



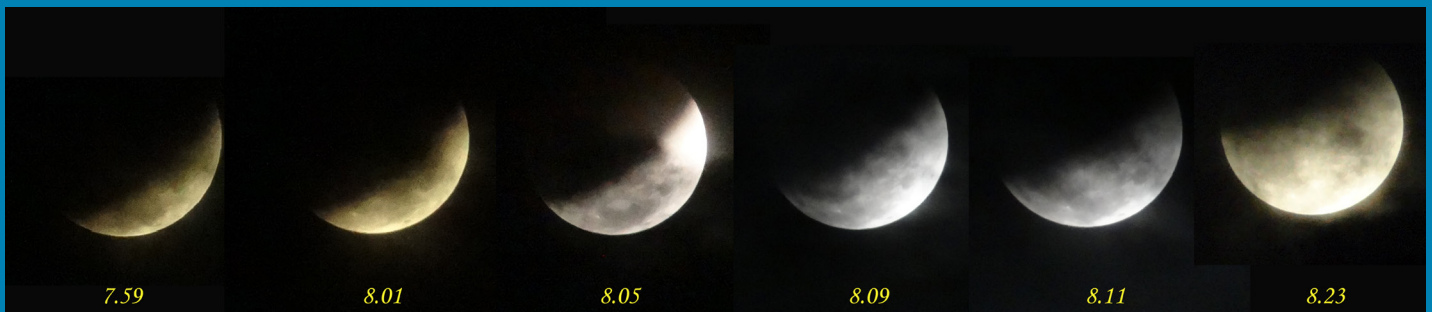
Arthur C Clarke Institute for Modern Technologies (ACCIMT). Katubadda, Moatuwa, 1 0400, Sri Lanka.  
Tel +94-11-2650569, +94-11-2650838, +94-11-2650462 Email - [infor@accmt.ac.lk](mailto:infor@accmt.ac.lk) Web - [www.accimt.ac.lk](http://www.accimt.ac.lk)



The Orion Nebula,

also known as Messier 42, M42, or NGC 1976, is a diffuse nebula situated in the Milky Way, being south of Orion's Belt in the constellation of Orion. It is one of the brightest nebulae, and is visible to the naked eye in the night sky. M42 is located at a distance of 1,344 light years and is the closest region of massive star formation to Earth. The M42 nebula is estimated to be 24 light years across.

This spectacular nebula was captured by 45 cm Cassegrain telescope at Arthur C Clarke Institute. The camera is Cannon Mark III color CCD connected to the prime focus of the telescope.



## Observation of Total Lunar Eclipse – 31 January 2018

A total lunar eclipse was observed on 31 January 2018 at Arthur C Clarke Institute. Due to heavy cloud cover, the totality could not be observed. After the totality, the moon was appeared through the clouds and the partial eclipse was captured.



# ACCIMT embarked upon a project to design, develop, test and launch of Sri Lanka's first ever Nanosatellite

Arthur C Clarke Institute for Modern Technologies initiated a project to design, develop, test and the launch of first ever Sri Lankan Nanosatellite in collaboration with one of the world's prestigious universities in aerospace, the Samara State Aerospace University(SSAU) working in conjunction with the State Space Rocket Center, in Russia.

Apart from that the ACCIMT would be teaming up with academics and professionals from local universities and other related government organization to make this endeavor a success. Nanosatellites can be built in standard format known as a Cube-sat, a 10 cm cube, weighing 1-10kg. Some Nanosatellites comprised units of two or three cubes. Satellites of this scale and other small satellites are moving from being experimental kit to delivering useful scientific data and commercial services.

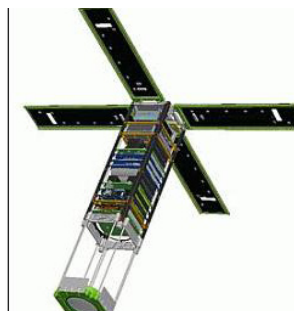
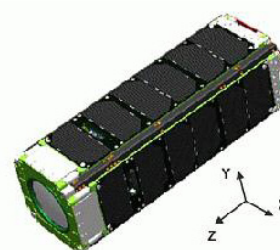
Nanosatellite provide much of the performance of a conventional satellite for a fraction of the cost. Further latest technological advancements in smartphones and other miniature consumer electronic products provide wealth of ready-made technological developments that can be incorporated to nanosatellites to perform most of the functions of conventional satellites, bringing the development cost as well as weight requirement down by considerable proportions. This results in increased number of opportunities for the usage of nanosatellites in commercial and other related applications.



