KMVPHY-SPECTRUM

WE LEAD OTHERS FOLLOW

A PHYSICS NEWS LINE

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You need virtual reality to understand high level science or high level math. It's very helpful to explain third and fourth dimensional things that people are constantly addressing in quantum physics. But, as soon as you're creating an avatar, and you can live and you can start to feel sensations on VR, that has gone too far.

Jaden Smith

Visionary Physicist

WOMAN IN SCIENCE AWARD WINNER: NANDINI HARINATH

Nandini and her colleagues came into the limelight only recently when a picture of them celebrating the success of the Mars mission was released, breaking away from the perception that "Women cannot succeed as scientists" and popularizing the moniker #ScientistsInSarees, albeit for a brief time. A rocket scientist at the Indian Space Research Organisation (ISRO) Satellite Centre in Bengaluru, Nandini has worked on 14 missions in her 20 years of work. She was the deputy operations director for the Mangalyaan mission. From a very Young age, Nandini Harinath started developing an interest in space research and science and says that her first exposure to science was the popular cult television series Star Trek. This made Nandini go for space research. ISRO was the first job which Nandini applied and it is now 20 years of experience in ISRO. Currently, She is planning and executing science payloads operations in the Martian orbit.

Nandini is also working for NASA-ISRO joint satellite named as NISAR. NISAR is planned to be launched by ISRO in 2020. She won the "India Today Woman in Science Award" in the year 2015. Nandini is married to Harinath Sharma and the couple is blessed with two daughters.

On the worldwide acclaim of Mangalyaan, Nandini Harinath says "It was a good thing that ISRO went public. It brought us to a new level and the entire world appreciated us and recognized our expertise." Globally this meant a newfound respect for India as a leader in space travel. In India, this meant we all got to be involved with one of the greatest achievements of our country. In fact, Nandhini recounts, "My daughter was changing her WhatsApp dp based on what was happening. I even heard schools were watching the session." On ISRO, Nandini notes that although there are significantly more men than women, she is proud to work at an organization that shows no gender discrimination. This can be seen in the numerous women scientists involved with the Mangalyaan mission. She says she never feels any different as a women in the field because she is treated equally. Nandini expresses, "I would like to be known as a scientist, not a woman scientist." Harinath says she takes "immense pride" in Mangalyaan and was "really thrilled" to see its photograph on the new `2,000 notes. But it was not an easy assignment and working days were long. In the beginning, the scientists worked about 10 hours a day, but as the launch date came closer, it went up to 12 to 14 bruising hours of work. At the time of the actual launch, they barely left office. The ISRO scientist is candid enough to admit that women have to put in "twice the effort to stand on a same platform as men."

Nandini who is now an epic inspiration to many girls said that "All of you should have a dream. But make sure you have a passion to drive that dream. It's not going to be easy. You won't always get success wherever you go. You have to be persistent. It may sound cliche, but that's all it is."

PRESTIGIOUS EINSTEIN PRIZE WINNER: ABHAY ASHTEKAR

Abhay Vasant Ashtekar (born 5 July 1949) , an Indian scientist who has dedicated the last four decades to study gravitational science, will soon be awarded the prestigious Einstein prize, which was established by the American Physical Society (APS) in 1999. The award carries a prize of $10,000 and will be conferred upon Ashtekar for numerous and seminal contributions to general relativity, including the theory of black holes, canonical quantum gravity, and quantum cosmology. Ashtekar is professor of physics, Evan Pugh Professor, Holder, Eberly Chair, and director of the Institute for Gravitation and the Cosmos at the Pennsylvania State University.

"The prize is special because is it the highest honour bestowed by APS in the broad area of gravitational science. The first Einstein prize was awarded jointly to Peter Bergmann and John Wheeler, who introduced general relativity to American universities by creating research groups. Perhaps because the first award often sets the tone, subsequent prizes have come to recognise 'lifetime achievements'. So the news was deeply satisfying," Ashtekar told IANS in an email interview.

In 1974, Abhay received his PhD from the University of Chicago. Since then, he has served as a prominent member in various universities in France, Canada, and India. His biography on the National Academy of Science, of which he was elected member in 2016 describes him as, "A theoretical physicist specialising in general relativity, cosmology, and quantum gravity. He is best known for initiating the Loop Quantum Gravity programme by introducing new variables to simplify Einstein's equations, for analysing the very early universe using Loop Quantum Cosmology, and for his contributions to the study of the asymptotic structure of space-time and gravitational waves in full non-linear general relativity". As the creator of Ashtekar variables, he is one of the founders of loop quantum gravity and its subfield loop quantum cosmology. He has also written a number of descriptions of loop quantum gravity that are accessible to non-physicists.

