



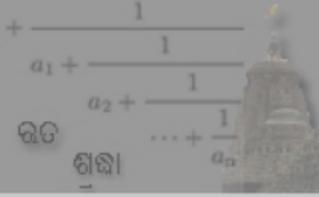
$$c_n = \frac{p_n}{q_n} = [a_0, a_1, \dots, a_n] = a_0 + \frac{1}{a_1 + \frac{1}{a_2 + \frac{1}{\dots + \frac{1}{a_n}}}}$$

ଅନେକ ସମ୍ପର୍କ ରଚନା ସବୁ ବିଶୁଦ୍ଧ ।
ଉଚ୍ଚ ଶିକ୍ଷା

Madhava-Ramanujan Ganita-Vijnanotsava

(MRGV-2019)

Rtapalli Vidyapitha
August 16-18, 2019



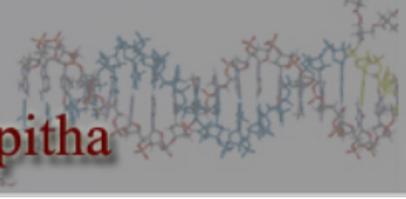
The question is:

How do we ignite young minds towards inquiry and discovery?

Can it be done by telling them exciting stories about the laws of nature and setting them on a lifelong journey in pursuit of beauty and truth - *Rtam*?

That is what we at Rtapalli set out to experiment in a celebration of science and mathematics in August 2019.

What followed was a three-day-long storytelling at Rtapalli Vidyapitha ...



$c_n = \frac{p_n}{q_n} = [a_0, a_1, \dots, a_n] = a_0 + \frac{1}{a_1 + \frac{1}{a_2 + \frac{1}{\dots + \frac{1}{a_n}}}}$

ଅନେକ ସଂଖ୍ୟା ଗୁଣନୋ ସବୁ ବିଶ୍ୱସ୍ୟ ।

ଉଚ୍ଚ ଶିକ୍ଷା

The story of **COLOURS**, atoms, molecules, and stars

ଉଦଜାନ ରୁ ଆଲୋକ

କ୍ୟାଲସିୟମ୍

ପାରଦ

ଅଣୁ-ପରମାଣୁ, ନକ୍ଷତ୍ର ଓ ଦୀପାବଳିରେ ରଙ୍ଗର କାହାଣୀ

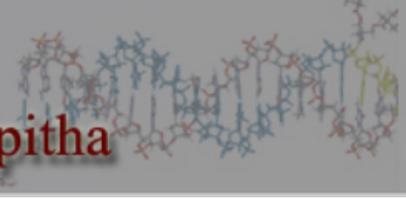
ଆମେ ଦେଖିବା କି ସୂର୍ଯ୍ୟ
ଆଲୋକରୁ କେମିତି ସବୁ
ରଙ୍ଗ ବାହାରେ

ତାରାର ରଙ୍ଗକୁ ଦେଖି ଆମେ
ତା' ବିଷୟରେ କଣ କଣ ଚିନ୍ତା
ପାରିବା

Numbers writing stories in nature



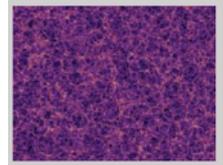
ଶଙ୍ଖ , ସୂର୍ଯ୍ୟମୁଖୀ ଫୁଲ , କଙ୍କି ପାରା ଭିତରେ ସଂଖ୍ୟା



The story of our sun, our galaxy, and our universe



ପୃଥିବୀରୁ ବାହାରି ସୂର୍ଯ୍ୟ ପାଖରେ ପହଞ୍ଚିବା, ସେଇଠୁ ଦେଖିବା ଆମ ଛାୟାପଥ ନକ୍ଷତ୍ର ପୁଞ୍ଜ (Milky-way Galaxy)



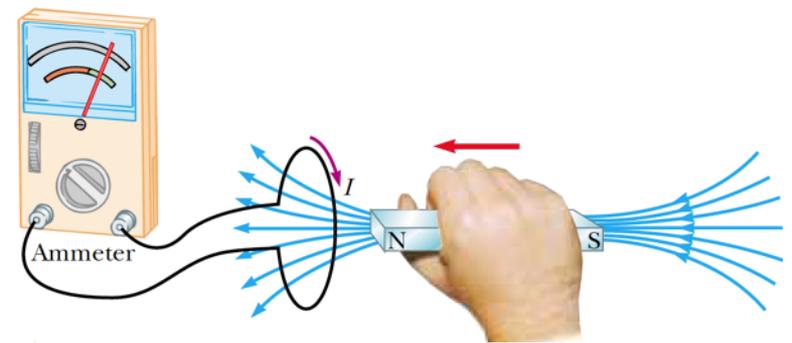
ଆମ ବିଶ୍ୱର ଇତିହାସ ବୁଝିବାକୁ ଚେଷ୍ଟା କରିବା

The story of gravity and the laws of motion



ମାଧ୍ୟାକର୍ଷଣ ଯୋଗୁଁ ଆମ ଯଦି ଗଛରୁ ଗଳି ପଡୁଛି ତା' ହେଲେ, ଜହ୍ନ ଆକାଶରୁ ଗଳି ପଡୁନି କାହିଁକି ?

