measuring device that worked without pricking the skin, a joint project of LUMS and University of Glasgow.



# WRITING PRIZES

**2021 Winners of Writing Prizes Sir Sayyid Ahmed Khan and Jacob Bronowski Writing Prizes have been awarded to**

**Syed Babar Ali School of Science and Engineering (SBASSE) is pleased to launch the creation of the Sir Sayyid Ahmed Khan and Jacob Bronowski Writing Prizes. The following prizes will be distributed every year.**

## Sir Sayyid Ahmed Khan Award

Based on the best written dissertation for a BS final year project (two awards)

## Jacob Bronowski Award

Based on the best written dissertation for an MS project (two awards)

## Review Process

The Dean will initiate the process every year. The Department Chairs will be asked to submit their best dissertations that, in their view, meet the criteria mentioned above. The dissertations (soft copies) will then be sent to a review committee, (announced by the Dean and mainly comprising members from outside SBASSE). The top ranked candidates, two in each category, will be the final winners.

## Review Committee

The review committee for this Prize comprises:

Dr. Sameen Mutahhir  
Dr. Muhammad Hamid Zaman  
Zain Humayun  
Fatima Perwaiz Khan

## Each winner will receive

A year-long membership of a professional society of his/her choice or a year-long subscription of an international science journal.

A package of books written by Pakistani authors to each winner (sponsored by Gufhtugu Publications).

A certificate of honorable mention.

Excerpts of the dissertation may be published in The Particle as well as the School's website.

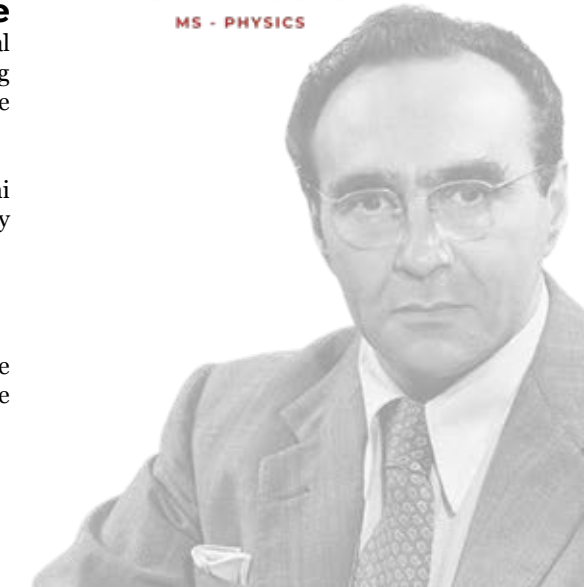
Written by the Particle Team



**IRFAN JAVED**  
BS - PHYSICS



**MUHAMMAD BASIT**  
MS - PHYSICS





# Physics Nobel Prize Lecture 2021

**The Physics department at Syed Babar Ali School of Science and Engineering organised a talk based on the Physics Nobel Prize 2021 on the 12th of November.**

The Nobel Prize in Physics 2021 was awarded “for groundbreaking contributions to our understanding of complex systems” with one half jointly to Syukuro Manabe and Klaus Hasselmann “for the physical modelling of Earth’s climate, quantifying variability and reliably predicting global warming” and the other half to Giorgio Parisi “for the discovery of the interplay of disorder and fluctuations in physical systems from atomic to planetary scales.” Complex systems research is very interdisciplinary and finds applications from systems biology, statistical theory of evolution, atomic and molecular systems all the way to planetary and galactic ones, climate modeling and understanding complex fluid motions, computational complexity theory, neural networks and information theory, to name a few.

This talk focused on the contributions of Giorgio Parisi to enhance our understanding of complex physical systems, from his pioneering contributions to spin glasses till the motion of starling flocks.

## About The Speaker

Silvio Franz is currently Professor of Physics at the University of Paris-Sud where he is associated with Laboratoire de Physique Statistique et Modèles Statistiques (LPTMS). He obtained his PhD from Sapienza Università di Roma in 1992. He has held various research and teaching positions at the École Normale Supérieure, the University of Oxford, the Nordic Institute for Theoretical Physics (NORDITA), and the Abdus Salam International Center for Theoretical Physics (ICTP).



**Giorgio Parisi**



**Silvio Franz**

# Roundtable IC Design in Pakistan

December 24, 2021

The discipline of Integrated Circuit (IC) design is of paramount importance in modern era as it forms the basis for the development of all microelectronic devices in use today. The list includes the micro-processors (that are the brains of all computing systems, e.g., desktops, laptops, cell phones, etc.), the image processing circuits (that power the display systems, e.g., computer monitors, overhead projectors, television sets, cinema screens, etc.), and the sensors that are used in wearable and implanted medical devices. These microelectronic devices also enable the mounting use of artificial intelligence (AI) that is reaching new horizons in applications such as autonomous vehicles, machine vision, industrial automation, and natural language processing.

**In this context, the Department of Electrical Engineering, Syed Babar Ali School of Science and Engineering organized a one-day roundtable, “IC Design in Pakistan” on Friday, December 24, 2021.**

Notable people from academia and industry in Pakistan participated in the roundtable as panelists and brainstormed on the future and feasibility of strengthening the IC Design education and research in Pakistan. The discussion was led by Prof. Asad Ali Abidi who is the Distinguished Chancellor’s Professor

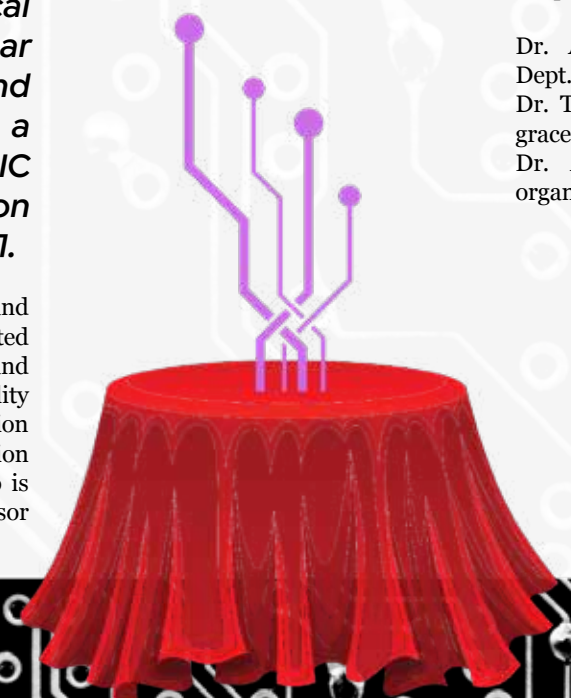
at UCLA and Abdus Salam Chair at the Syed Babar Ali School of Science and Engineering (SBASSE), Lahore University of Management Sciences (LUMS). This roundtable also provided a unique opportunity for different stakeholders in IC Design Discipline in Pakistan to interact with each other to come up with a workable solution to manage the sub-critical mass problem in IC Design Education in Pakistan.

Dr. Sajid Baloch, Director General National Electronics Complex (NECOP), Pakistan; Dr. Naveed Sherwani, CEO RapidSilicon; Dr. Bilal Zafar, Founder and CEO 10xEngineers; Dr. Yasir Qadri, GM NECOP, and Mr. Ashraf Nisar, GM RapidSilicon were among the industrial panelists. Similarly, Dr. Rashad Ramzan, FAST-NUCES, Islamabad; Dr.