The Russian expert team from Samara State Aerospace University was led by Prof. Igor Belokonov, a leading Russian specialist in the field. During the workshop a team of Sri Lankans were given an overview of the project with the aid of a SWOT analysis, a basic roadmap and a human resources development proposal was developed.

In April 2017 two groups from the ACCIMT visited Samara National Research University for two training programmes in Nanosatellite technology. The training programmes included lectures in the sphere of space engineering, analysis of space missions, flight dynamics, space navigation and communications, technologies of projecting and construction of nanosatellites, its on-board system and pay load, development of on-board software and visits to various laboratories and test facilities. The two groups consist of engineers and senior managers from ACCIMT and senior lecturers from University of Peradeniya and University of Moratuwa.

The ACCIMT plans to launch first nanosatellite in 2020. As per the views of Eng. Sanath Panawennage, Former Director General & CEO of the Arthur C Clarke Institute for Modern Technologies, development of nanosatellites and providing technological developments in other allied fields would be a very lucrative global business in coming years and the space technology programme planned by the ACCIMT would provide opportunities for Sri Lanka to enjoy the benefits from related business opportunities, which would be created in the future.



# ADAPTATION OF SCASA TECHNIQUE FOR SURGE PROTECTIVE DEVICES FOR EQUATORIAL BELT COUNTRIES

Electronics and Microelectronics Division

Modern electronic systems are very susceptible to failures due to high energy transients superimposed on the power input or the signal ports. In equatorial belt countries like Sri Lanka, lightning activity is high and it causes severe damage to equipment. To safe-guard electronics from such high energy transients, surge protection devices (SPD) rated to absorb repeated surges are required. Traditionally, SPDs use cascaded multiple non-linear devices (NLD) to clamp the transient overvoltage created by a transient. However, typical NLDs have energy absorption ratings based on short-term basis, and they have a limited life time.



Supercapacitor assisted surge absorber (SCASA) technique is a patented novel technique, where a very large capacitor's continuous energy absorption capability given by  $\frac{1}{2} CV^2$  could be effectively coupled with NLDs, filters and a multi-winding magnetic component for a low component count based SPD where repeated transients can be absorbed.

In adopting this technique for absorbing severe transients with several orders of Joules dumped into a SPD, on a repeated basis, selection of the supercapacitor and the multi-winding magnetic core is a very critical design-task. Since the combination of the leakage and magnetizing inductances of the multi-winding magnetic core plays a dominant role, selection of the core is critical.



In absorbing repeated Class-B type surges, in equatorial belt locations like Sri Lanka, specific attention is required to come up with a reliable SPD design and this paper presents the design details and test results for an early-version of a prototype design of a differential-mode surge protector based on the SCASA technique. Experimental results generated using a lightning surge simulator with surge capability up to 6 kV/3 kA is used to validate the results.

Performance of this technique with optimized magnetics is compared with some selected commercially available surge protectors sold in Sri Lanka. Test results clearly indicate, the developed device has a much higher energy absorption capacity than tested commercial products and can be used in commercial surge protectors.

## ජල රොකට් තරඟවලිය



ආසියා - ශාන්තිකර කලාපීය අභ්‍යවකාශ තාක්ෂණ සංසදය වාර්ෂිකව "ආසියා - ශාන්තිකර කලාපීය ජල රොකට් තරඟවලිය" සංවිධානය කරනු ලබයි. ඒ සඳහා ශ්‍රී ලංකාවෙන් තරඟකරුවන් ඉදිරිපත් කිරීමේ කාර්තව්‍යය සිදුකරනු ලබන්නේ අප රට තුළ අභ්‍යවකාශ තාක්ෂණය ප්‍රවලිත කිරීමේ පුරෝගාමී ආයතනය වන හවින තාක්ෂණ පිළිබඳ ආතර් සී ක්ලාක් ආයතනයයි. මෙහිදී වාර්ෂිකව අයදුම්පත්‍ර කැඳවීම මඟින් තෝරාගන්නා පාසැල් සිසුන් සඳහා ජල රොකට් නිර්මාණය පිළිබඳ නිවැරදි ප්‍රායෝගික දැනුම ලබාදෙන වැඩමුළු පැවැත්වීමේ සිට දේශීය ජල රොකට් තරඟය පවත්වා වීම තරඟයේ ජයග්‍රාහකයන් ජාත්‍යන්තර ජල රොකට් තරඟය සඳහා ඉදිරිපත් කිරීම දක්වා වන ඉතා වැදගත් වූ කාර්යභාරය සිදුකරනු ලබන්නේ හවින තාක්ෂණ පිළිබඳ ආතර් සී ක්ලාක් ආයතනය විසිනි.