His passion for physical sciences started while he was in high school in India. He was exposed to Hindi and English literature in the age of 11 only before that he was known to the Marathi Language only. During this time he learned Newton's laws and universality of gravity — what makes the apple fall on earth also makes the planets go around the sun and the concept was stunning by itself to him. What he found most remarkable was that, unlike art and literature which are "so tied to human conditions", Newton's laws transcend both. "It was striking to me that the same Newton's laws are taught and admired in India as in China, Japan and the West."Later, in college, fundamental physics seemed to me to be the deepest and purest way to pursue understanding of nature. In graduate school, I chose to work in general relativity, cosmology and quantum physics because that is where the most fundamental questions about space, time and the nature of the physical universe are discussed," he said. Ashtekar explored Fundamental Physics during his university days. He termed it to be the purest and deepest way to understand the nature (the external world). For his graduation, he chose to study General Relativity, Cosmology and Quantum Physics.

He is pleased by the 'LIGO-India' project that is now placing India firmly in the front ranks of international efforts. He further adds that the Inter-University Centre for Astronomy and Astrophysics in Pune, in particular, would play an important role in major discoveries that will be made with the international network of gravitational wave observatories between 5 and 10 years from now.

Science News Section

Harnessing nuclear fusion is a step closer

Scientists from Swansea University, Culham Centre for Fusion Energy, ITER in France, and the Max-Planck Institute of Plasma Physics in Germany paired x-ray and neutron imaging to test the robustness of parts.

The sun is a shining example of fusion in action. In the extremes of pressure and temperature at the centre of the sun atoms travel fast enough to fuse together, releasing vast amounts of energy. For decades, scientists have been looking at how to harness this safe, carbon-free and virtually limitless source of energy. One of the main approaches to fusion, magnetic confinement, requires reactors which have some of the greatest temperature gradients on earth, and potentially in the universe: plasmas reaching highs of 150 million °C and the cryopump, which is only metres away, as low as -269 °C. The research team focused on one critical component, called a monoblock, which is a pipe carrying coolant. This was the first time the new tungsten monoblock design has been imaged by computerised tomography. They used ISIS Neutron and Muon Source's neutron imaging instrument, IMAT.

Dr Triestino Minniti of the Science and Technology Facilities Council said: "Each technique had its own benefits and drawbacks. The advantage of neutron imaging over x-ray imaging is that neutrons are significantly more penetrating through tungsten.

NASA InSight lander 'hears' Martian winds

NASA's Interior Exploration using Seismic Investigations, Geodesy and Heat Transport InSight lander, which touched down on Mars just 10 days ago, has provided the first ever "sounds" of Martian winds on the Red Planet. InSight sensors captured a haunting low rumble caused by vibrations from the wind, estimated to be blowing between 10 to 15 mph (5 to 7 meters a second) on Dec. 1, from northwest to southeast. The winds were consistent with the direction of dust devil streaks in the landing area, which were observed from orbit. Two very sensitive sensors on the spacecraft detected these wind vibrations: an air pressure sensor inside the lander and a seismometer sitting on the lander's deck, awaiting deployment by InSight's robotic arm. The two instruments recorded the wind noise in different ways. The air pressure sensor, part of the Auxiliary Payload Sensor Subsystem (APSS), which will collect meteorological data, recorded these air vibrations directly. The seismometer recorded lander vibrations caused by the wind moving over the spacecraft's solar panels, which are each 7 feet (2.2 meters) in diameter and stick out from the sides of the lander like a giant pair of ears.

Write with heat, cool and then repeat with rewritable paper

Scientists have developed an easy-to-make 'rewritable' paper that can be drawn or printed on over and over again. The messages can last more than half a year, compared to other rewritable papers whose messages fade after a few days or a few months. The new material consisted of three layers in a sandwich-like structure. The researchers painted one side of a piece of paper with a blue dye that becomes colorless upon heating, just like the t-shirts popular in the 1990s that changed color when they were touched with a warm hand. Then, the other side of the paper was coated with a black toner layer that produces heat upon excitation with light. Using a "pen" that applies heat, a thermal printer or a source of near-infrared light, the team created images and words that remained legible for more than six months.