Arsalan Jawed, PAF-KIET, Karachi (over Zoom); Dr. Hammad Cheema, RIMMS, NUST, Islamabad, and Dr. Muhammad Tahir, UET, Lahore, were among the panelists from academia. LUMS had the largest IC Design faculty share in the roundtable with Dr. Shahid Masud, Dr. Wasif Tanveer Khan, Dr. Wala Saadeh, Dr. Awaib Bin Altaf and Dr. Adeel Pasha.

One of the major highlights of the roundtable were the live/recorded Zoom interviews with the leading experts in IC Design who soughed the seeds of IC Design revolution in neighboring countries of India, Iran and Egypt. These globally-renowned experts were Dr. Venu Gopinathan, ex-Director of Kilby Labs, Texas Instruments, Bangalore; Prof. Ali Fotowat, Sharif University, Tehran, and Prof. Emad Hegazi, Ain-Shams University and founder, SysDSoft (acquired by Intel), Cairo.

Dr. Abubakr Muhammad (Chair EE Dept.), Dr. Sabieh Anwar (Dean SSE) and Dr. Tariq Jadoon (Acting Provost) also graced the occasion with their presence. Dr. Adeel Pasha was the principal organizer of the event.



Written by the Particle Team



# THE LUMS MATH CIRCLES

Written by the Particle Team

## What are Math Circles? ○○○

A math circle is a social structure where math teachers and students alike explore mathematical concepts not generally explored in the classroom. They often aim to delve into the intricacies of mathematical thinking, propagate the culture of doing mathematics, and create knowledge. Participants will normally work on various aspects of mathematics through means such as problem-solving and mathematical modeling. These meetings generally take place outside the regular school day and are independent of the syllabus being taught in schools and universities.

LUMS Math Circles is a project launched in 2021 by the Department of Mathematics. We identified a gap between students' interest in math and the extent to which they are able to explore the subject. In an increasingly competitive world, it is important we provide opportunities for students to practice and hone their skills of problem solving in mathematical sciences.



### Contact us!

Email: [math.circle@lums.edu.pk](mailto:math.circle@lums.edu.pk)

### Our Team:

Director: Dr. Imran Anwar  
Email: [imran.anwar@lums.edu.pk](mailto:imran.anwar@lums.edu.pk)

Advisor: Dr. Shaheen Nazir  
Email: [shaheen.nazir@lums.edu.pk](mailto:shaheen.nazir@lums.edu.pk)

For more information on this program, please scan:



## Early Career Achievement!

### Dr. Ihsan Ayyub Qazi

Recognized for his academic background, service to the University of Pittsburgh, and success in addressing very timely issues in the field of computer science, Dr. Ihsan Ayyub Qazi (Associate Professor and Chair Department of Computer Science, SBASSE) has been awarded the prestigious **Sheth International Young Alumni Achievement Award**.

This award was created by Dr. and Mrs. Jagdish N. Sheth to honor a member of the University of Pittsburgh alumni network who earned a degree in the last fifteen years, is committed to global endeavors, and has made substantive contributions to the international community through a professional achievement. This award is given to only one alumnus every year.

Reflecting on the honor bestowed upon him, Dr. Qazi said, "I feel deeply honored to have been selected for the award and I believe this is equally a recognition of the amazing people and work taking place at LUMS."

We extend our heartiest congratulations to Dr. Qazi and wish him well in his pursuit of knowledge. Please visit this link to learn more about the Sheth International Young Alumni Achievement Award: <https://www.ucis.pitt.edu/main/sheth-international-achievement-awards>

## Faculty Spotlight





# FIVE UP

*Congratulations to the 5 faculty members from the Syed Babar Ali School of Science and Engineering who have just been promoted and granted tenure!*



**ZUBAIR KHALID**

*Dr. Zubair Khalid is amongst the world's leaders in spherical signal processing and a celebrated teacher, decorated with the first VC Teaching Excellence Award.*

Dr. Zubair's research is focused on the development of new signal processing techniques to analyze signals defined on the sphere. Analysis and processing of signals, defined on the sphere find applications in various fields of science and engineering, such as cosmology, geophysics, acoustics, and medical imaging, storage systems and how the batteries are integrated in the practical systems.



**MURTAZA TAJ**

*Dr. Murtaza Taj's forte is taking computer vision literally to the trenches--his work on digital archeology has claimed global attention.*

In particular, he is interested in detection and tracking of object in 2D and 3D scenes and automatic generation of 3D models from raw point cloud data. At LUMS he is a director of Computer Vision and Graphics Lab (a research group within LUMS computer science department) and a director of Technology for People Initiative (TPI) (a research and development group at LUMS that develop solutions to leverage technology to catalyze development in the public sector and improve data accessibility to facilitate good governance.



**AMIR FAISAL**

*Meanwhile Dr. Amir Faisal is attempting to make cancer a thing of the past with tools in molecular biology.*

He leads the biology department as well. He has established the Cancer Therapeutics Lab that focuses on early phase drug discovery and research into cell signaling. Dr. Amir Faisal is particularly interested in the identification and characterization of hit compounds that target microtubules and Aurora A kinase; two critical components of mitotic cell division. Work in his lab aims to discover microtubule targeting agents (MTAs) that overcome Pgp-mediated multidrug resistance.



**SAFEE ULLAH**

*Dr. Safeeullah has tamed his computers to search for drugs, therapies, and navigate through complex genetic and proteomic labyrinths.*

Dr. Safee Ullah has worked on computational modelling of multiscale cancer systems biology. He took an agents-based (multi-agent) approach to model tumorigenesis and uncovered the role of cell death in Warburg Effect. This work also led to the development of Electronic Cancer System (ELECANS), which is a next-generation modelling platform for applications in cancer systems biology.



**MUHAMMAD FARYAD**

*And last but not the least, Dr. Muhammad Faryad in his journey from classical numerical optics employing strange metamaterials is now looking for quantum connections in his new initiative, the QuantaC.*

In addition to his community work that focuses on science outreach to children, Dr. Faryad's research work focuses on the interaction of light with modern metamaterials and complex materials. His major research areas are surface plasmonics, optical sensors, electromagnetics of complex materials, dyadic Green functions for anisotropic mediums, and nanostructured solar cells. He has authored and coauthored more than one hundred journal articles and proceeding articles, a book chapter, and a book.



## Making it to the Editorial Board

### Dr. Tauqeer Abbas

Dr. Tauqeer Abbas, Assistant Professor in Chemistry and Chemical Engineering has been selected for the editorial board of the Journal of Ionic Liquids, a prestigious frontline journal capturing cutting edge research in ionic liquids.

The Journal of Ionic Liquids is a high-quality international journal that reports academic and industrial research in the field of ionic liquids, with a focus on fundamental measurements, molecular simulations, processes, and products. It is the only journal primarily dedicated to articles based on ionic liquids research.

Dr. Tauqeer now joins the ranks of 38 world-class researchers, emanating from 15 different countries, that are part of the editorial team.

