

PC MAGAZINE

By The South African Institute Of Physics



EXCLUSIVE

THE BLACK HOLE SYMPHONY:

WHERE MUSIC AND CREATIVITY COLLIDE TO TELL THE EPIC STORY OF OUR UNIVERSE

PROF. TJAART KRÜGER

UNPACKS THE PHYSICS AND BIOLOGY OF DRINKING ALCOHOL THIS FESTIVE SEASON

SAIP'S ECD PROGRAM:

LAYING THE FOUNDATION FOR FUTURE SCIENTISTS

A PSYCHOLOGIST'S GUIDE:

THE IMPORTANCE OF RESTING

DECEMBER 2025

Dr. Luca Pontiggia



Theoretical Physicist, Mr Supranational Africa & Co-founder of Universe On Stage

Editor's Note

December is both a culmination and an invitation—to pause, to reflect, and to consider how knowledge shapes the way we live.

This final edition of PC Magazine for the year brings together science, society, and the human experience in ways that feel especially relevant as South Africans enter the festive season. Our cover story features Dr. Luca Pontiggia, a theoretical physicist whose groundbreaking theatrical production, *Universe on Stage*, reimagines how complex scientific ideas can be experienced. By placing physics in the realm of performance, Luca challenges us to engage with science not only intellectually, but emotionally.

In this edition, we also explore the physics behind alcohol consumption, with insights from a biophysicist unpacking what truly happens in the body—an essential conversation as social gatherings increase during this time of year. Complementing this is a thoughtful contribution from a clinical psychologist on the importance of rest, examining what rest does for the brain and why it is not a luxury, but a biological necessity.

Beyond individual well-being, this issue reflects science in service of society. We highlight the SAIP SACE-accredited Early Childhood Development programme, reinforcing the importance of nurturing scientific curiosity from the earliest stages of learning. We also take readers inside SAIP's participation in the G20, where science, policy, and global collaboration intersect to help shape the future.

And this is just the beginning. This December edition is filled with voices and stories that remind us that science is not confined to laboratories or journals—it is woven into our bodies, our classrooms, our policies, and our everyday choices.

We also invite you to extend your reading experience by watching exclusive interviews and in-depth conversations related to many of the articles in this issue on our YouTube channel, hosted by the South African Institute of Physics.

Thank you for being part of our journey. We look forward to continuing the conversation in the new year.

— EDITOR-IN-CHIEF

A handwritten signature in black ink that reads "Dr. Edwin Mapasha". The signature is written in a cursive, flowing style.

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THE PHYSICS BEHIND CONSUMING ALCOHOL

If you asked most South Africans what defines the festive season, “*good food and good drinks*” would make the list almost instantly. But behind every glass of wine, cider, or spirit is a world of physics quietly shaping how alcohol moves through the body—and how it ultimately makes you feel. Biophysicist Prof. Tjaart Krüger from the University of Pretoria gives us profound insights into how *physics*, *biology*, and *alcohol* intersect. Many of these deeper explanations are intentionally left out of this article—because they deserve to be heard directly from him. You can watch his full interview on the South African Institute of Physics (SAIP) YouTube channel titled *Physics & Life: Alcohol*, where he breaks down concepts in a way that is both fascinating and accessible. You most definitely want to watch that.