Physics Puzzles

Balloon in a car: There is a car with a flat roof, on a plain level road. There is a helium balloon in the car, barely scraping the roof – any slight force will move it. You start the car and accelerate forward very fast. Does the balloon move with respect to the car? If so, how ? (No any trick and no any air from window)

Soap Box Derby. A kid is building an unpowered downhill racing car. He has the brilliant idea of using, instead of four wheels, only three wheels, to reduce the friction on the car. Will this modification increase the car's performance in a downhill race? Why?

Physicists finally calculated where the proton's mass comes from

A proton's mass is more than just the sum of its parts. And now scientists know just what accounts for the subatomic particle's heft. Protons are made up of even smaller particles called quarks, so you might expect that simply adding up the quarks' masses should give you the proton's mass. However, that sum is much too small to explain the proton's bulk. And new, detailed calculations show that only 9 percent of the proton's heft comes from the mass of constituent quarks. The rest of the proton's mass comes from complicated effects occurring inside the particle. So, for protons, the Higgs explanation falls short. Instead, most of the proton's 938 million electron volts of mass is due to complexities of quantum chromodynamics, or QCD, the theory which accounts for the churning of particles within the proton. Making calculations with QCD is extremely difficult, so to study the proton's properties theoretically, scientists rely on a technique called lattice QCD, in which space and time are broken up into a grid, upon which the quarks reside. In addition to the 9 percent of the proton's mass that comes from quarks' heft, 32 percent comes from the energy of the quarks zipping around inside the proton, Liu and colleagues found. Other occupants of the proton, massless particles called gluons that help hold quarks together, contribute another 36 percent via their energy.

The remaining 23 percent arises due to quantum effects that occur when quarks and gluons interact in complicated ways within the proton. Those interactions cause QCD to flout a principle called scale invariance. In scale invariant theories, stretching or shrinking space and time makes no difference to the theories' results. Massive particles provide the theory with a scale, so when QCD defies scale invariance, protons also gain mass

Answers to previous issue questions and puzzles

Think Out of the Box

Because it always has lots of problems

Telephone

A clock

Science Crossword Puzzles

Across

1.Milkyway 4. Dwarf 6. Venus 9. Mars 10. Mercury 11. Seven 13. Lightyear 17. Telescope 19. Rotation 20. Asteroids

Down

2. Astronomer 3. Hypergiant 5. Constellation 7. Magnitude 8. Jupiter 12. Polaris 14. Galaxy 15. Revolution 16. Saturn 18. Comet

KMV ORGANIZED ANUBHOOTI- STUDENT–STUDENT MENTORING

P.G. Department of physics organized an innovative program "ANUBHOOTI" for all science students. Under this program undergraduate students were given a platform to present their concept based innovative experiments and projects that they have designed under DBT star college scheme. In this workshop senior students interacted with junior students and explained them about the basic concepts through basic Experiments. The students showcased their projects like hair dryer, charging of cell phone through banana, detection of sound by handmade speakers and many more. This program was initiative step towards value education.

KMV M.SC GIRLS ORGANIZED 'PHYSICS SPARK'

Final Year PG students of Department of Physics organized "Physics Spark". It was aimed at bringing elements of excitement, creativity and knowledge among the students. There were 5 sub events like crossword, group discussion, young minds quizophile, physics rapid fire and extempore. The program was started by extempore and its topic was "Science in Everyday Life", in which participants gave a short speech on this topic. It followed up by group discussion and its topic was "Science Boon or Bane". Each team put up a whole hearted effort and showed an amazing performance and a great spirit. Also there was a crossword competition in which there were some science related puzzles. Last event was Physics rapid fire, where the organizers asked the students back to back physics questions.

The results were concluded scientifically at the end of the program. The competition was aimed at developing the knowledge and excellence base among the students through healthy and motivating meet. Madam Principal appreciated the hosted and participated students on this event, that they had put great efforts and for learning team work through these events.

EXTENSION LECTURE ON DETECTION TECHNIQUES OF NUCLEAR RADIATION

Dr. KULWANT SINGH THIND, former Professor and head, Dept of physics, GNDU, Amritsar delivered an expertise talk on Detection Techniques of Nuclear Radiation to the students of M.SC Physics and B.Sc III and demonstrated the theoretical work in a practical way by using the apparatus placed in the institute. He also explained scintillation counter and its applications. At the end, he interacted with the students and cleared their queries about the core areas of Nuclear physics.