The story of electricity and magnetism





The story of a robot and its control across continents



କମ୍ପ୍ୟୁଟର ମାଧ୍ୟମରେ ଗୋଟେ ଗାଡ଼ିକୁ କଣ୍ଟ୍ରୋଲ୍ କରିବା ଗୋଟେ ଯନ୍ତ୍ରମାନବ (Robot) ଗଢ଼ିବାର ଅଭିମାନ

The story of particles and waves



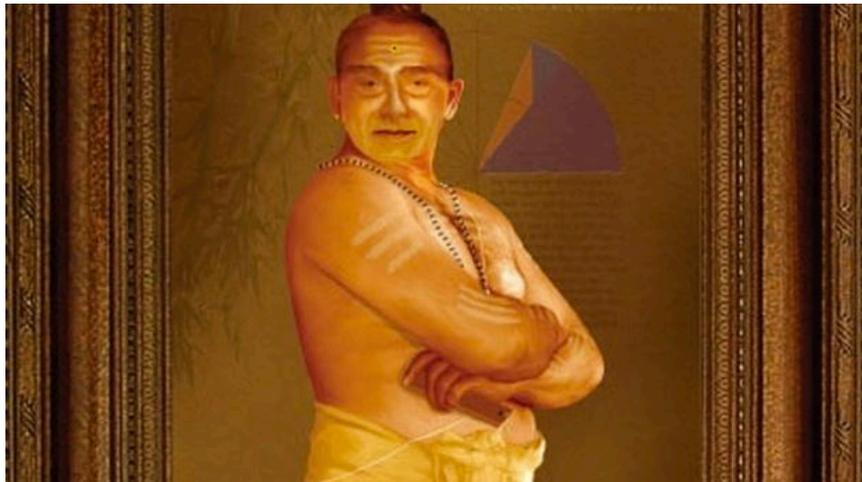
ପରମାଣୁ ଓ ଆଲୋକ; ତରଙ୍ଗ ନା କଣିକା ?



The stories were in the honour of:

Madhava of Sangamagrama:

The man who started the story of Calculus



An Artist's Rendition

<https://alchetron.com/Madhava-of-Sangamagrama>

<https://www.youtube.com/watch?v=z4oN6uoN1E4>

Srinivasa Ramanujan:

The man who told the story of Infinity



And

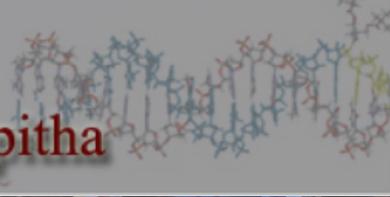
<https://www.youtube.com/watch?v=NP0IUqNAw3k>

<https://www.youtube.com/watch?v=h1XHwMgS06c>

ରତପଲ୍ଲୀ
ବିଦ୍ୟାପୀଠ



Rtapalli Vidyapitha



$$c_n = \frac{p_n}{q_n} = [a_0, a_1, \dots, a_n] = a_0 + \frac{1}{a_1 + \frac{1}{a_2 + \frac{1}{\dots + \frac{1}{a_n}}}}$$

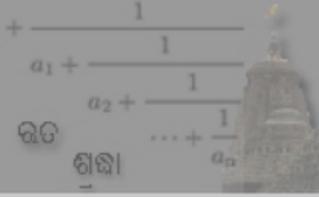
ଆମେ ଉପାସ କରୁନାମେ ଉତ୍ତୁ ବିଶ୍ୱାସ ।
ଉତ୍ତ ଶିକ୍ଷା



The inquisitive audience for the stories was selected through a mathematics test prepared by:

Bibudha Parasara, Ph.D. Student, Chemical Biology, Cornell University, Ithaca, USA, and
Dr. Rajesh Malla, Research Associate, Physics, Los Alamos National Laboratory, USA

The organizers, headed by Niranjana Mania (President, Rtasrota, the daughter organization of Rtapalli), conducted the test at nine centers in Odisha.

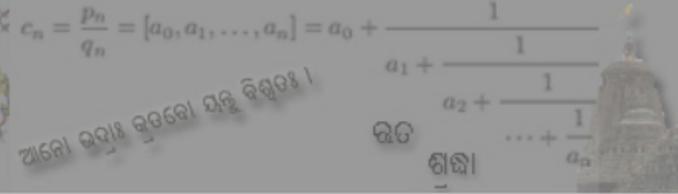
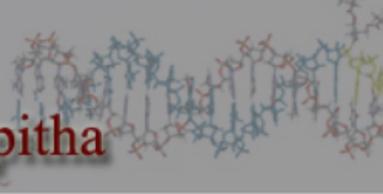


Rtasrota Team

	Batch	Name
1	1997	Suresh Singh
2	1998	Bhakta Ranjan Satpathy
3	1999	Niranjan Mania
4	2000	Ambuja Prusty
5	2004	Gokulananda Dash
6	2004	Sarthak Swasti Swarup Behera
7	2005	Chinmay Kumar Rout
8	2005	Sambit Kumar Rout
9	2005	Shashibhusan Pattanaik
10	2005	Soumya Ranjan Ray
11	2005	Sourav Purohit
12	2005	Swikruti Swabhimana Behera
13	2006	Pabitra Nayak
14	2007	Mukesh Kumar Dash
15	2007	Ripan Kumar Sahoo
16	2008	Arijit Rana
17	2008	Kamalesh Bhol
18	2008	Krushnakanta Sahoo
19	2008	Lalatendu Bidyadhar Sahoo
20	2009	Amrutamaya Behera
21	2009	Shreetam Mishra
22	2009	Pratyush Pattanaik
23	2010	Bismay Dash
24	2010	Surya Swaroop Dash