Why Alcohol Moves Through the Body So Quickly

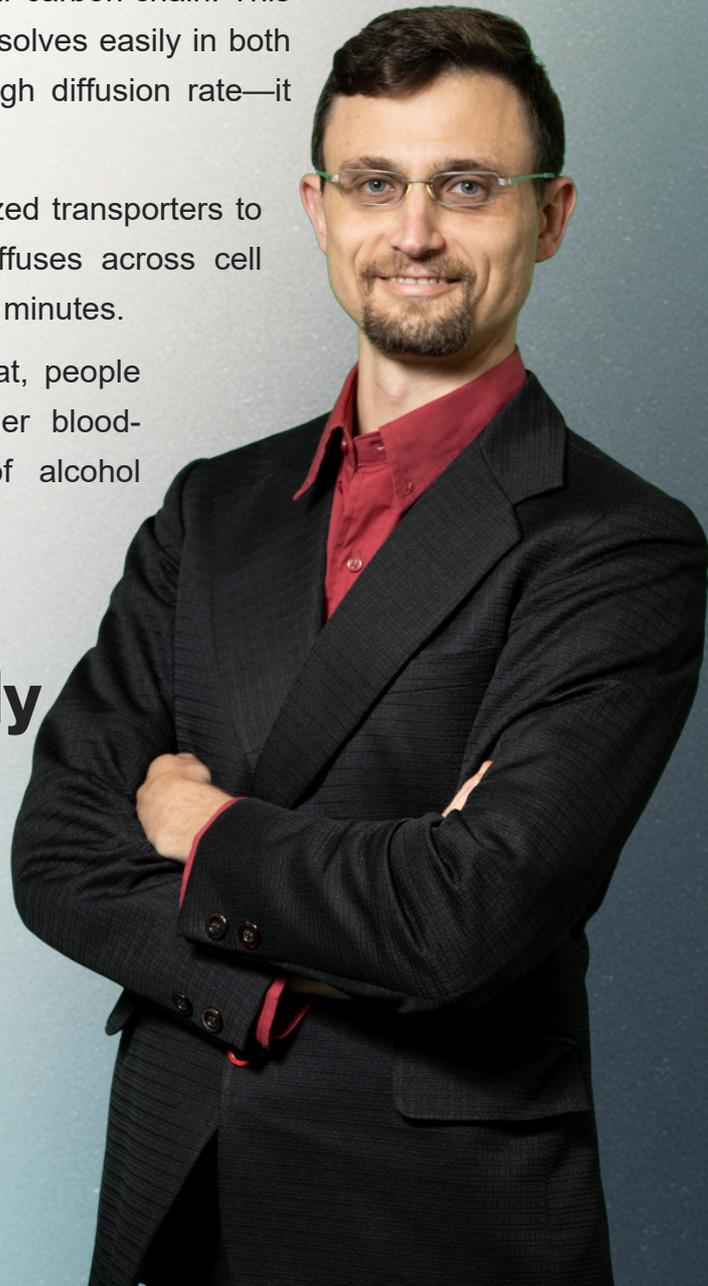
The type of alcohol we’re dealing with here is ethanol, a small organic molecule with a polar $-OH$ group and a short non-polar carbon chain. This dual nature makes ethanol amphiphilic, meaning it dissolves easily in both water and lipids. In physics terms, this gives it a high diffusion rate—it spreads rapidly wherever water is present.

Unlike most molecules, ethanol doesn't need specialized transporters to pass through the stomach or intestine. It simply diffuses across cell membranes, entering the bloodstream and brain within minutes.

Because ethanol distributes primarily in water, not fat, people with higher body-fat percentages often reach higher blood-alcohol concentrations from the same amount of alcohol compared with individuals who have more body water.

Why Alcohol Makes You Feel Warm—But Actually Cools You Down

Ethanol creates a warm sensation by dilating blood vessels near the skin’s surface. These vessels relax because ethanol disrupts the lipid membranes of their smooth muscle cells. As warm blood flows to the skin, you feel a pleasant heat.



Science meets theatre

COVER STORY: DR. LUCA PONTIGGIA

When the worlds of theoretical physics and pageantry collide, few can command both with the same poise and brilliance as Dr. Luca Pontiggia. With a PhD in theoretical physics specializing in String Theory, Luca is not just studying the universe—he is redefining how it can be experienced by everyday South Africans.

But Luca is far more than a physicist. As the second runner-up for both Mr South Africa and Mr Supranational Africa, he is a rare blend of intellect, charisma, and showmanship. These achievements are not simply about accolades—they are a platform through which Luca conveys his deepest mission: making science fun, accessible, and unforgettable.