2004 වර්ෂයේදී ඕස්ට්‍රේලියාවේ කැන්බරා නුවර පැවති සමුළුවකදී ජාත්‍යන්තර ජල රොකට් තරඟය පැවැත්වීමට මුලින්ම තීරණය වූ අතර 2005 වසරේදී එම තරඟය පැවැත්වීම ආරම්භ විය. මේ දක්වා එම තරඟය ජපානය, ඉන්දුනීසියාව, ඉන්දියාව, වියට්නාමය ආදී රටවල් කිහිපයකදී පවත්වා ඇති අතර ශ්‍රී ලංකාව 2005 වසරේ සිට අඛණ්ඩව එම තරඟවලියට සහභාගී වෙමින් ජයග්‍රහණ කිහිපයක් ලබාගැනීමට සමත් වී තිබේ ඒ අතුරින් 2005 වසරේ ජපානයේ පැවති තරඟවලියෙන් 3 වන ස්ථානයත් 2009 වසරේ වියට්නාමයේ පැවති තරඟයෙන් 3 වන ස්ථානයද, 2017 වසරේ ඉන්දියාවේ පැවති තරඟයෙන් පලමුවන ස්ථානයද සහ 2018 සිංගප්පූරුවේ පැවති තරඟයෙන් 1හි ස්ථානයද ලබා ගෙන ඇත.

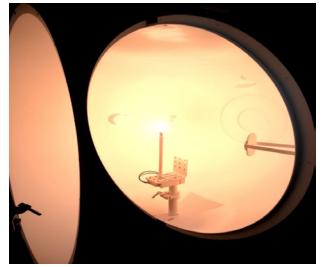
## The Light Measurement Facility Industrial Services Division

In line with the initiatives taken to enhance testing facilities, the ACCIMT has started setting up of a light measurement laboratory to measure photometric characteristics of CFL, LED light sources, which include AC and DC domestic and automobile lamps. Setting up of this new facility would be beneficial for manufactures, importers and finally the consumers.



This new facility established at the ACCIMT, enables either manufacturers or importers to find out performance of their products with respect to rated or anticipated specifications. Hence more importantly manufacturers would be able to continuously improve their products. This facility will be able to measure not only photometric characteristics but also electrical characteristic of a bulb with very high precision.

The electrical parameters that can be measured include total harmonic distortion, power consumption, wattage, voltage and current and photometric parameters include luminous efficacy, colour temperature, total radiant flux, lumen flux, colour coordinates etc.



One of the most latest and upto date version of integrated software platform is used for testing, analyzing and report generation purposes. Further the software package used is one of the most innovative and user friendly software to measure specific customer requirements in light measurement.

Compliance against following two Sri Lankan National standards

- SLS 1225:2002
- SLS 1231 Part 1 2002

for energy efficiency of self ballasted lamps and performance of lamps can be tested using this facility.

## First Radio Astronomy Facility in Sri Lanka

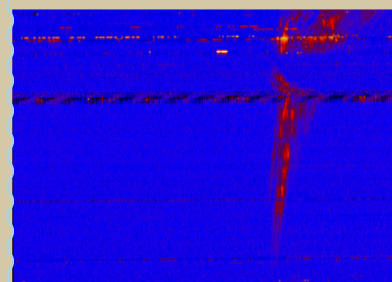
### Astronomy Division

Arthur C Clarke Institute is collaborating with e – CALLISTO program which is an instrument array for solar observation. At present over 70 identical radio spectrometers among 38 nations are in operation under this program. In this system the CALLISTO Spectrometer receives the solar radio emission which is emitted by solar flares. The system has three components, the spectrometer donated by the Institute of Astronomy, Switzerland, the Log – periodic antenna and low noise amplifier, designed and constructed by the Arthur C. Clarke Institute.

The radio emissions of the solar flares spread along the entire radio frequency region. Therefore the receiver should have a large bandwidth to grab the radio emission. The CALLISTO receiver bandwidth is 45 – 870MHz. The antenna is also designed to receive the entire frequency range, 45 – 870MHz. This type of antennas are unique and known as Log – Periodic antennas. The antenna is around 6 m tall and 3 m span in longest dipoles.