Center Coordinators

1	Basant Kumar Sahu	Rengali
2	Nirakar Das	Kendrapara
3	Bipin Kumar Nayak	Dhenkanal
4	Pratap Chandra Dash	Mayurbhanj
5	Rtashrees	Kendujhar
6	Shukadev Sahoo	Sambalpur
7	Chitta Ranjan Dash	Konark
8	Pratap Das	Kantabania
9	Kaberi Pahi	Jajpur Town



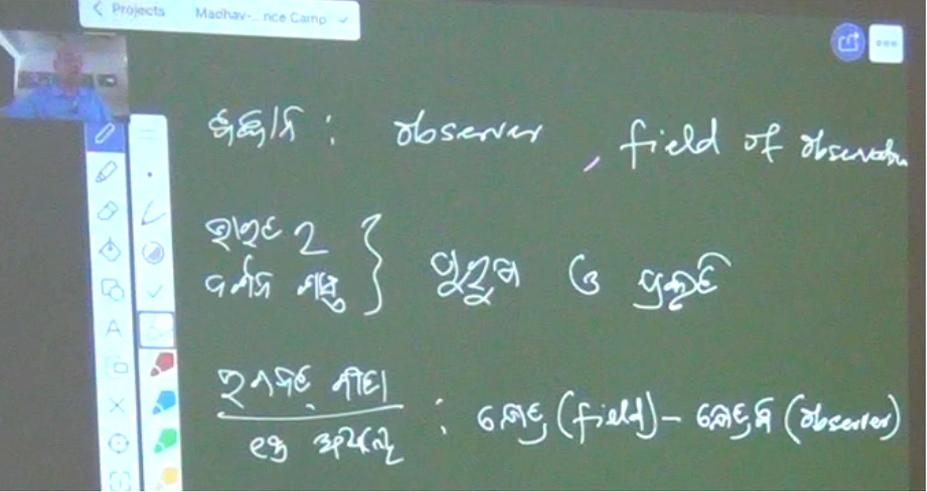
Storytellers

Stories

- 1 Dr. Atulya Yellepeddi, B. Tech., IITR, Ph.D. (Electrical), MIT & WHOI
Research Scientist, Analog Devices, Inc, Boston, USA
Signal processing and machine learning
A robot and its control across continents
- 2 Bibudha Parasara, M.Sc. (Chem), IISER-K,
Ph.D. Student (Chemical Bio), Cornell Univ. Ithaca, USA
Development of synthetic immunology approaches to understand and regulate inflammation
Chemistry in Biology: Cells, DNA, RNA
- 3 Dr. Bidyut B. Das, M.Sc., IITK, Ph.D. (Phys), City Univ. of New York
Ultrafast spectroscopy and imaging, and nano-photonics
Energy, Electricity and Magnetism
Light, Atomic Spectra, Waves & Particles
- 4 Prashant Samal, B.Sc., B.Ed., Chem., Headmaster, Rtapalli Vidyapitha
Colours and Chemistry, Binary Numbers
- 5 Dr. Rutuparna Das, BS (Phys), MIT, Ph.D. (Phys), Univ. of Michigan
Astrophysicist and Science Communicator, Harvard-Smithsonian Center for Astrophysics
Our Amazing Universe
Science Education and Research in the evolution of dark energy through observations of galaxy clusters
- 6 Sambit Rout, Rtashree-Class XII
Hemachandra (Fibonacci) Numbers and Golden Ratio
- 7 Sulekha Biswal, Rtashree-Class XII
Counting Atoms
- 8-14 Abhilipsa, Anubhab, Arup, Beda, Durga, Ranjit, and Subhashree
Various Demonstrations



Nature is the Highest Guru and Mathematics is its Language
Day1: August 16, 2019



Rtapalli believes that young minds can be exposed to important thought processes, such as the parallels between science and ancient Indian thoughts. For example:

Observer: One who observes, asks questions, and performs experiments and observes again

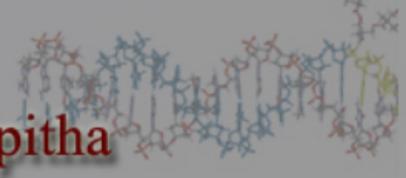
Field of observation: On what the experiment is done and observed

The children were encouraged to enjoy observing nature around them and asking questions. Observing and asking important questions leads to new discoveries, learning new aspects of truth with joy.

After this introduction, the children were shown a video, “ **The Scale of the Universe**”:

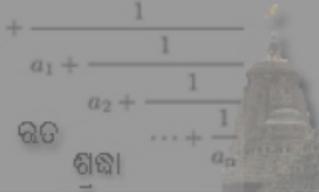
<https://www.youtube.com/watch?v=uaGEjrADGPA>

Following this was the first live demonstration of the camp.