You can learn more about the journal and its editorial team here:

<https://www.journals.elsevier.com/journal-of-ionic-liquids/editorial-board>



## SBASSE welcomes new faculty

### Dr. Faheem Akhtar

**Dr. Faheem Akhtar has joined the SBASSE family as Assistant Professor (Tenure-Track) in the department of Chemistry and Chemical Engineering.**

Dr. Faheem did his PhD in Chemical Engineering from the King Abdullah University of Science and Technology (KAUST), Saudi Arabia in 2019. He works on the development of polymer and mixed-matrix membranes, which are extremely promising for developing sensors, in particular for environmental applications.



### Dr. Amna Ijaz

Dr. Amna received her MPhil in Environmental Biotechnology from National Institute for Biotechnology and Genetic Engineering (NIBGE) in Faisalabad, Pakistan, where she participated in the development of a sustainable and cost-effective wastewater treatment technology that has since been extensively installed in wastewater stabilisation ponds/canals in Pakistan, by her mentor at NIBGE, Dr. Muhammad Afzal's research group, for water quality restoration.

She then went on to the USA, through the Fulbright Foreign Student Grant, to pursue a PhD at Michigan Technological University (MTU), where her research shifted to Atmospheric Chemistry.



### Dr. Farzada Farkhooi

**Dr. Farzada Farkhooi received a bachelor's from Allameh Tabataba'i University, Tehran, Iran, and her master's from the University of Nottingham, UK.**

She completed her Ph.D. at Freie Universität Berlin, Germany, in computational neuroscience in 2011. She was a postdoc fellow and visiting scholar at the National Institute of Health, Bethesda, USA, and CNRS, Paris, France. She established her independent line of research at the Institute for Mathematics at Technische Universität Berlin, Germany, in 2015. Afterward, she moved to the Institute for Theoretical Biology at Humboldt-Universität Berlin, Germany. Her work is pursued in close collaboration with outstanding experimental and theoretical research groups around the world. She is building a strong publication record with articles in journals such as Physical Review Letters, Physical Review E, PLoS Computational Biology, and Proceedings of the National Academy of Sciences.





# A VALUED ADDITION

**Dr. Shahana Khurshid** joins the Department of Chemistry and Chemical Engineering as Visiting Associate Professor.

Written by the Particle Team

**How can a better environment be engineered for a healthier future? How can our lungs cope with reactive oxygen species and tiny inorganic particles that can cause big problems? This is what inspires our latest addition to the SBASSE family – Dr. Shahana Khurshid**

We welcome Dr. Khurshid as a visiting associate professor at the department of chemistry and chemical engineering.

Dr. Shahana Khurshid obtained her B.S. in Environmental Engineering from MIT, M.S. in Biomedical Engineering and Ph.D. in Environmental Engineering from the University of Texas at Austin (where she received the NSF IGERT Fellowship and the EPA STAR Fellowship). After her Ph.D. she has worked at the National Institute of Standards and Technology (NIST) and at the University of Texas at Austin. Clearly, her passion takes cue from the dips and curves in the relationship of air, pollutants and environmental conservation. Dr. Khurshid has published

more than 15 articles in recognized journals such as Advanced Materials, NISTIR and Toxicology in Vitro. Her papers have been cited more than 2500 times.

Dr. Khurshid is an effective communicator and a thorough researcher. Her master's degree in biomedical engineering also fits neatly with the School's vision of a new masters programme in biomedical sciences. We extend our heartiest congratulations to Dr Shahana Khurshid on joining the LUMS community!



A student points towards their research poster, as part of a poster presentation organised by the Department of Chemistry and Chemical Engineering.



FALL 2021 | CHE 312

## Fundamentals of Environmental Engineering

We may not be able to completely geoengineer the planet, but we can certainly think about ways to make our air more breathable, water more drinkable and land cleaner and greener. This is an introductory course that centres on fundamental chemical principles and processes that help understand and solve environmental challenges related to atmosphere, water and soil pollution. Students will also learn about the effects of anthropogenic activities on the chemistry of the Earth. Specific topics include air pollution (smog, particulate matter, greenhouse gases, ozone), water contaminants and purification, toxic organic chemicals and metals in the environment.

**Join Dr. Tauqeer Abbas to explore the fascinating possibilities of how we can make our planet a cleaner, greener place.**

**For more course information:**  
<https://sbase.lums.edu.pk/course-advertisements>

EE558 -

## Battery Energy Storage Systems

**EXPLORE  
THE  
INVENTION  
THAT  
POWERS  
MODERN  
TECHNOLOGY**

**Like sunlight for plants, our technology lives off the electrons flowing in and out of a well charged battery, eager to supply power into miniature electronic circuits, bringing the silicon to life! Batteries – this course is all about batteries!**

Join this course to learn how this wonderful invention breathes life into tech. Take a panoramic view of battery operations, modelling and ageing. We will start with the electric equivalent circuit model followed by physics based models. We will then cover the battery dynamics and state space models. Battery Management Systems will be introduced. The reliability and degradation analysis of batteries and how we can estimate the health and useful life of the battery will be discussed. Finally, we will study important use cases of battery energy storage systems and how the batteries are integrated in the practical systems. Explore ways to supercharge battery tech to enable better, more efficient performance.

Your guides for this journey will be Dr. Naveed Ul Hassan and Dr. Ijaz Haider Naqvi.





FALL 2021 | EE 562 / CS 5610

# Robot Motion Planning

by Dr. Abubakr Muhammad  
& Dr. Talha Manzoor

Taught by complex series of numbers, words, and symbols (aka coding) and powered by millions of tiny electrical impulses, each a decision unto itself, robots can finally rise from their digital crypts and simply, move!

This course, instructed by Dr. Abubakr Muhammad and Dr. Talha Manzoor, is a sinuous tour that follows deep grooves of motion planning algorithms, mathematical modelling, kinematic and dynamic capabilities of robot systems and the role of sensors, actuators, computation, and control in building an autonomous robot. This course attempts to bridge the theoretical gap between low-level regulatory control and high-level AI in robots – you cannot miss it!



EE212 | Fall 2021

## *Mathematical Foundations for Machine Learning & Data Science*

by Dr. Zubair Khalid

### **When did machines start learning?**

Well, from the moment you start scrolling Facebook, to the umpteenth selfie that still doesn't look right – the sophisticated electronic highways inside your modern smart devices and computers are busy creating sense from patterns. Machine learning is the great filter through which we get precise search results that are no longer limited to text queries but have expanded to pictures and videos. Couple data science with chipsets that are getting exponentially complex, and we have a recipe for some mind-blowing results!

Enter EE 212: Mathematical Foundations for Machine Learning and Data Science – a course offered for Fall 2021 by Dr. Zubair Khalid from the Department of Electrical Engineering at SBASSE. This exciting course reveals the elegant fabric of technology, knitted by strong mathematical and statistical skills and fundamental computing training. There are limited slots to fill and a lot of exciting, scenic routes on this technological journey; a highway to machine learning and data science.



by Dr. Tayyab Imran | FALL 2021

PHY 5315 | PHY 433 | EE 5315 | EE 433

# Zap, Zap!

**The latest course on  
laser engineering is here!**

When Einstein predicted stimulated emission, no one was suggesting barcodes and lasik surgery. Lasers have indeed come so far.

The course covers the technological and engineering aspects of laser design construction and operation, it includes understandings of resonator theory, pulsed and continuous wave operation of lasers. Laser pulsed techniques such as Q-switching, mode-locking and harmonic generation. Discussion about the most popular and advanced lasers, their operation and design construction. First few lectures will be a basic introduction to lasers and review of laser research history and later weeks will cover the advanced laser system design understanding.