Vukosi Mashele had the opportunity to witness Luca live, and it's clear why he calls the experience "*more than a show—it's a transcendental experience.*" On stage, Luca's presence is magnetic. He takes audiences on a journey where physics, creativity, and performance intersect, challenging the stereotype that science is confined to classrooms or laboratories.

Universe on Stage is not a lecture. It is not a workshop. It is a theatrical science production—a bold artistic rendering of creation’s greatest mysteries. On stage, Luca paints a vivid narrative of the universe’s origins, guiding the audience through the profound enigma of the black hole and ultimately toward a poetic exploration of how everything came to be.

Through storytelling, physical presence, and carefully crafted pacing, Luca transforms complex scientific ideas into a visceral journey. The universe is no longer distant or abstract—it is embodied, narrated, and felt. Science becomes theatre, and theory becomes story.

The experience is elevated further by a live piano score performed by Yasheen Modi, co-founder of the production and an actuary by trade. The pairing is as improbable as it is inspired: a theoretical physicist and an actuary coming together to create a science production that feels both rigorous and deeply emotional. What are the odds? Yet on stage, the collaboration feels inevitable.

The piano does not merely accompany the performance—it converses with it. As Luca narrates the unfolding of cosmic mystery, the music breathes life into abstraction, giving emotion to equations and weight to ideas that typically live only on paper.

Luca has been clear about his intention. He wanted to advocate for science—but not in the traditional way. He wanted to make it creative, immersive, and human. And in Universe on Stage, he does exactly that.

This is science as storytelling. Science as theatre. Science as an experience that lingers long after the curtain falls.



Dr. Luca Pontiggia reminds us that science does not lose its integrity when it meets art. Instead, it gains resonance. On this stage, the universe is not simplified—it is felt.

And once you’ve seen it, you’ll never think of physics the same way again.

PC Magazine brings readers exclusive, in-depth, behind-the-scenes coverage of Universe on Stage, offering insight into the vision, and philosophy behind this extraordinary production. The full feature is available now on our YouTube channel: ***South African Institute of Physics***.

Recharge to Thrive

The Psychology of Rest and Recovery.

Written by Ndebele Tshepiso, Clinical Psychologist.

I recently came across a LinkedIn post that read: “Switch off those laptops, your company’s employee of the year award already has its winner.” It was amusing, yet deeply revealing of how modern society has come to glorify busyness. We live in a world where being constantly occupied is often worn as a badge of honour in the so-called “rat race.”

The “Rat Race” Dynamics

The “rat race” metaphor, popularised in Jay Franklin’s 1950 book, captures an exhausting, coercive, and highly competitive cycle of striving for status, financial security, and material gain. In this cycle, individuals remain perpetually busy, yet often feel purposeless and unfulfilled.

The rat race reflects the frantic—and frequently hollow—pursuit of success in modern life. It represents a materialistic and competitive societal structure focused on getting ahead in pressured urban work environments, often at the expense of fulfilment, leisure, meaningful connection, and rest. The outcome is a culture of high-achieving, high-producing, chronically fatigued, and burned-out individuals.

The Science of Rest vs Sleep



It is increasingly common to hear people express that rest feels almost impossible to find. Life’s demands continue to intensify, days feel shorter, and technology keeps us permanently accessible, making it difficult to truly switch off. Many people report feeling exhausted despite getting sufficient sleep.

This highlights a common misunderstanding: the assumption that sleep and rest are the same. From a psychological perspective, rest is a critical form of self-care that extends beyond sleep. It is not merely an abstract concept, but a fundamental component of our biopsychosocial functioning. While sleep restores the body, rest encompasses the many ways we mentally and emotionally unwind, regulate stress, and replenish our internal resources.