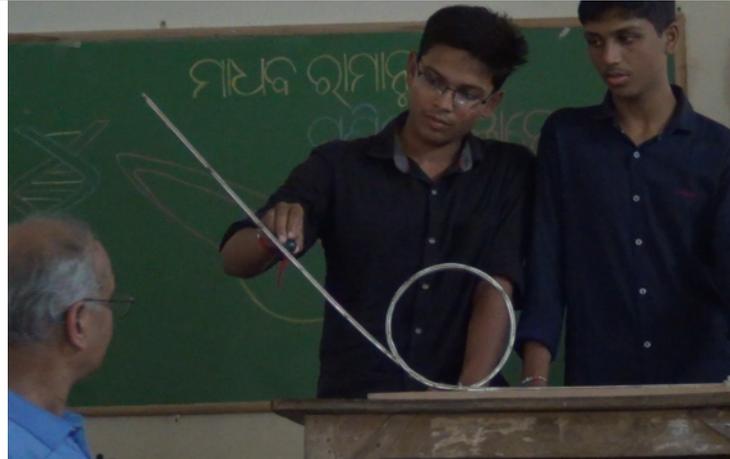
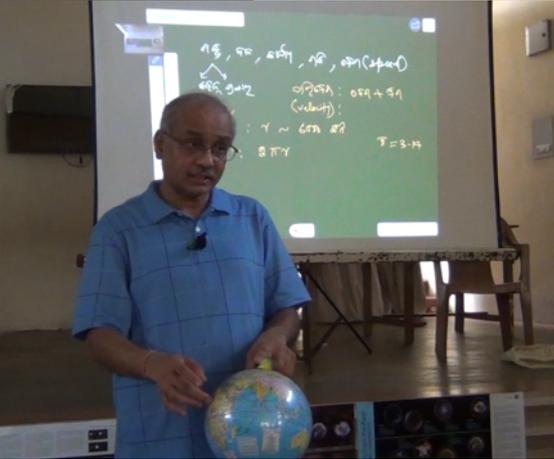


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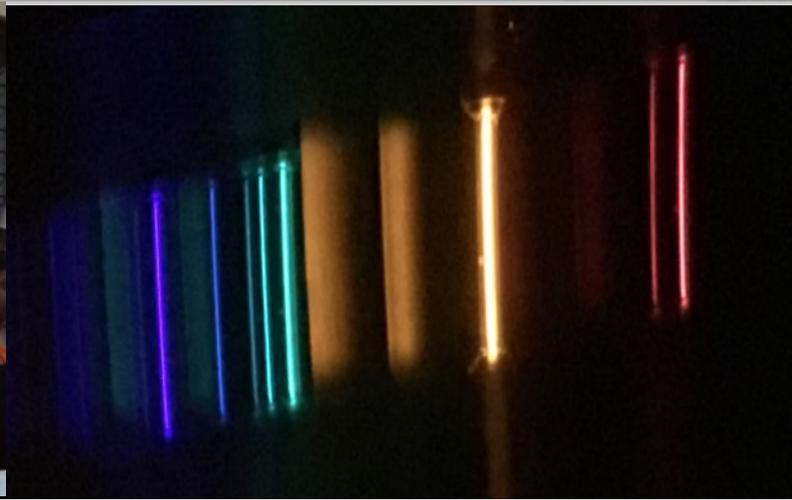
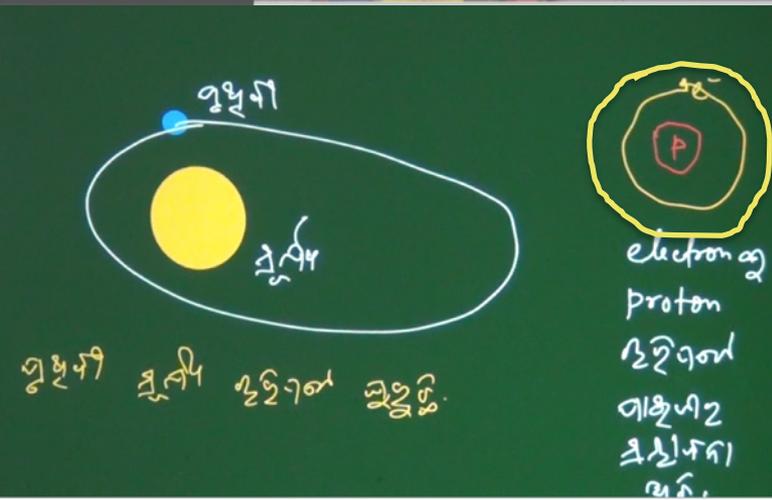
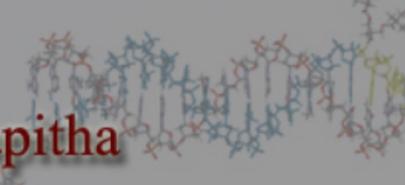
Students observed how the colour of light changed when different molecules were added to the fire: lithium chloride, sodium chloride and copper sulphate. Prashanta being helped by Durga and Anubhab. What joy of learning!



Newton's Laws of Motion:
Discussion and video demonstration on Inertia of Motion - a moving cart shooting a ball - led the students to understand how a bird returns to its nest in the evening even though the nest on earth has moved thousands of kilometers.

Circular Motion:
Class V students were able to understand and explain why the moon does not crash onto the earth while a mango from a tree does. They could also explain under what conditions the moon will crash into our earth. Anubhab and Durga demonstrated this point using a steel ball on a steel roller-coaster, built for the school by Banku.

Energy:
Children learnt the concepts of work and transfer of energy, from food to their body, and then on to a football or a book on a shelf. The fifth graders could explain that while a moving football can have any amount of energy (any number on a real number line), a book needs a packet (quantum) of energy to be raised from one shelf to another (like an integer on the number line).



Children observing atomic spectra of various molecules through hand-held diffraction gratings while being observed by Louis de Broglie from behind. What a coincidence!

The Orbital Motion of Earth Around Our Sun And The Orbital Motion of Electron Around the Nucleus:

The children learnt that while we know where the earth exactly is, we are not certain where the electron is. There is a probability of finding it somewhere in its orbit.