The system is operating in 24 hours and connected to the central server at Switzerland. All other stations are also connected to the main server and whenever a solar radio burst occurs it will be detected by e – CALLISTO network. (<http://www.e-callisto.org>)

With this facility, the radio astronomy branch is also initiated in the Arthur C Clarke Institute in addition to the well established optical astronomy facility. As the pioneering research, the Institute in astronomy in the country, the institute will continue its service to the nation introducing new facilities and technologies.



## Establishment of Spectral Signature bank of Sri Lanka Space Technology Application Division

Arthur C Clarke institute for Modern Technologies has spectroscopy facility with hand-held contact probe and PSR-1100F portable Spectroradiometer (spectral range of 320–1100 nm) which takes measurements of spectral reflectance of targets. This instrument consists of stand-alone system that works independently without the connection of a PC. This enables high portability while maintaining the accuracy of the measurement. Spectroradiometer can be utilized to collect Spectral Signatures of different surface types such as water, bare ground, vegetation, etc and any other materials.



Spectral signature of a particular object is the foundation of Hyperspectral Mapping, and it indicates inherent advantages of Hyperspectral Remote Sensing (Imaging Spectroscopy) than Multispectral Remote Sensing. There are many applications which can take advantage of Hyperspectral Remote Sensing like Vegetation types mapping, Forest types mapping, Atmospheric Studies, Mineral and soil types mapping, Coastal Applications, Urban Applications etc.

Establishment of a Spectral Signature Bank for Sri Lanka is one of the major continuing project using this Spectroradiometer, and the instrument has already been used to collect the spectral signatures of various traditional Rice varieties, Mangrove species

and different land cover types. While establishing the “Spectral Signature Bank for Sri Lanka” the collaborative projects are being continued with Government Institutes and Universities according to their institutional requirements. One of the completed projects is “Evaluation of Spectral signature Characteristics of Traditional Paddy varieties of Sri Lanka”. This project was carried out in collaboration with Rice Research and Development Institute, Bathellogoda to differentiate spectral variations of 22 paddy varieties in different wavelength regions. Pigments and Structural sensitivity vegetation indexes which related for canopy chlorophyll content, photosynthesis intensity, nitrogen and water content were employed in this study to find



the differences in spectral reflectance among paddy varieties and statistical analysis was carried out. Government and non- government institutes who interest in spectral data based project or research works, are encouraged to interact with ACCIMT for collaborative works.

### ACCIMT News

## සූර්යයා නිරීක්ෂණය කිරීමේ කඳවුර

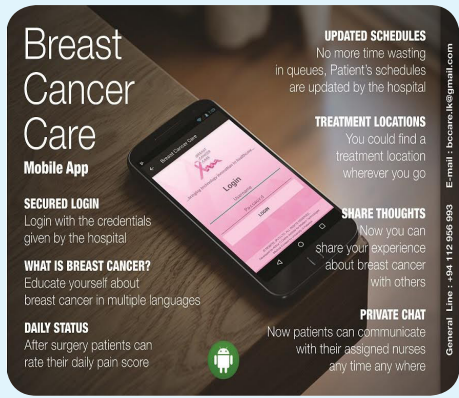
ආතර් සී ක්ලාක් ආයතනයේ අභ්‍යවකාශ යෙදවුම් අංශය මඟින් තාරකා විද්‍යාව පාසැල් දරුවන් හා විශ්වවිද්‍යාල ශිෂ්‍ය ශිෂ්‍යයාවන් අතර ප්‍රචලිත කිරීම යටතේ වැඩසටහන් 2ක් පසුගිය දා පැවැත්විණි මෙහි පළමුවැන්න රුහුණු විශ්වවිද්‍යාලයේදී පැවති රුහුණු නිපැයුම් හා නවෝත්පාදන ප්‍රදර්ශනයේදී ද දෙවැන්න පිළියන්දල මධ්‍ය මහා විද්‍යාලයේ උසස්පෙළ විද්‍යා අංශය මඟින් සංවිධානය කළ විද්‍යා දින වැඩමුළුවේදී ද පැවැත්විණි රුහුණු විශ්වවිද්‍යාලයේ වැඩසටහන සඳහා පාසැල් දරුවන් ගුරු හවතුන් ඇතුළු 2000ක පමණ පිරිසක් සහභාගී වූ අතර පිළියන්දල මධ්‍ය මහා විද්‍යාලයේදී සහභාගී වූ පාසැල් දරුවන් සංඛ්‍යාව 1000ක් පමණ විය.