KMV ORGANIZED LEARNING OF PHYSICS BY INNOVATIVE ACTIVITIES

P.G. Department of physics, organized a "Learning of physics by innovative activities" for science students. Total 17 Teams were participated in this activity. Students were given a platform to present their concept based innovative experiments, demonstrations and projects that they have designed. The objective of the event was to develop the creative minds of the students so that they could implement the scientific ideas in day to day life. This activity include Homemade Projector, Cyclotron, Hydraulic Brakes, Newton Cradle and many more. This program was initiative step towards value education and created a lot interest among the students in understanding physics laws and principles through demonstrations.

KMV STUDENTS VISITED ELECTRICITY TRANSMISSION POWER STATION

Department of Physics of Kanya Maha Vidyalaya, Jalandhar organized an industrial visit to electricity transmission power station near Focal Point, Jalandhar for the students of B.Sc Non medical and Computer Science third semester. This visit provided an opportunity to students and teachers to have one on one interaction with Sn. Engineer Gurgaurav Singh and his staff members. Er. Gurgaurav Singh explained about basic fundamentals behind transformers.

EXTENSION LECTURE ON "BIO NANO SENSORS"

P.G Department of Physics organized an extension lecture on the topic "Bio Nano Sensors". The resource person was Dr. Sachin Tyagi, scientist from CSIO Mohali. In his lecture he interacted with the students of B.Sc and M.Sc Physics. He explained the synthesis of nonmaterial by top up and top down techniques. He also provided knowledge about sensors made from nanomaterials. Further, he discussed practical applications of the sensors in various fields like defense and stealth aircraft. He explained in very interesting way that how an explosive material likes TNT can be detected using gold-nano sensor and quantum dot sensors. In another application of nonmaterial he told about magnetic paints which can make the materials invisible to radar. Theses sensors and materials can have vast applications in defense and anti-terrorist drives.

REMEMBERING DR. KALAM ON HIS 87TH ANNIVERSARY

P.G Department of KMV, The Heritage Institution Jalandhar, commemorated the birth anniversary of "Missile Man of India" on **12th October, 2018** , where tribute was given to Dr. A.P.J Abdul Kalam by organizing various events. Students of M.Sc and B.Sc participated in this event. The event began with PowerPoint presentation on biography of Dr. Kalam. His simplicity, his dedication to his profession, his patriotism inspired the students. Then some of the best quotations that inspire the young minds were presented by the students. It was followed up by a book review event in which supreme books like "Ignited Minds", "Wings of Fire" were delineated. These books stimulated the students to have dreams and to follow those dreams. In the last event, some of the scientific contributions of Abdul Kalam sir were outlined. Further, various charts and slogans depicting Dr. Kalam's life and work were displayed. Principal Prof. (Dr.) Atima Sharma encouraged the Physics faculty for holding such events. She also motivated the students to upgrade their knowledge through these events and to follow such role models in their life.

THE FIRST DAY OF 5 DAYS INSPIRE CAMP WAS DEVOTED TO PHYSICS

Dr Neetu Chopra from Physics department of KMV demonstrated various hands on experiment on the First day of INSPIRE and discussed various types of waves and related the experiments. The students participated actively in the workshop.

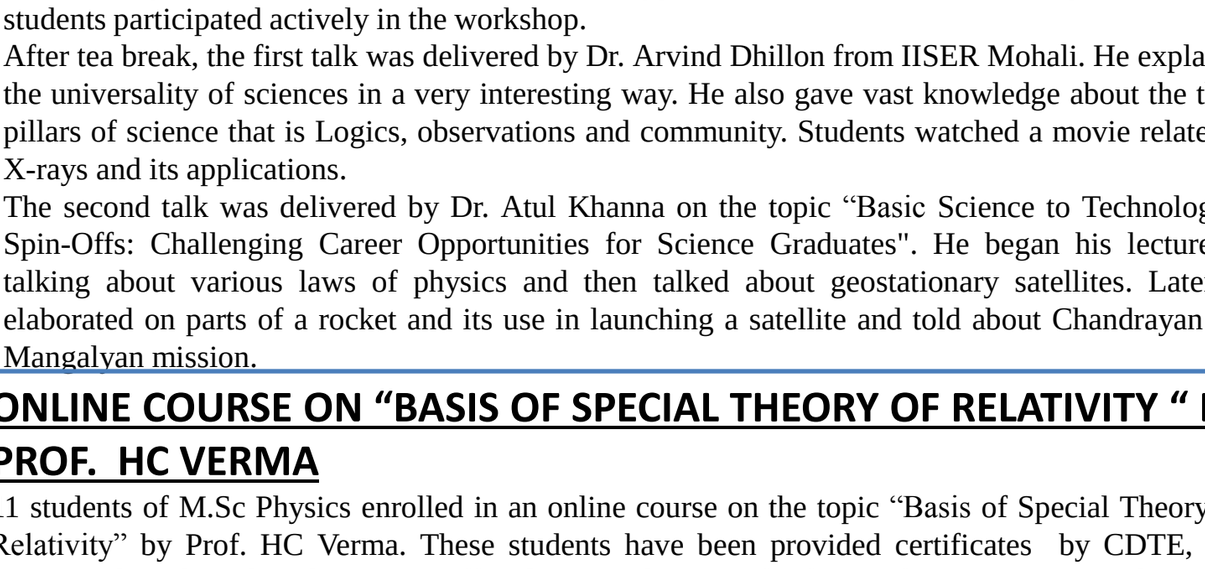
After tea break, the first talk was delivered by Dr. Arvind Dhillon from IISER Mohali. He explained the universality of sciences in a very interesting way. He also gave vast knowledge about the three pillars of science that is Logics, observations and community. Students watched a movie related to X-rays and its applications.