Children could explain that while the energy of our earth can have any value (real number), the electron needs a quantum (packet) of energy to go to a higher orbit.

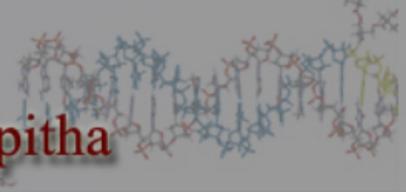
Particles, Waves and Atomic Spectra:

As the packets (quanta) of energy came out as light when electrons jumped to lower orbits, the question was: were they moving as packets of energy like particles in a sandstorm, or moving as waves like ripples in a pond?

Many observers (scientists) have asked this question.

Light can be observed like particles sometimes and waves at other times.

What mystery!



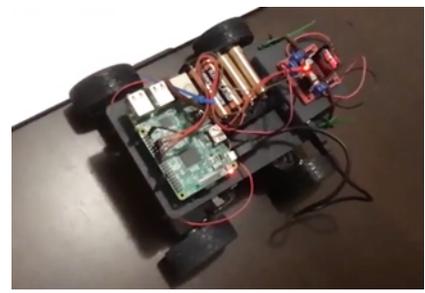
Robot Control with Python
Day 2: August 17, 2019



```
^[A(pybot) pi@rtapi:~/rtabotpy/src/rtabot $ nano instructions.py  
(pybot) pi@rtapi:~/rtabotpy/src/rtabot $ python rtabot.py  
robot.forward(0.75)  
  
continue_for(5.0)  
  
robot.backward(0.85)  
  
continue_for(5.0)
```



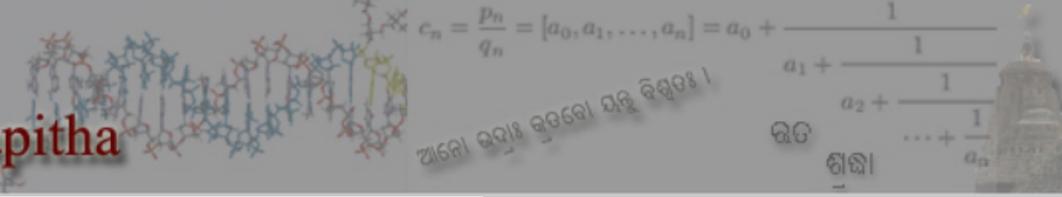
Pratyush, on right, modifies a python code in India, and controls the motion of the robot in the USA, which was originally programmed by Atulya.



This was one of the most enjoyable moments for the children.



A Glorious Journey Through The Universe
Day 2: August 17, 2019



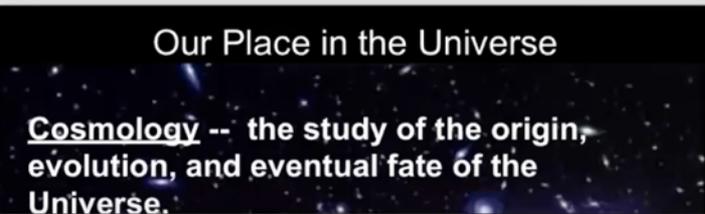
Our Amazing Universe



Stars, Galaxies, and the Universe:
Students were taken on a thrilling journey into the deep cosmos.

They observed our sun at various wavelengths.

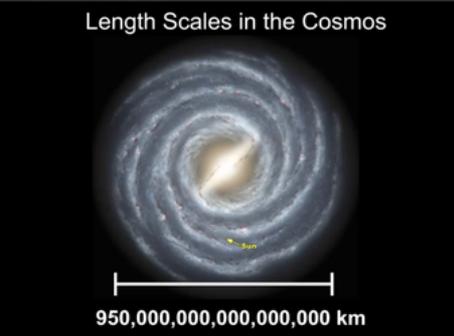
They learnt about the birth and the death of stars, and about how our sun is going to turn into a giant earth-sized diamond.



Our Place in the Universe

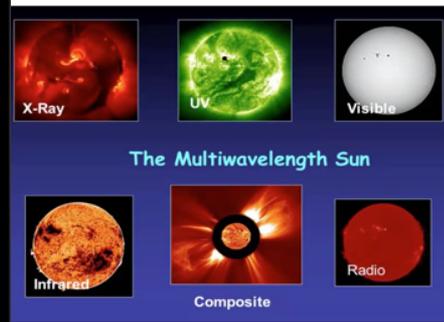
Cosmology -- the study of the origin, evolution, and eventual fate of the Universe.

They learnt how we are all made from stardust.



Length Scales in the Cosmos

950,000,000,000,000 km



The Multiwavelength Sun



ରତପଲ୍ଲୀ
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Rtapalli Vidyapitha



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**Rtashrees Entertaining the Little Guests
Day 2: August 17, 2019**



The tablists



The gurus

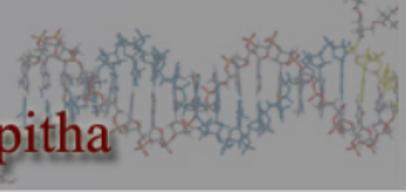


The flute team



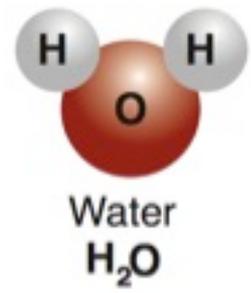
Odissi followed by folk dance

“Maili Chaadar Odhke Kaise”, “He Shibapati Parvatipati Trahi Mam Bhavasagaram”, “Bhajore Bhaiya Rama Govinda Hari”, “Madhurastakam”



Atoms and molecules are so tiny.
 Can you count them?
 “Sure,” says Sulekha, and effortlessly
 explains the concept of moles.