## Fire Drill was successfully conducted in SBASSE, dated December 15, 2021, at 03:00 PM.

More than 300 people evacuated and participated in the drill, including Faculty, Staff, Students, Security and Facilities, and the engineering team. A Fire Drill is a practice of evacuating the building in the event of fire and is conducted to assist the building occupants to familiarize themselves with the evacuation routes and procedures.

Fire wardens are the designated people among building occupants, equipped with fire safety training, and help the building occupants to evacuate the building in the event of a fire and can be identified with their red reflective vests.

*Written by Muhammad Eaitsam Akram  
Photography by Syed Roshan Bukhari*





# SCINTILLATING BRILLIANCE

## ALUMNI SPOTLIGHT

### Muntazir Abidi's deep journey into the realms of Physics



Years after setting sail for his academic journey, Muntazir Abidi has gathered respect and recognition for his dedication to curiosity and perseverance. A celebrated alumnus of the International Center for Theoretical Physics (ICTP) Diploma programme, Dr. Abidi, who graduated from the Physics programme from SBASSE back in 2012, is the subject of the center's latest alumni spotlight.

Like many before him and possibly more after, Dr. Abidi's interest in science was catalyzed by his read of Stephen Hawking's best-seller "Brief History of Time", a gift by one of his teachers. Recalling memories from his early days at ICTP, Dr. Abidi said *"After reading that book, I took a special interest in physics, but when I went to university in Lahore, for my bachelor's the focus was mostly on engineering. When I arrived at ICTP I still did not know what I wanted to specialize in, I was just genuinely interested in physics. I was taking courses and most of the time I was just reading random books in the library. I really liked the ICTP Library, I spent a lot of time there."*

After landing in Trieste in 2012, his exploration of the universe began through studies in High Energy, Cosmology and Astroparticle physics. During the time it took for him to

complete his Diploma at the ICTP, the grit of work, warmth and support of colleagues and teachers and the very well-structured program overall helped transform him on a professional, as well as personal front.

***"I think the Diploma Programme changed my life and if I am where I am it's because of ICTP. There's no doubt about it, says Dr. Abidi."***

"Researchers at ICTP come from all around the world and people are very friendly and cordial. Here I met a lot of great scientists, I got to meet people who I considered my heroes."

Dr. Abidi returned to Pakistan and settled in Karachi to continue his journey as a lecturer at the Karachi Institute of Technology and Entrepreneurship and later at the Institute of Business Administration, Karachi. It was then, that the threads of fate weaved a net large enough to catch both his biggest ambitions and his wildest dreams; he was awarded a special fellowship at the University of Cambridge, UK. Like a well-written story of completing life's proverbial circles, he was positioned

at the Stephen Hawking Centre for Theoretical Cosmology. The center bore name of the scientist whose book flamed Dr Muntazir Abidi's love for science in the first place! *"When I went to Cambridge for my Master's, it felt like a great time in my career, because I had the chance to really explore things because I got to meet people who are working on specialized fields,"* says Dr. Abidi.

Since November 2020, Dr. Muntazir Abidi has joined the University of Geneva as a post-doctoral researcher, where he is working with Prof. Camille Bonvin on testing gravity using galaxy and intensity mapping surveys. He was also invited as a short-term researcher by the Cosmology X Data Science group at the Simons Foundation's Flatiron Institute in New York, USA. He has been collaborating with Prof. Shirley Ho's group on simulation-based analysis of galaxy surveys as well as applications of deep learning in cosmology.

Dr. Muntazir Abidi's brilliant yet young career spawns motivation. We congratulate him on receiving the recognition from the ICTP. Looking back the story of Dr. Abidi, perhaps the force needed to guide the compass of our mind and get the impetus of learning going is as nimble as reading an interesting book on one's favourite subject.

Written by the Particle Team



# Treasures from Trash

Written by the Particle Team

*Plastic has become a dirty word. We all should have seen it coming, and its finally here.*

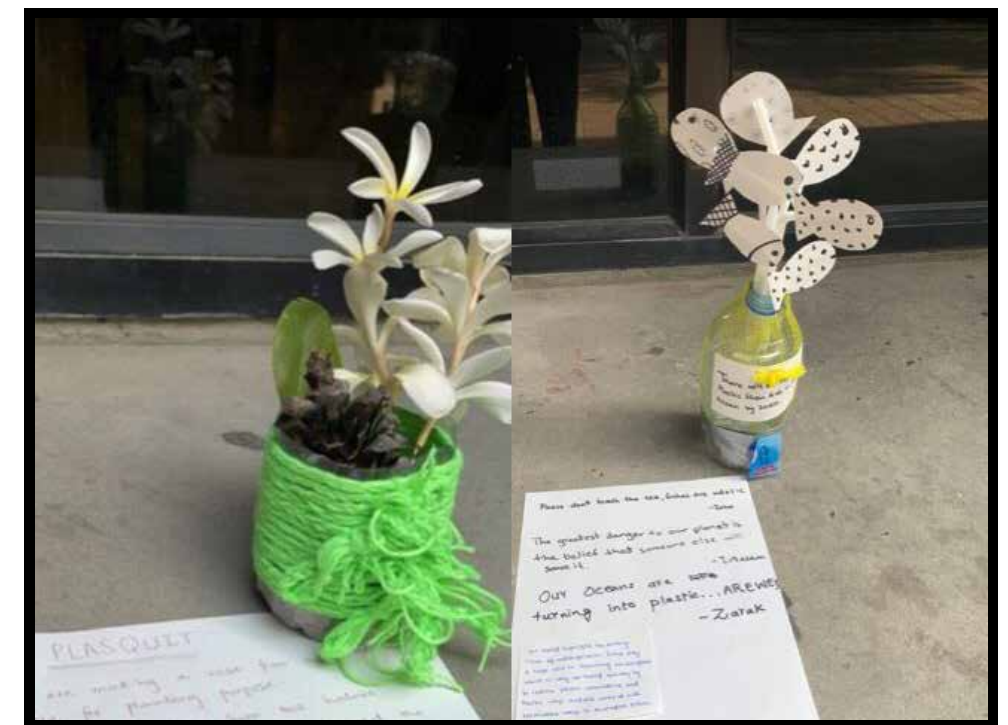
This awareness comes at a critical time, when the planet is reacting to man-made changes to the environment such as the devastating effects of global warming, and the healthcare nightmare that has risen in the form of rising air pollution levels; Lahore bobs up and down as the world's most polluted city. There is a need to change our ways, and that change should emanate from within us first. Students from the SCI 103 course have done just that! They have created sculptures from trash, using plastic and other non-biodegradable materials, to highlight their environmental hazards.



This commitment and direction has seen much love, appreciation and acceptance from the entire LUMS community. Therefore, it has been decided that these treasures from trash will remain displayed throughout the day with LUMS environmental Action Forum (LEAF), leading a bigger PlasQuit campaign on the campus. This is exactly what's needed now. We must steer away from using plastic. This great leap of faith has been taken.

***If LUMS can become plastic neutral and eventually plastic-free in the coming years, this will indeed be a giant leap in the right direction.***

We need the support from our students, staff, faculty and the entire LUMS community to make this happen. Let's commit to a greener and more sustainable future. The future is now. We begin right here from the Syed Babar Ali School of Science and Engineering.