The Role of Rest in Cognitive Function

The brain requires downtime to form connections that fuel creativity and insight. Rest is essential for neuroplasticity, allowing the brain to process information, consolidate learning, and reorganise neural pathways for optimal functioning. When individuals remain in survival mode for extended periods, they become reactive rather than proactive. Productivity diminishes, emotional regulation weakens, and the sense of purpose fades. True productivity is not determined by the number of hours worked, but by the quality of output—and quality inevitably declines when we continue to operate from an empty cup.



Research consistently shows that compromised neurocognitive functioning significantly affects mental health. Persistently pushing through fatigue and burnout increases vulnerability to psychological distress and, in severe cases, mental health disorders such as depression, anxiety, somatisation, substance misuse, and addiction.

Recharge to Thrive

Incorporating intentional and effective rest is not indulgent—it is essential. It is a vital skill and a cornerstone of sustainable wellbeing. Rest requires recognising when our internal reserves are depleted and responding with compassion rather than guilt.

Professional success, financial stability, and career progression are not in opposition to rest. On the contrary, rest is an integral part of achieving and sustaining these goals. When we allow ourselves to recharge, we don't merely function—we thrive.

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SAIP Launches SACE-Endorsed ECD Science Programme

The South African Institute of Physics (SAIP) has unveiled a pioneering Science Skills Accelerator Programme for Early Childhood Development (ECD) educators, marking a transformative step toward strengthening South Africa's long-term science and technology pipeline. The programme is officially endorsed by the South African Council for Educators (SACE), enabling participants to earn Continuing Professional Development (CPD) points—a major boost for professional growth in the early learning sector.



South Africa continues to face deep-rooted challenges in maths and science performance, with shortages of qualified science teachers and persistent resource limitations across the basic education system. These challenges contribute to declining enrolment in key science subjects—evidenced in the Western Cape, where between 2014 and 2022, 26 schools phased out mathematics and 23 phased out physical sciences due to low learner uptake of these subjects^[1]. Such trends intensify the national shortage of science, engineering, and technology (SET) skills.

Worldwide research ² shows that by age seven, children have already formed lasting attitudes—positive or negative—towards science. However, in South African research by James et al. (2019) ³ highlights the extent of the challenge: ECD practitioners frequently avoid teaching science, despite its inclusion in the national curriculum. The study attributes this to a lack of science training, unclear curriculum guidance, and the prioritisation of Life Skills, Mathematics, and Home Language over science.



Using fun, hands-on, low-cost, and CAPS-aligned experiments, the programme trains practitioners to guide scientific curiosity, encourage observation and questioning, and integrate science with art, play, language, and problem-solving. Educators learn to teach foundational concepts in science, all designed to nurture children's natural curiosity and build early critical thinking skills.

The programme also strengthens collaboration and communication, encouraging children to conduct simple experiments together, discuss results, and express ideas through creative tasks such as recycled-material crafts and weather or astronomy-themed art. Most importantly, it helps practitioners develop confidence and a positive attitude toward science—qualities they then pass on to young learners.

Young women, who make up the majority of South Africa's ECD workforce, stand to benefit greatly. By equipping them with science teaching competencies, the programme also advances social empowerment and economic participation. The secondary beneficiaries—the youngest learners—gain early exposure that will shape their future interest in science and

Dr. Tshifhiwa Ranwaha Highlights South Africa's Just Energy Transition on G20 Broadcast

In a timely spotlight on the global shift toward sustainable energy, Dr. Tshifhiwa Ranwaha, a leading expert in green-energy systems, was featured on the G20 Broadcast to discuss South Africa's Just Energy Transition and the opportunities presented by the circular economy. The interviews, co-produced by Vukosi Mashele on behalf of the South African Institute of Physics (SAIP), aired on Thursday, 20 November, and continued on Friday, 21 November 2025 as part of SABC Plus News coverage.