Chemistry in Biology
 Day 3: August 18, 2019



Arup and Subhashree:
 Ethanol Fermentation by Yeast:
 demonstration of a biochemical
 reaction, where yeast metabolizes
 sugar anaerobically (in the absence of
 oxygen) to produce ethanol (detected
 by smell) and carbon dioxide (Ziploc
 pouch expands).

Handwritten calculations on a digital whiteboard:

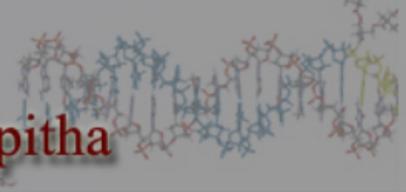
$$1 \text{ gram} \rightarrow 6.023 \times 10^{23} \div 101$$

$$1000 \text{ gram} \rightarrow \frac{6.023 \times 10^{23}}{1.01} \times 1000$$

$$= 5.963 \times 10^{26} \text{ Hydrogen atom}$$

5963 000,000,000,000,000,000,000,00

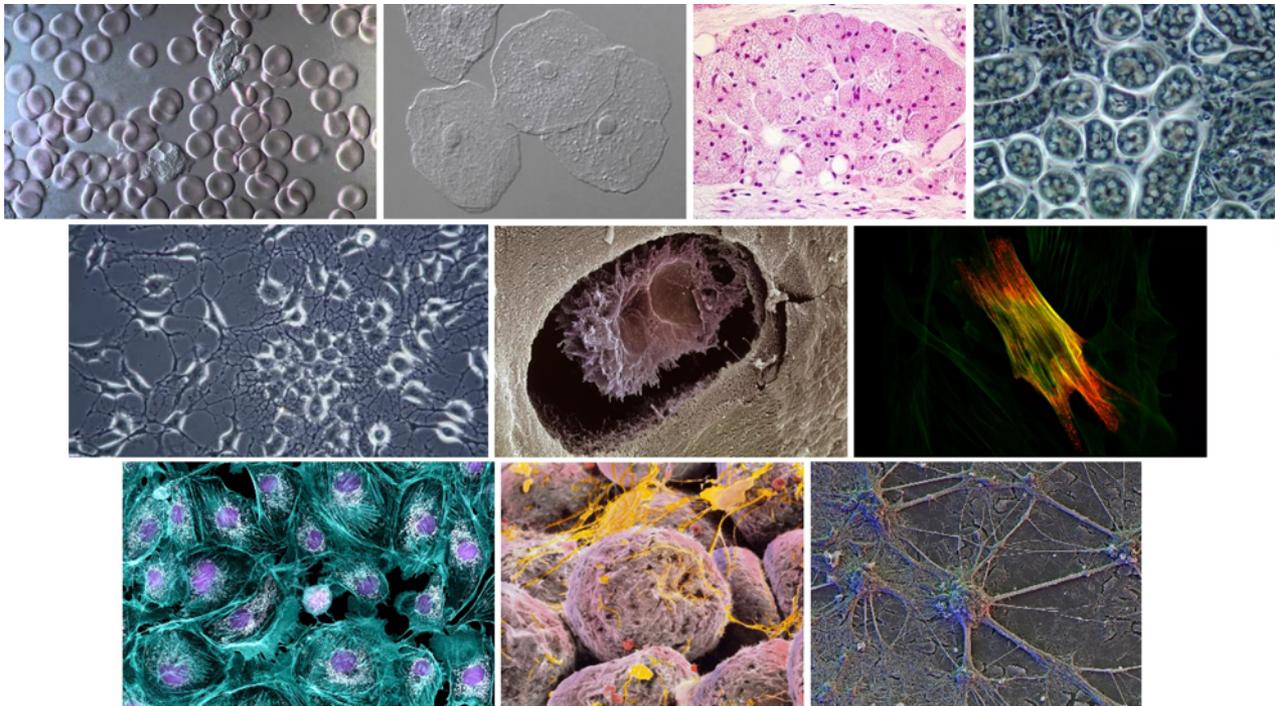
$$H_2O \rightarrow 1.01 \times 2 + 15.99 = 18.01 \text{ gram}$$

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ଓଡ଼ିଆ ଭାଷାରେ ଉପରୋକ୍ତ ସୂତ୍ର ବିବରଣୀ ।

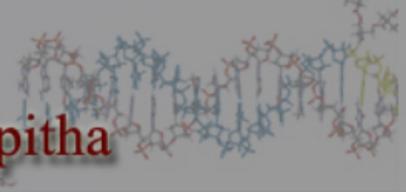
Chemistry in Biology
Day 3: August 18, 2019



Bibudha Parasar

The journey through the universe in Day 2 reverses direction in Day 3 and heads into human body, cells, DNA...