# SBASSE Dean's Honour List Award Ceremony 2021

**The annual Dean's Honor List Ceremony for the undergraduate students of Syed Babar Ali School of Science and Engineering at LUMS was held on Friday, 3 December 2021 and a large number of students, parents and faculty members from the school participated.**

The esteemed co-founder of LUMS, Syed Babar Ali, Vice Chancellor of LUMS, Dr. Arshad Ahmad and the Provost, Dr. Farhat Haq, also graced the occasion with their presence. The ceremony was arranged by the team of Dean's Office, SBASSE in one of the Library lawns, and was hosted by Dr. Ammar Ahmed Khan from the Department of Physics, at SBASSE.

The ceremony commenced with the recitation of the Holy Quran by Hafiz Haris Ahmed (SBASSE BS Class of 2022) and was followed by Dean Dr. Muhammad Sabieh Anwar's opening address, who congratulated the students on their outstanding performance and for making it to Dean's Honor List.

He described the school as a "*silent revolution*" as SBASSE is geared towards providing its students science, engineering and technology education, which opens up minds and to some extent, their hearts. He said that the goal of the School is not to create robots, but students who think about Pakistan and look to the future to work towards its betterment. He also added that the students should strive to become honest human beings, think big and leave a legacy by inventing things, instead of running after the finite things of this universe.

Dr. Ammar then requested esteemed guest, Syed Babar Ali to share a few words. He began by sharing his vision that led to the formation and development of SBASSE was to create minds through science and engineering

which would contribute towards the improvement of the quality of lives of the people and end economic inequality. He congratulated the students and requested them to not just conquer the world, but also think about how they can help our country.

Commencing further with the event, Dr. Ammar called each student on the stage to receive their certificates from Dean SBASSE, while the parents clapped and beamed with pride. One of the highlights of the event was the Abdul Razak Dawood Scholar Award, which is given to the overall top student at the end of first year of the undergraduate programme across the university. This year, this was awarded to Muhammad Hashir Hassan Khan, BS Physics student from the Class of 2024. Overall, fifty-nine students from the BS Senior Class of 2022, eighty-three from Class of 2023 and eighty-nine from Class of 2024 were awarded the DHL certificates.

The Vice Chancellor, Dr. Arshad Ahmad, then addressed the audience and congratulated the students on their brilliant achievements. He thanked the parents, friends and family for joining the ceremony to celebrate the accomplishments of the students. He said that the students must pass this gift of education and learning, that their parents have given them, to those who do not have the opportunity. This, according to Dr. Arshad, is a virtual cycle that represents our shared hope for the development of our country, as well as a better world. He also

congratulated everyone for working hard and not giving up during the tough days which the pandemic presented to us. Dr. Arshad shared a story of Abdullah Khan, who came from a local district of Tando Allahyar from Sindh. Abdullah is one of the seven students in LUMS who have been on the DHL for every single year with a 4.00 CGPA. Dr. Arshad requested the students to be the "multiplier" that LUMS and the country can count on, and help other people to achieve more than what they have. He once again congratulated all the students and wished them success and hope for their future endeavors. The ceremony concluded with refreshments and networking for the guests.

After that, Dr. Ammar called upon the students who received the Honoric Fellowship Awards for their outstanding performance in the field of basic sciences. Three students from the Class of 2022, two from the Class of 2023 and three from the Class of 2024, received the Bilquees Mujeeb Fellowship Awards for their academic brilliance in the field of Biology. One student from the Class of 2022 and one from the Class of 2024, who are majoring

in Chemistry, received the Ahmed H. Zewail Fellowship Award, while three students from the Class of 2022, six junior students from Class of 2023, and three students from the Class of 2024, received the esteemed Chandrasekhar Fellowship Award for showing excellent results in the discipline of Physics.

Finally, seven PhD students, who received the Syed Babar Ali Research Fellowship Award for their excellence in research, were called on the stage to receive their certificates.



Written by the Particle Team





# PRO-MOTED

As the pall of covid-19 drifts away, there rises undulating clouds of hope, optimism and good spirit from the chimneys of the SSE building. Good news! We are delighted to inform that eighteen staff members from the Syed Babar Ali School of Science and Engineering have been promoted!

**Congratulations, everyone!**  
*Shine on through the coming years  
and keep up the good work!*



Yawar Abbas Bokharee



Aleena Khan



Muhammad Asif



Ayesha Ikram Butt



Murtaza Saleem



Maryam Amir



Muhammad Umar Hassan



Hina Ahmad



Muhammad Kaleem



Muddasar Hayat



Muhammad Tanveer Sajid



Muhammad Farooq Usman Ali



Khadim Mehmood



Ali Hassan



Afaq Ahmed Butt



Muhammad Abubakr



Chaudhry Mansoor Asif



Arshad Maral



## Packaging – Thinking Out of the Box for a Sustainable Planet



Written by the Particle Team

**Introduction to the Environmental Science (SCI-103), is an introductory course taught by Dr. Fozia Parveen at Syed Babar Ali School of Science and Engineering.**

This elective course was designed as a standalone course for students of all levels from all across LUMS in order to understand the complexity of environmental issues and encourage individuals to be active agents of change for a sustainable planet. The course aims at establishing a link between an individual and their hydrosphere, geosphere, atmosphere, and biosphere to bring about the much-needed sensitization through science.

In order to get a better understanding of the issues and to propose relevant solutions at the end of the course, Dr. Fozia took her students to visit one of the largest packaging factories in Lahore – Packages Limited. The activity

comprised of visits on two consecutive Saturdays, where around 50 students of the class accompanied by the faculty, visited the factory site in Lahore. These visits took place on 2nd and October 9, 2021. As the course aims to offer an experiential learning experience for students, after learning about renewal and non-renewable resources of energy and plastic as a byproduct of fossil fuel, it was time for the students to get a sense of scale of the industrial processes, with a focus on the environmental inputs and the impact on the environment as a result of the industry. The visit was followed by an assignment for student to submit their observations and recommendations.

The students were given a presentation by the lead engineers, who also chaperoned the students throughout the various areas of the factory. The students were able to get a first-hand experience of how paper printing and plastic printing is done for the everyday products which we consume day-in-day-out. The host also engaged the students in giving them a better understanding of how they use environmental quality parameters to ensure lesser pollution. They explained how they manage their

social impacts and ensure supply chain sustainability throughout their product life cycle, by closely working with the suppliers to mitigate potential risk for continual improvement. The power-supply for the entire factory and the adjacent property is being managed by solar power and clean energy.

Their two-basic plants are committed to printing paper material for boxing of goods and products which come in every-day use, while the other plant component is for plastic wrapping and packaging. To ensure compliance of all rules, Packages has added One Point Lessons (OPLs) within the factory facility, so that all employees understand and follow the required methods. Their quality assurance pyramid represents the hierarchy when the employees operate the assembly-lines and work with the larger-than-life machinery.

This was an extremely beneficial activity for the students, who could see the on-site examples of how a large factory uses and recycles their material and gave them a greater understanding of the impact of such facilities on the environment.