The second talk was delivered by Dr. Atul Khanna on the topic "Basic Science to Technological Spin-Offs: Challenging Career Opportunities for Science Graduates". He began his lecture by talking about various laws of physics and then talked about geostationary satellites. Later he elaborated on parts of a rocket and its use in launching a satellite and told about Chandrayan and Mangalyan mission.

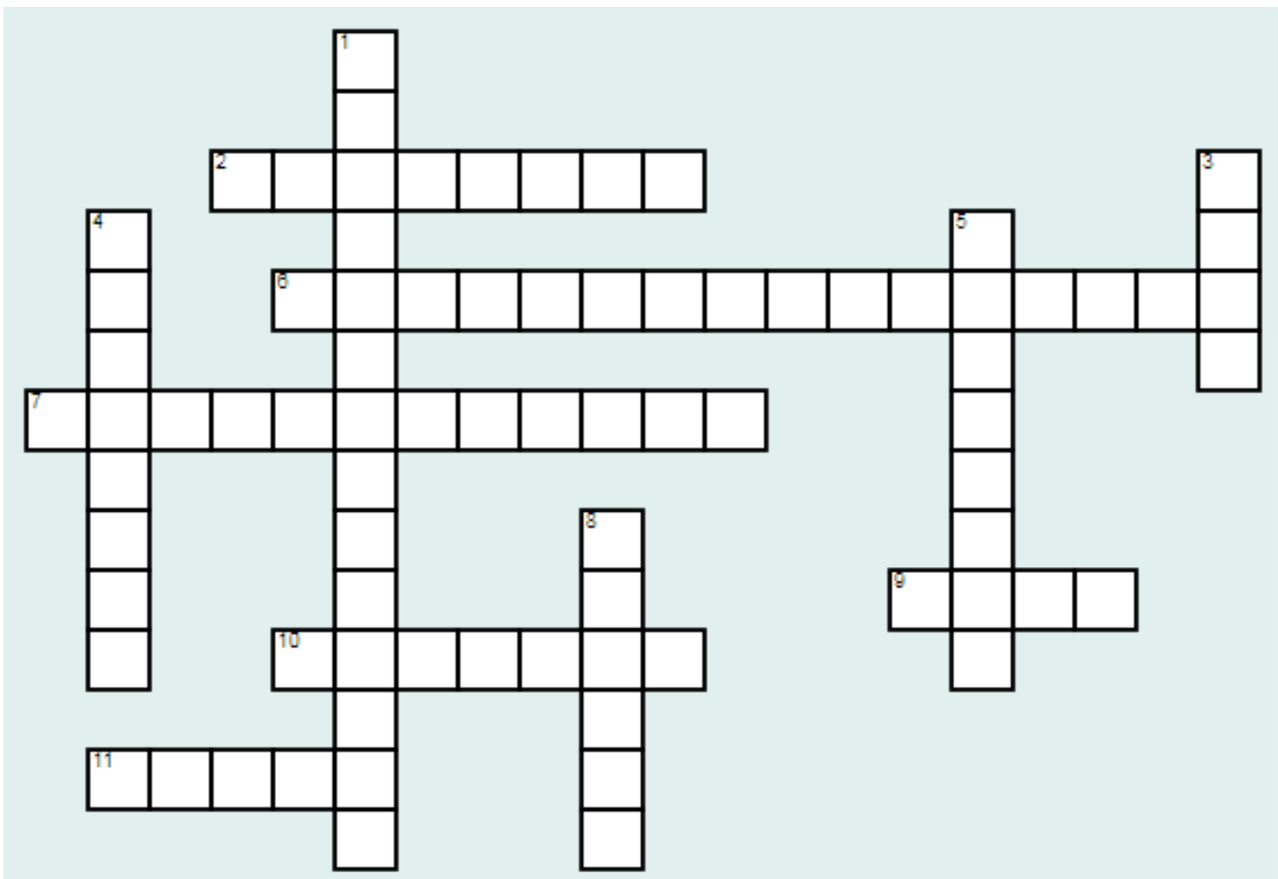
ONLINE COURSE ON "BASIS OF SPECIAL THEORY OF RELATIVITY " BY PROF. HC VERMA

11 students of M.Sc Physics enrolled in an online course on the topic "Basis of Special Theory of Relativity" by Prof. HC Verma. These students have been provided certificates by CDTE, IIT Kanpur. The selected students were offered to attend a camp for face to face interaction and given a chance for performing experiments. This course include the following topics:-

Inertial and non-inertial frame, Invariance of Newton's law under GT Newtonian relativity, Maxwell equation under GT, Michelson-Morley experiment, Postulates of specuial theory of relativity, Lorentz transformation, time dilation, length contraction, relativity of simultanity, sychronization of clocks, velocity transformation, relativistic mass, redefining linear momentum, expression for kinetic energy, relation between total energy and momentum



Science Crossword Puzzles



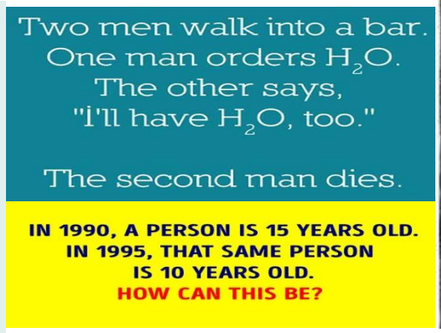
Across

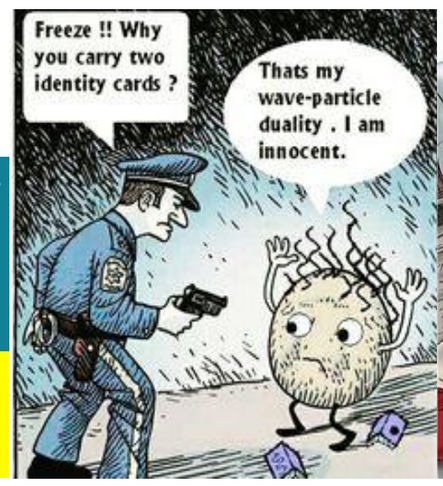
2 An objects speed in a particular direction
6 When one side has greater force than the other
7 Change in motion cause by unbalanced forces or a change in speed
9 To move toward
10 Two masses pull objects to the center of the Earth
11 Push or pull

Down

1 They have the same amount of force on eachother