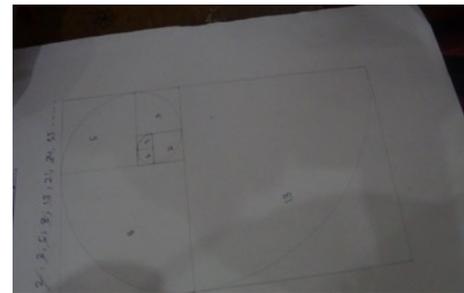
During the talk the children watched: **Inner life of a cell:**
https://www.youtube.com/watch?v=B_zD3NxSsD8



Hemachandra (Fibonacci) Numbers and Golden Ratio Day 3: August 18, 2019



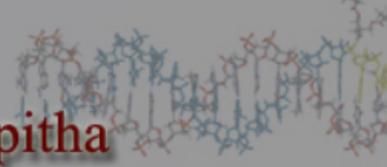
Sambat with fruits, vegetables and flowers: enthusiasm personified.



ଶଙ୍ଖ, ସୂର୍ଯ୍ୟମୁଖୀ ଫୁଲ, କଙ୍କି ପାରା ଭିତରେ ସମ୍ପର୍କ



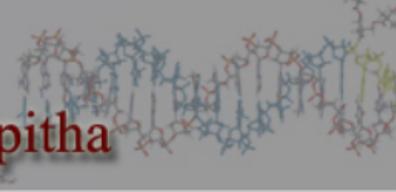
One of the most engaging talks given at the camp was by Rtashree Sambit who explained how numbers write spiral stories in nature. Here he shows the presence of the Golden Ratio in the human body. Showed **Nature by Numbers**: <https://www.youtube.com/watch?v=kkGeOWYOFoA>



Credit for posters and paper circuits activity:
Chandra X-ray Center (chandra.si.edu)

Children learnt to calculate current in a circuit.
How do you start the flow of charges? With a battery of course.
With that current you can light up a light-emitting-diode (LED).
The current flows only in one direction.

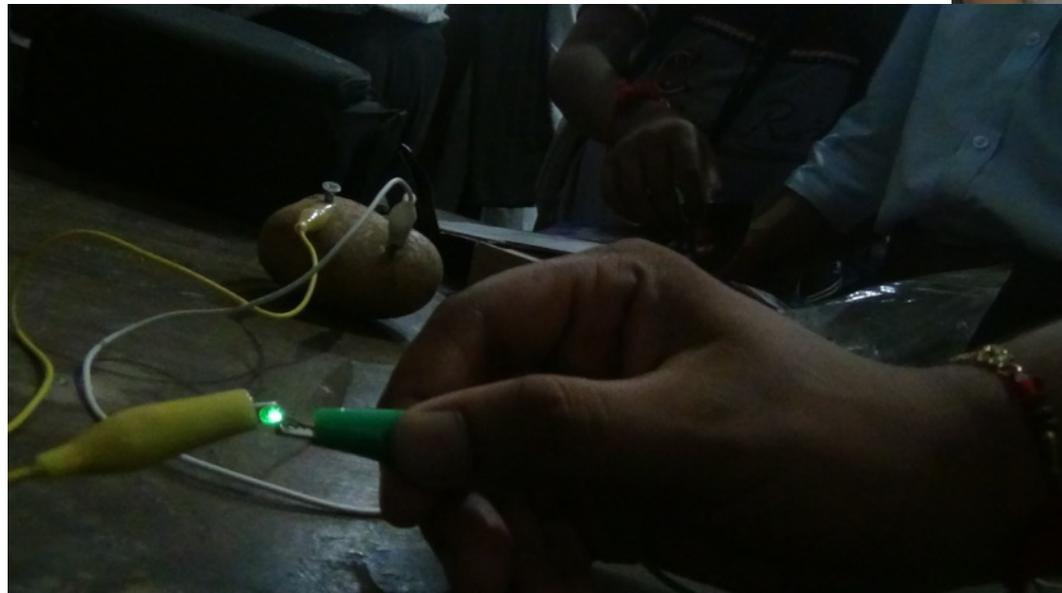
The children were given copper tape, a battery, a paper clip, and a foldable card with the picture of a galaxy or nebula on the front. The children made a circuit on the back, keeping the LED at the center of the galaxy or nebula. The circuit was completed by folding the corner to touch the copper tape to the battery. Watch the joy above!

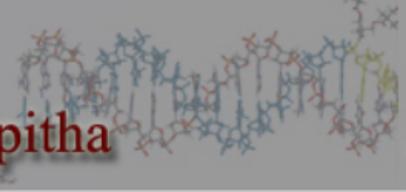


The Story of Electricity and Magnetism

Children learnt that current is the flow of charges (electrons) in a wire.
How do you start the flow? With a battery.

No batteries! What do we do?
“How about using potatoes as batteries?” asked Abhilipsa.





The Story of Electricity and Magnetism



No batteries, no potatoes! Now what do we do?
According to Michael Faraday, you just move a magnet near a coil.

A magnet was moved into a coil of wire. The coil was connected to a galvanometer, showing that there was indeed current produced.

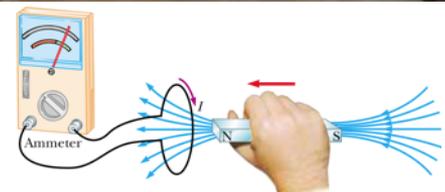
Live demonstrations on electric motors and generators were given by Anubhab and Beda.

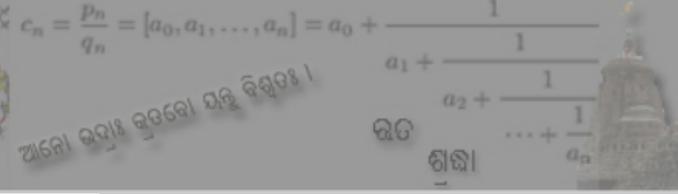


Current flows in a coil when it spins in a magnetic field: a generator.