# برقی انقلاب

مصنف: راز احتشام

اسی سلسلے میں ڈاکٹر نوید ارشد سے جب ہماری گفتگو ہوئی تو انھوں نے پر اُمید لہجے میں پاکستان میں بجلی پر چلنے والی گاڑیوں میں اضافے کی نوید سنائی۔ ان کے مطابق یہ تحقیق پاکستان میں ایک برقی انقلاب کا پیش خیمہ ثابت ہوگی۔

اس تحقیق میں پاکستان میں بجلی پر چلنے والی گاڑیوں کی موجودہ تعداد، صارفین میں اس کی مزید طلب کا رجحان، پاکستان میں کام کرنے والے بزنس ماڈل، بجلی پر چلنے والی گاڑیوں کی ممکنہ طلب اور دیگر کئی پہلوؤں پر روشنی ڈالی گئی۔ غرضیکہ یہ اس نوعیت کی پہلی مفصل اور جامع تحقیق ہے جس میں پاکستان میں بجلی پر چلنے والی گاڑیوں کے حوالے سے موجود تمام اہم معلومات موجود ہے۔ اس تقریب میں مختلف شعبہ ہائے زندگی سے لوگوں نے شرکت کی جن میں سرمایہ کار، کمپنیوں کے وفود، سرکاری ادارے، انجینئرز، اساتذہ اور طلباء نے شرکت کی۔ شرکاء کی بڑی تعداد نے لمز کے اس تحقیقی کارنامے کو نہ صرف خوش آئند قرار دیا بلکہ بجلی پر چلنے والی گاڑیوں کی ضرورت اور اہمیت پر اتفاق کیا۔

بہت سے لوگوں کے لیے یہ ایک حیران کن انکشاف ہوگا کہ ۱۹۰۰ میں امریکہ میں بنائی جانے والی کل گاڑیوں میں سے ۳۰ فیصد بجلی پر چلنے والی گاڑیاں تھیں! یہ گاڑیاں کہاں گئیں اور کن وجوہات کی بنا پر یہ گاڑیاں متروک ہو گئیں یہ موضوع ایک الگ تفصیل کا متقاضی ہے لیکن فی الحال ہماری دلچسپی کا سامان یہ ہے کہ عنقریب بجلی پر چلنے والی گاڑیاں دوبارہ اس تخت پر براجمان ہونے جا رہی ہیں جن سے کسی وقت میں انھیں معزول کر دیا گیا تھا۔

حال ہی میں امریکہ کے صدر نے اعلان کیا کہ ۲۰۳۰ء میں پچاس فیصد گاڑیاں بجلی پر چلنے والی ہو جائیں گے۔ پاکستان کی موجودہ حکومت نے بھی بجلی پر چلنے والی گاڑیوں کے حوالہ سے اپنے اہداف مقرر کیے ہیں۔ اسی سلسلے میں یو ایس ایڈ کے تعاون سے پاکستان میں بھی بجلی پر چلنے والی گاڑیوں کے حوالے سے تحقیقاتی کام کا آغاز ہوا۔ اس تحقیقاتی کامیڈہ لمز کے پروفیسر ڈاکٹر نوید ارشد نے اپنے سر

لیا۔

# طلبا کی انڈسٹری سے ہم آہنگی

انڈسٹری کے تجربہ کار لوگوں سے ملاقات بھی کرائی جائے گی جس سے انہیں بلاواسطہ انڈسٹری کی ضروریات کا اندازہ ہوگا۔ اس پروگرام سے طلباء میں کیا بہتری آئی اور انڈسٹری کی ضروریات کو سمجھنا ان کے لیے کس قدر فائدہ مند ثابت ہوا اس کا تعین تو ان اولین طلباء کی کارکردگی سے ہوگا بہر حال یہ پروگرام ایک روشن مستقبل کی جانب پہلا قدم ہے جس سے بجا طور پر بہت سی امیدیں وابستہ کی جاسکتی ہیں۔

وقار احمد کے مطابق اس پروگرام کے اختتام پر طلباء اس قابل ہو جائیں گے کہ وہ اپنی پسند کی کمپنی میں کام کر سکیں اور اگر طلباء میں سے کوئی اپنے کاروبار کا آغاز کرنا چاہے تو اس کے پاس بھی مطلوبہ معلومات موجود ہوگی۔ اس پروگرام کا دائرہ کار فی الحال صرف کمپیوٹر سائنس کے طلباء تک ہے لیکن مستقبل قریب میں وہ اسے دیگر شعبہ جات کے طلباء تک بڑھانے کا ارادہ رکھتے ہیں جس سے پراجیکٹ پر مختلف پس منظر اور تعلیمی مہارت رکھنے والے طلباء مل کر کام کریں گے۔ اس طرح جہاں طلباء مجموعی محنت سے ایک پراجیکٹ کو تکمیل دیں گے وہیں ان میں مل جل کر کام کرنا، ہم آہنگی اور تعاون کی مہارت بھی مزید بہتر ہوگی۔

طلبا کی طرف سے ایک سوال کم و بیش ہر جگہ سب سے زیادہ پوچھا جاتا ہے اور وہ یہ کہ جو کچھ انہیں تعلیمی اداروں میں پڑھایا جاتا ہے اس کا عملی دنیا میں اطلاق کیوں نہیں ہوتا؟

اس سوال کے جواب کی مختلف جہات میں دنیا میں تیزی سے بدلتا ہوا سائنسی منظر نامہ، نصاب تعلیم کا مطلوبہ رفتار پر بہتر نہ ہونا، پاکستان جیسے ملک کا سائنس کی دوڑ میں پیچھے ہونا، تعلیمی اداروں کی جانب سے مناسب رہنمائی نہ ہونا وغیرہ جیسی کئی جہات شامل ہیں۔ ایک بات تو طے ہے کہ جن تعلیمی اداروں میں انڈسٹری کے اصولوں سے واقفیت کی بنیاد پر طلباء کی رہنمائی کی جاتی ہے ان کی کارکردگی دیگر اداروں سے بہت بڑھ جاتی ہے۔

اسی اصول کو مد نظر رکھتے ہوئے لمز میں وقار احمد کی سربراہی میں ایک پروگرام کا اجرا کیا گیا جس کے بنیادی مقاصد میں طلباء کو تیزی سے بدلتی ہوئی عالمی منڈی سے روشناس کرایا جائے اور خصوصاً ان کے آخری سال کے پراجیکٹ کو اس طرح سے تشکیل دیا جائے کہ وہ جدید انڈسٹری کے بدلتے ہوئے تقاضوں سے ہم آہنگ ہو کر ایک مثبت اضافہ ثابت ہوں۔

اس سلسلے میں مزید تفصیلات جاننے کے لیے ہم نے اس پروگرام کے سربراہ وقار احمد سے بات چیت کی۔ ان کے مطابق اس پروگرام کے پہلے مرحلے میں پچاس طلباء اس کا حصہ ہیں جن سے ہر دو ہفتے میں ایک بار ملاقات کی جاتی ہے۔ ملاقات میں ان سے پراجیکٹ پر پیش رفت اور پیش آنے والے مسائل کے حوالے سے گفتگو کی جاتی ہے۔ ان کو جدید مارکیٹ سے روشناس کرانے کے لیے

مصنف: راز احتشام



## GRATITUDE

*Holding in her hands little saplings of joy  
I saw the gratitude dancing in rain  
Fragrant drops cleansing her soul  
Though brighter, she was ready to  
sparkle again*