3 A force to move someone or something
4 Slows down or stops movement
5 How hard it is to slow down or stop an object
8 Position changes

Fun Times with Physics





Story time

Down and Out

Although… what had Roov said about the excavations Above? Th ey were digging up there, too, but that was rock. And you couldn't melt through rock.

A milliflex later she was out of her web. Boro was already long gone, so she began cantering towards town. A new rain of bubbles had just fallen; pools of methane and carbon dioxide lay in the low valleys. She deflated her bladders and skidded across a small air pool, enjoying the smooth sensation on her feet. Soon she came to the largest air pocket in the city. This was the primary local factory, much larger than any of her personal air labs, but similar in concept. It had taken forever to dig the huge hole, let alone fill it up with carbon dioxide, but the goods produced here had already paid back its cost many times over. This factory specialized in plastics and steel, and trade with other cities brought in more exotic items.

With a long-practiced move she stepped onto the enormous bubble, inflated her bladders to maximum, and then *inverted* herself. It was a sensation that bothered many Rygors, but it felt perfectly natural to Ogby. Fully inflated, her bladders were so heavy they acted as anchors from which she could pull herself downward. Her ankles flexed 180˚, and then she was dangling upside down inside of the air pocket, barely touching the water with her five feet. The trick was mental reorientation: she told herself that she was actually standing right-side-up, her feet floating on the surface of the water. It was a ridiculous image, but it enabled her to avoid the unpleasantness experienced by many of the others.