In the reverse case, a current passing through a coil in a magnetic field makes the coil spin: an electric motor.

What an amazing relationship between electricity and magnetism!





The Story of Electricity and Magnetism



The last demonstration:

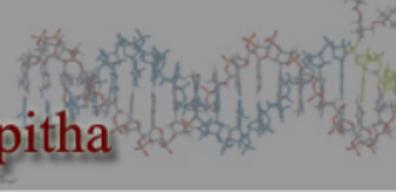
A ball was dropped through a copper tube and it came out in a fraction of a second due to gravity.

Then a strong magnetic sphere was dropped into the copper tube, and the sphere did not come out for several seconds.

“Children, what happened to the ball?”

“The falling magnet generated current in the tube. You had also told us before that a current-carrying coil behaves like a magnet. So the tube is like a magnet now. This magnet opposed the falling magnet. So it took so long,” answered Pratyush calmly.

“Brilliant, brilliant,” the instructor could not contain his excitement at the reply of the ten-year-old fifth-grader.



Each child was given books to take home. The top students also won a gift of books each for their schools. Each child also took home their circuit card, some LEDs, a diffraction grating, a binary number card, and a certificate of participation. All the children agreed that the camp was too short, and wished that it had been longer. “I simply forgot home these three days,” said a little girl in front of waiting parents.



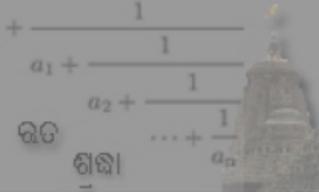
Pranati Manjari Pradhan
Saraswati Shishu Vidya Mandir, Unit-8, BBSR



Pratyush Prakash Prusty
Greenland Public School, Mangalpur, Jajpur



Swadhin Priyadarshi Das
Saraswati Shishu Mandir, Konark



Top eight students of Madhava-Ramanujan Ganito-Vijnanotsava, 2019				
Rank	Roll No	Name	Examination Center	School Name
1st	KRK- 019	Swadhin Priyadashi Das	Vivekanda Shiksha Kendra, Konark	Saraswati Shishu Mandir, Konark
2nd	2019-111-005	Pratyush Prakash Prusty	IBRAIN , Kantabania, Pritipur, Jajpur	Greenland Public School, Mangalpur
3rd	RTA- 002	Pranati Manjari Pradhan	Rtapalli Vidyapitha , Guabari, Khordha	Saraswati Sishu Vidya Mandir, Unit - VIII Bhubaneswar
4th	NKD-004	Anshuman Sahoo	Saraswati Shishu Mandir, Naktideul, Sambalpur	Saraswati Shishu Vidya Mandir, Jagannath Prasad, Naktideul, Sambalpur
5th	UDL-037	Rushav Bedayan Panda	Saraswati Shishu Vidyamandir, Udala , Mayurbhanj	Saraswati Shishu Vidyamandir, Udala, Mayurbhanj
6th	2019-105-001	Amar Prasad Sahu	Devi Coaching Center, Sandaposi Patana, Dhenkanal	Govt. Up Graded High School, SingaRaitala, Dhenkanal.
7th	REG - 076	Bishnupriya Nath	Hatiadanda New UP School, Hatiadanda, Rengali, Angul	Rajamunda U.P. School, Rajamunda, Saradhapur, Sundargarh
8th	JPR034	Chinmayee Samal	Venkateswar School, Dogada, Jajpur Town	Saraswati Shishu Vidyamandir, Bitana, Jajpur



$$c_n = \frac{p_n}{q_n} = [a_0, a_1, \dots, a_n] = a_0 + \frac{1}{a_1 + \frac{1}{a_2 + \frac{1}{\dots + \frac{1}{a_n}}}}$$

ଅନେକ ପ୍ରକାରର ଭବନକୁ ବିଶ୍ୱାସ ।
ଉଚ୍ଚ ଶିକ୍ଷା

Our storytelling does not end here. Potential future storytellers are:

- **Biswaprakash Mahanta**, M.Sc. (Biology), IISER-Kolkata, Ph.D. Student (Biology), Univ of Minnesota, Minneapolis, USA
Orientation and polarization of cells during movement
- **Debadatta Dash**, B.Tech. (Electrical), VSSUT, Burla, Ph.D Student (Biomedical Engineering), Univ. of Texas, Austin, USA
Speech-brain computer interface with artificial intelligence
- **Parthasarathi Das**: M.Sc. (Chem), IIT, Dhanbad, Ph.D. Student (Chem), Univ of Lincoln, Nebraska, USA
Protein modification using unnatural amino acids
- **Dr. Rajesh Malla**, M.Sc. (Phys), IISER-B, Ph.D., (Phys), Univ. of Utah, Salt Lake City, Post-Doctoral Research Associate, Los Alamos National Laboratory, USA
Light-matter interaction in 2D-materials
- **Dr. Sanjit Ghose**, M.Sc. (Phys), Utkal Univ., Ph.D., Physics, Inst. of Physics, BBSR, Physicist, Brookhaven National Laboratory, USA
Next generation material synthesis
- **Sayantane Paul**, Ph.D. Student (Bio), Univ. Mass., Boston, Activation induced substrate engagement in ERK signaling
- **And many many more to join**