*Sitting in the shade, was bewildered hate  
Owning grudges, lacking grace  
Pain has brought her up, ahh! ill fate  
Embracing others, in her life had no space*

*The difference in both lies in letting go  
As the hate is heavy, it will never let you grow  
While gratitude is like a beautiful spring  
That never finishes and loves to flow*

**Novaira Rizwan**  
Ms, Biology

## LITTLE THINGS

*Once I asked the nature to unravel its story  
The creation of which created an allegory  
She said, clues are all around, ready to disclose  
The rattling tale of dominion, and sublime glory*

*The wandering bird perceives the path  
The drowning stone knows the depth  
The fading leaves have witnessed the dark  
The spreading light beholds the breadth*

*The secret lies in little things  
of both the heaven and the earth  
For the people of understanding  
who for sure value their worth!*

**Novaira Rizwan**  
MS, Biology

## بازگشت

یاد کے بچکے رات کا آئینہ، دونوں میں مہربان ہست  
جلتی ریت میں بننے، بکھرتے، دل کے ہیں ارمان ہست

کوئی تو در کھلا رکھتے، سارے کیوں مُقتل کے  
ہرجائی کے شام ڈھلے لوٹنے کے ہیں امکان ہست

سوچ کی ساری وسعتوں میں، نام تمہارا پنہاں ہے  
اب کے پاگل ہونے کو ہو رہے ہیں بلکان ہست

بھری بھری سی رہتی ہیں، گلیاں آدم ذادوں سے  
قہدان فقط احساس کا ہے کہنے کو انسان ہست

ہوگا ابن مریم بھی دُکھ کی دوا کرنے کے لیے  
ہم بیماروں کو تو اُن کی، بلکی سی مسکان ہست

ساری بات ہے نیت کی، عبادت اور ریاضت میر  
پیشانی پہ داغ لیے، پھرتے ہیں شیطان ہست

دوست بھی اپنے جیسے ہیں، ذات کے زیریں خانوں میر  
چہرے پہ مُسکان لیے، رہتے ہیں پریشان ہست

نعمان بیگ

## روتیداد

آنکھیں موندیں تو یاد آیا، وعدہ اک پُرانا سا  
سنگ جینے کا مرنے کا جیسے اک ہسانہ سا

سانس کی ڈوری ٹوٹی تو خواب سارے بکھر گئے  
اب تو کھنڈر لگتا ہے، دل تھا جو آشیانہ سا

سالوں کی تو بات نہیں، ساتھ تھا چار مہینوں کا  
چھوڑ کے اپنی راہ چلا، یار تو تھا بیگانہ سا

زندگی تیری چاہت نے، خوب نئی پہچان دلائی  
ہم جو باغ بہاراں تھے، اب لگتے ویرانہ سا

پیار تھا دلربائی تھی، سوچ کی نہ پرچائی تھی  
اب تو سارا خاک ہوا، نام میرا شاہانہ سا

بادل تھا آوارہ سا، منزل تھی تب دور بہت  
اب رستے پر بیٹھا ہوں، ڈھونڈتا اک ٹھکانہ سا

شام کی اس تنہائی نے، سارے پردے چاک کیے  
میں تو بس اک سطر ہوا، کبھی جو تھا افسانہ سا

نعمان بیگ

## STARRY NIGHT

*I gape in awe at this motley of raging furnaces,  
Which from afar my bewildered eye embraces,  
To see glittering constellations in harmony,  
Exuding a profound beauty, an unsung symphony!*

*A melody that ensnares the soul of my solitude,  
By the pangs of loneliness that protrude  
From the vastness of this pearl-strewn fabric,  
This sea without a shore, this boundless attic.*

*But lost in this wretched emptiness,  
My soul becomes utterly joyless.  
Swept by the abounding nothingness,  
My heart feels endlessly lifeless.*

*Until a thought of you dances in my mind's balcony,  
To sing another song and breathe another symphony;  
Perched on my heart's sill like a nightingale,  
It heralds an end to my relentless bale!*

*The ether of love fills the gnawing emptiness.  
The reed of love tears the shrieks of loneliness.  
The pearls are but strewn in the fabric of love.  
The firmament is but housed in the attic of love.*

**Hassan Mehmood**  
Physics Junior - Batch of 2023



## STARRY MIGHT

... Ever wondered how exceedingly mighty a star could just be?  
A raging furnace it is; true, but how big actually ...  
The blip of innocence we see ... is it so really?  
The calm light we fancy ... does it spell serenity?

The gossamer swathe of flickering dits wrapping the nightly sky  
In truth teems with monsters having superpowers to deploy.  
Each as fiercely bright as to thoroughly blind the eye,  
They are the same stars whose grandeur we enjoy.

Speaking of their powers, we may begin with godly speed,  
At which these splendorous beasts either approach us or recede.  
Charging across the cosmos as if hurled by punishing slings,  
They're fast as Hermes and the most Hermes-ish of the things.

Most frightening is any mention of the deadly pull they possess,  
The pull that tears planets and makes heaps of gas coalesce.  
Capable of crushing all and sundry into flat pancakes,  
The pull of stars is lethal as a shrill shriek of mandrakes.

Tremulous goes the universe with a mere dance of theirs,  
For they shake the very soul-of-space like birds writhing in snares.  
As intimidating as their ferociously bright glares,  
This hold on space can whirl it like a devout Sufi in prayers.

What could be loftier than an ultimate hold of the reins of times?  
The massive beings stars are but quite painlessly rule the chimes.  
Time and tide stop for none, but for stars do sands of time;  
Freezing the heck out of time is every star's "flip of a dime."

With distance but this might gets morphed into a starry night,  
A night which pleases every mind and comforts every sight.  
It betokens that the stars could also be somewhat oracularous;  
At once fiends and adornments, they're veritably miraculous

Hassan Mehmood

Physics Junior - Batch of 2023

## غزل

چاندنی کو صبح کا نشان سمجھا  
مقصودِ عشق ہم نے کہاں سمجھا

پہمن خود جیون سے اکتا گیا تھا  
ہم نے اُسے موسمِ خزاں سمجھا

سوچ خوابوں میں اس لیے الجھ پڑی  
گزر گیا جو وہ پل بھی جواں سمجھا

اُسے شاید اس لیے بھا گیا یہ ویرانہ  
غم کو ہم نے جو سدا مہماں سمجھا

آنکھیں بند ہوئیں ہیں تو یہ راز کھلا  
جو حد نظر تھی اُسے ہی جہاں سمجھا

اُس نے تو بھرم میں کچھ نہ کہا ثیاب  
ہم ہی ناداں، خاموشی کو ہاں سمجھا

افتخار ظفر

## Drosophila in The Lab

"When we look up in the sky,  
Visible are only the astronomical lights.  
It makes you wonder, surely it does,  
But it also exasperates your mind.

A curiosity-driven pursuit it is,  
A long-legged individual I am.  
We combine to make a fortune,  
maybe because scientific in nature is all I am!

Do you play with Drosophila, the fruit fly?  
That surely must make their lively stocks cry.  
But, alas! Nothing is without a purpose.  
While they help solve problems, they do inevitably die.  
Refresh, refresh, flip the vials!  
So, their sacrifices will not go in vain for a while.

They thrive on a medium with sugar and yeast,  
climbing the walls like a miniature beast.  
Once you observe their nature at play,  
All else in life becomes a little less grey.