It *was* unpleasant not being able to breathe, but Ogby was better than most at holding her breath. Only six or seven times each work period did she have to duck her head in the water tanks. And being in the air pocket allowed for other benefits. She began to refresh the stale air from her bladders, first from her central cavity, and then one foot at a time. It felt good. But she still had to find Boro. Walking along the surface of the water Ogby presently arrived at the smallest forge, where Boro spent much of his time. She climbed up the stairs, opened the hatch, and there he was, just closing the thermal shielding around the primary steel cauldron.

"I'm surprised to see you," Boro chromed.

Ogby skipped the small talk. "Those excavations Roov is doing above. He's not melting through, like we do. He's actually digging?"

Boro rippled a 'no'. "Blasting, I think. You know about those new compounds they're making, over in High City? I think he's using those, setting them off from a distance."

Ogby stood stunned for a moment. She had thought explosives were still in the research phase. Roov was already putting them to use? Science was progressing so fast these days that she couldn't even seem to keep up. "Well," she said at last, "why can't we use them, too? I'm sure it would speed up the dig. Maybe we could even blast down far enough to test my calculations."

"Do you have any idea how much those things cost?" Boro replied.

"I don't need many to start with. Let's buy a few, give it a try in Deep 4."

Boro looked concerned. "If you really want to blow the last of your research money.... Oh sure, why not. I'll pilot the ship again, if you'd like."

"I'm piloting," Ogby chromed with a literal fl ash of defiance. "You haven't piloted since we broke 800 lengths. You've just had a minor breakdown, and—" "I can handle it, Boro."

Boro stared at her for a long time before responding. "Okay. I think I believe you."

Ogby flashed a contented pattern, then turned to leave. A strange noise made her stop, though, and when she looked back around she saw that Boro was soning her through the air. She was surprised; soning in air was incredibly painful. If he had simply wanted to get her attention....

"I wanted to tell you," Boro chromed, "it's good to have you back."

Ogby felt a sudden wave of attraction for Boro, the first such wave in many flexes. Was it her season already? She checked her specialized fingers on her third foot, somehow already knowing what she would find. "What is it?" Boro asked.

Ogby wiggled her third foot at him enticingly. "I don't think we've ever done it in the air before."

He didn't look pleased. "Not now, Ogby."

Ogby was stunned. How could he resist…? But of course. There was no water to carry her scent. She walked over to him, reached for his third foot with her own, and made the transfer directly.

Boro put up no further resistance — not until he ran out of breath and desperately leaped into the emergency water tank. Ogby followed him right on in.

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Deep 4 was the largest excavation in the ocean, far from the nearest city. Here the ice naturally dipped to half a kilolength below standard ground and the entire valley would have been below air if not for constant maintenance. Currently most of the crew was cowering in the generator shelter, but Ogby wanted to be outside when the package landed. Boro stood next to her nervously, along with three of the braver technicians. The lip of the circular excavation was just a few lengths away.

"It should have reached the bottom by now," chromed a tech. "I don't—"

At that moment the blast hit. Even with the pads over Ogby's sonar receptors, even with the explosion over a kilolength below, it felt like a series of body-blows.

Boro shuddered after the waves had passed. "Next time I'll be in the shelter," he chromed unhappily. Ogby shook off the sensation and pushed Boro toward the edge. She was worried that the explosion would propel fragments of ice up in their direction. "Look down, see if there's any debris coming this way. I'm getting into the ship." Now that the blast had arrived, every microflex counted. It was cold in the deeps, and only artificial heaters kept anchor ice from filling in the hole. Ogby had to get down there quickly if she was going to wire up the new heaters.

She started to close the ship's hatch, making sure everyone was at their stations.

A final glance at Boro confirmed that no debris was going to endanger her. Thanking him, she shut herself inside and ran a cursory check of the equipment. Fuel, batteries… check. The common light was on, but she never trusted it blindly. She activated the microphone with her first foot. "TEST," she soned into the mike.

She looked out of the port window at the giant spool of cable, 2.3 kilolengths long, which connected her ship to the shelter. Fortunately the sound was converted to electrical signals, or else the communication would have been unbearably slow. After a moment the words "test received" sounded from the ship's speaker. The cable was operational. Now came the scary part; going over the edge. Ogby positioned herself in front of the controls and began adjusting the ship's buoyancy. After lifting off the ice, it only took a single thrust to position herself directly over the hole. It was a long way down, Ogby knew, but that was exactly where she had to go.