Recognised as one of South Africa's foremost young voices in energy innovation, Dr. Ranwaha outlined the country's progress in renewable energy integration while addressing the key challenges slowing large-scale adoption. He explained that the intermittency of solar and wind power—particularly reduced output during cloudy or winter periods—combined with rising energy demand, means renewables are not yet able to fully sustain the national grid. Regulatory bottlenecks, he added, further limit impact by delaying independent power producers from feeding electricity into the grid.



Dr. Ranwaha highlighted advanced battery storage, green-hydrogen systems, carbon-capture technologies, and fusion research as critical to accelerating the transition. Carbon capture, he noted, is essential for accurately tracking emissions and achieving South Africa's target of halving carbon emissions by 2030, while battery and hydrogen storage provide grid stability by storing excess energy for later use.

He stressed that meaningful progress will require grid modernisation and simplified licensing processes to enable greater participation by independent producers, alongside large-scale storage infrastructure to safeguard energy security. International collaboration, particularly partnerships with countries such as France, was cited as vital for skills transfer, joint research, and technology development.



Dr. Ranwaha also addressed the growing role of artificial intelligence in energy systems, explaining that AI supports predictive maintenance, real-time optimisation, and improved grid resilience. Addressing job-loss concerns, he emphasised that AI complements human expertise and, with proper upskilling, enhances efficiency rather than replacing workers.

Concluding the broadcast, Dr. Ranwaha encouraged young scientists and engineers to develop skills in AI, digital technologies, and green-energy innovation, underscoring the critical role the next generation will play in shaping a sustainable and resilient energy future for South Africa and the continent.

“Beyond the Classroom: How a Physics Workshop Is Shaping South Africa’s Next Generation”

In September, the South African Institute of Physics (SAIP) hosted its Essential Skills for Physical Science matric workshop at iThemba LABS, bringing learners together for an intensive day of hands-on physics engagement. The session was led by Dr Derek Fish, a Physics Professor at the University of Zululand, whose long-standing commitment to physics education continues to shape classrooms and communities across South Africa. Known for his practical and accessible teaching methods, Dr Fish personally invited learners to attend, and his reputation was reflected in the enthusiasm and curiosity displayed throughout the day.

The Essential Skills initiative was born during the COVID-19 lockdowns, when many learners were excluded from online schooling. Concerned about the widening educational divide, Dr Fish began recording full matric-level physics lessons complete with experiments, demonstrations, and revision explanations. Determined to reach learners without reliable internet access, he distributed the materials through printed study guides, USB drives compatible with DVD decoders, and short WhatsApp-friendly videos. To date, more than 150,000 resources have been shared nationwide through philanthropic support, a contribution Dr Fish gratefully acknowledges.



Hosted at iThemba LABS—one of Africa’s leading research facilities—the workshop offered many learners their first experience inside a major scientific institution. Throughout the day, they worked in groups, tackled exam-level questions, and conducted improvised experiments using everyday materials. Engagement was high, with learners asking probing questions, debating solutions, and sharing discoveries. Dr Fish repeatedly reminded participants that “the physics of today is the technology of tomorrow,” highlighting the subject’s critical role in driving innovation and shaping the future.

Midway through the programme, Dr Fish addressed learners on the topic of motivation. He explained that early drive is often fueled by fear, such as disappointing parents, while later motivation can come from external rewards. Lasting motivation, he emphasised, comes from autonomy, mastery, and purpose: being trusted, loving one’s craft, and understanding why one does what one does. His words resonated deeply, drawing thoughtful silence and reflection, and underscoring that the programme’s impact extends far beyond physics content.

The workshop also demonstrated that shaping South Africa’s scientific future requires more than formal schooling. It calls for individuals willing to step forward through mentorship, volunteerism, and sharing knowledge. Attendees left iThemba LABS inspired, carrying a renewed sense of possibility and the clear message that ordinary citizens can be catalysts for change beyond their workplace roles. As matric learners enter the final stretch of their exams, initiatives like this continue to show what can be achieved when communities choose to invest in the next generation.