They oppose gravity and hurriedly fly to the top;  
from the dark side of the vial to the light spot!  
Like a moth to a flame, is Drosophila to light;  
a distance traveled to seek what is bright.  
Indeed, such wonderful behavior in one simple flight,  
the observation of which lifts my enormous plight.

This is all there is to scientific pursuits.  
A love affair, with many little flukes.  
Some harmony, with opportunities,  
Some ferocity, with mediocrities.

This is all there is to scientific pursuits;  
Just like a chance mutation,  
it helps us adapt too.  
It makes us stay positive,  
as if I were a subatomic proton.  
The excitement makes us jump too,  
perhaps like a transposon!

Like a harmonious tune, it embraces you.  
Like the heavenly shore, it calms you.  
This is all there is to scientific pursuits.  
What does it resemble, if not a melodious tune?"

Submission by:

Ahmed Hassan Abro (Tariq Lab,  
Department of Biology, SBASSE  
LUMS)



# Introducing first ever sustainable shoe - A “Good Shoe” for You and the Planet

Hush Puppies is renowned for its casual footwear catering to men, women and children. Their focus has always been about making a positive difference and inspiring their customers to “help shape a brighter world.” Today, that means a world where the pressing matter of climate change is addressed. According to German watch, Pakistan ranks 5th in the list of countries most vulnerable to the adverse impacts of climate change. Hush Puppies wants to help bolster our government’s efforts to mitigate this change through Vision 2025.

In line with this belief, they have introduced the first ever “Good Shoe” in their range – an eco-friendly, stylish shoe that doesn’t compromise on comfort. “The Good Shoe” uses bounce technology in the sole which helps one stay comfortable with sustained cushioning even up to 250,000 steps.

The shoe is made from algae harvested from water bodies where it is causing harm, and has 100% recycled uppers made from ocean landfills plastic (from approximately 500,000 plastic bottles) helping improve the environment by giving a second life to those plastics and reducing trash in our landfills.

All round, it is their most sustainable shoe. Their mission is to innovate their core Body Shoe category (which is also made from Bounce footbed technology, with bio-Dewix and bio-Derix, the antimicrobial inner and upper being made of these natural and sustainable dry fabrics which are good for moisture management, among many other benefits) and provide the wearer with unmatched comfort. And that isn’t all: Hush Puppies is planning to plant a tree for every Good Shoe sold, meaning each pair is a direct step towards climate resilience.

In order to get more people to play their part in creating a greener and cleaner future through small steps, the brand has also taken to social media with their initiative, creating the viral #smallstepchallenge. The company is firm in their belief that each positive action towards protecting the environment, no matter how small, is significant in the fight against climate change.

Hush Puppies has always been conscious of environmentally-positive measures. Another project undertaken as part of this environment protection initiative is the deployment of a large-scale solar power unit producing 50kW of clean electricity at their factory. This unit will significantly reduce the company’s carbon footprint. This switch towards using renewable and sustainable energy resources is a huge win for environmental health.

In addition to this, Hush Puppies is one of the only companies to have integrated D365 as their Point of Sale system online. This avoids production of paper waste through printing invoices, the company actively educates customers about the importance of SMS or Email based invoices to eliminate the need for paper entirely.

Mohammad Qasim, Managing Director of the company, is focused on leading the change: at Hush Puppies, we try to take every step we can to ensure a sustainable future. From our products all the way down to the hand sanitizers we use, we try to emphasize on eco-friendliness.

Hush puppies has clearly renewed their focus on sustainability and is making exhaustive efforts to ensure they not only reduce their carbon footprint with their green investments and sustainable products, but also encourage others to play their part in improving the environment. Their socially responsible and future-focused approach is inspiring and other companies should follow their lead in taking action in every capacity to combat the pressing matter of climate change.

# Hush Puppies® The Good Shoe



Introducing Hush Puppies  
Good Shoe range made from  
500,000 recycled water bottles.  
OUR MOST SUSTAINABLE BODY SHOE EVER



Earth-Friendly



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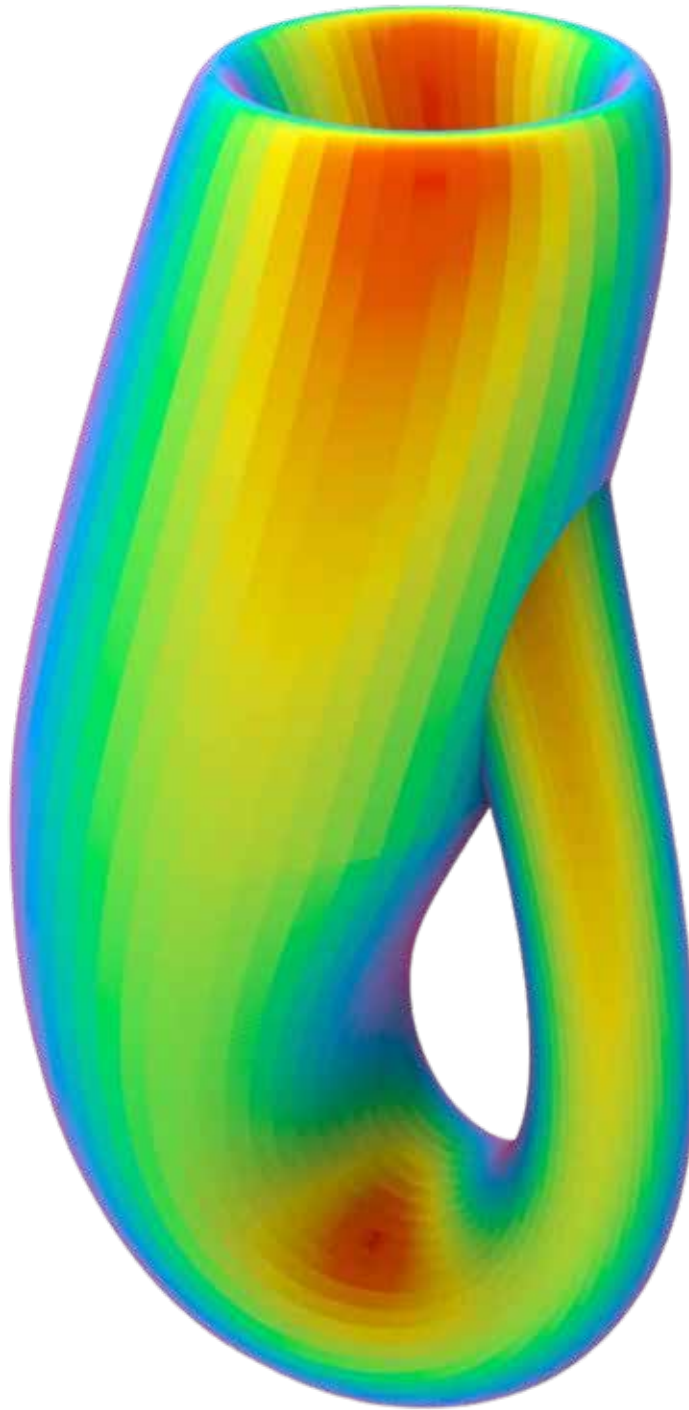
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In topology, a branch of mathematics, the **Klein bottle** is an example of a non-orientable surface. It is a one-sided surface which, if traveled upon, could be followed back to the point of origin while flipping the traveller upside down.