"DROPPING," she soned into the mike, while simultaneously shifting the plunger controls to negative buoyancy. In a moment she was plummeting into the cold, watery depths.

"FIRST HEATERS OKAY," she told base control as she passed the glowing devices. Aiming the ship's outer lights, she saw that the power cord was still firmly attached to the walls of the pit. Everything looked fine. She tipped the spotlight downward and continued her descent. The view out of the lower window was the first indication that something was wrong. The bottom of the pit was still beyond the power of the ship's lights, but instead of trailing away into darkness, the depths suddenly turned a foamy white. And the whiteness was rising, fast.

Uh oh, was all Ogby had time to think before the first jolt hit the ship. She was tossed to one side, and her head collided painfully with the cabin wall. After a moment the acceleration stopped, and Ogby quickly strapped herself into her seat. *What's happening* ? she asked herself. Debris from the explosion? No, any debris would have arrived with the original blast. It must be a second explosion, she decided, but how was that possible? Th ey had only dropped one package—

Another, stronger jolt shook the ship, but the straps held. Then another, and another, and Ogby began to worry about the ship coming apart at the welds. The view out the window offered little information. A dark froth of water and ice swirled past meaninglessly. "HELP," she soned, hoping the mike could pick up her voice from across the cabin. "EMERGENCY."

The buffeting continued, for ages, but just as she thought she could stand it no longer, cabin stopped shuddering. Now the window lit up with a brilliance she had never imagined possible. She narrowed her eyes, averted her head, but light was too strong, too painful.

And then, with a massive jerk, came the largest jolt of all. Ogby felt the straps cut into her body, and a tiny 'ping' sounded from the speaker just as gravity turned itself off. The light from the window was slightly more bearable now, but she barely noticed. Down here gravity wasn't infinite; it was zero! The bladders in her feet felt no force at all; it didn't matter whether she clenched them or not.

She didn't know how this was possible, but it was the discovery of a lifetime. She looked up toward the microphone…

…and her heart broke. The light was off. That 'ping' noise; it must have been the cable snapping. Communication was now impossible. Whatever was going to happen to her, whatever she encountered, she now had to face it alone. Movement through the window caught her eye and she stared through it, amazed. The scene was bright, but no longer too bright. There was no water. Instead she saw a beautiful icy landscape, covered with fractures and lines. The colors were remarkable; new minerals shouted to her with their unique spectra, arrayed in branching linear patterns. And the whole landscape was growing, filling the window with its details, coming closer and closer…

A sudden crunch of metal, a terrible pain, and all went black.

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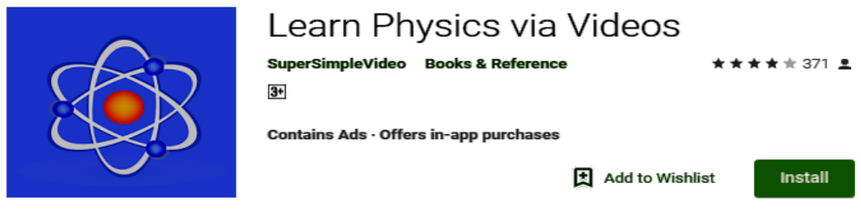
Continue…

Accidental Discoveries in Physics

We aren't actually talking about the discovery of the Big Bang theory itself, but rather of the cosmic microwave background (CMB), or the radiation that the Big Bang left behind. George Gamow predicted its existence in the 1940s but it wasn't until 1964 that two radio astronomers, Robert Wilson and Arno Penzias, discovered it completely by chance. Penzias and Wilson were working at Bell Labs in New Jersey and experimenting with a state-of-the-art horn antenna when they picked up some weird interference. At first, they thought this was due to something way less exciting than the CMB – pigeons. However, once they cleared the nest, they noticed that the interference remained. It could only be CMB. And thus the two astronomers discovered the first compelling evidence for the veracity of the Big Bang theory. At that time, the origins of the universe were in even hotter debate than today, with camps divided primarily by those who believed in an expanding universe (first put forward by Belgian priest/scientist Georges Lemaitre and later supported by Russian physicist George Gamow) or steady-state theory, the idea of a universe that always was and always will be. The discovery of the CMB tipped the scales in the Big Bang's favor.

App Center



This has been a fun and direct app for the subject. Many recent updates too so the developer keeps improving. I suggest it for those looking for a refresher or to finally learn what they didn't pay attention to in school. The app provides:

1. Snack sized tutorials.
2. Bite sized flashcards to memorize key concepts.
3. Simple and easy quizzes for self-assessment.