මෙහිදී ආතර් සී ක්ලාක් ආයතනයේ පර්යේෂණ විද්‍යාඥ වන්දන පීරිස් මහතා තාරකා විද්‍යාව පිළිබඳ දේශන පැවැත්වූ අතර දුරේක්ෂ ආධාරයෙන් සූර්යයා නිරීක්ෂණය කිරීමේ කඳවුරක්ද පැවැත්විණි.



# Breast Cancer Care - Mobile App

## Information Technology Division



Breast cancer (BC) is the commonest cancer among women and is the 2nd commonest cancer to affect humans globally. According to the World Health Organisation (WHO), BC incidence vary greatly worldwide from 19.3 per 100,000 women in Eastern Africa to 89.7 per 100,000 women in Western Europe.

Despite the increasing BC incidence in the South East Asia, knowledge/awareness on BC among the Sri Lankan women is poor. Thus, a proportion of BC patients present at an advanced stage where hopes of survival are low and will have a poor quality of life with limited treatment options.

In Sri Lanka, optimum healthcare facilities are not available in every hospital. Thus, patients have to travel to a tertiary care hospital for further management, i.e. ultrasound/mammogram, chemotherapy and radiotherapy.

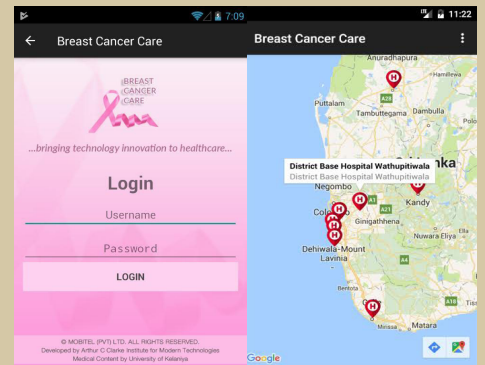
Patients come early in the morning, to get an appointment, for their clinic to either seek medical opinions/multi disciplinary team (MDT) decisions or trace investigation reports; i.e. biopsy reports. Unfortunately, some of these patients will have to come back on another day as their reports are not available as expected. The time and money these patients and their guardians spent is ultimately a waste.

Mobile apps developed so far have focused on provision of either, information on BC, guidance on the histological types or what to do for treatment related side effects.

“Breast Cancer Care” mobile app is the first comprehensive app. It provides;

1. information on the breast cancer (BC)
2. guidance and a schedule for patients (for investigations, operation and clinic visits)

3. facilitates round the clock communication between patient and breast care nurse (BCN)
4. facilitates communication between doctors concerned (surgeon/ oncologist) and BCN
5. facilities for the doctors concerned to monitor their patients’ status
6. facilities to share patient’s own experiences with others
7. information on new events/ workshops on BC
8. details of different treatment locations and BC care products



### ACCIMT News

## ගුරු පුහුණු වැඩසටහන

නවීන තාක්ෂණ පිළිබඳ ආතර් සී ක්ලාක් ආයතනය ජාතික ගුරු පුහුණු ආයතනය සමඟින් එක්වී ගුරු උපදේශකවරුන් සඳහා තාරකා විද්‍යා වැඩමුළුවක් පවත්වනු ලැබීය.

ආතර් සී ක්ලාක් ආයතනය ශ්‍රී ලංකාවේ අභ්‍යවකාශ තාක්ෂණය ප්‍රවර්ධනය කිරීමේ ප්‍රමුඛ ආයතනය ලෙස ඉටුකරනු ලබන කැපී පෙනෙන මෙහෙවරේ එක් අංගයක් වන මෙහි මුඛ්‍ය පරමාර්ථය වන්නේ ශ්‍රී ලංකාවේ පාසැල් සිසුන්ට ලබාදෙන විද්‍යා අධ්‍යාපනය ගුණාත්මකව වැඩිදියුණු කිරීමයි.

මෙහිදී පළාත් 9 නියෝජනය වන පරිදි ගුරු උපදේශකවරුන් 40ක් පමණ සහභාගී වූ අතර ඔවුන් සඳහා දේශන, ප්‍රායෝගික යෙදීම් මෙන්ම දුරේකේෂය ආධාරයෙන් රාත්‍රී අහස නිරීක්ෂණ කඳවුරක් පැවැත්විණි.

ආතර් සී ක්ලාක් ආයතනයේ තාරකා විද්‍යා උපදේශක මහාචාර්ය වන්දන ජයරත්න මහතා මෙහි ප්‍රධාන දේශනය පවත්වනු ලැබීය.



# Sattelite Communication

## Ground Station Antenna

### Communications Division

The concept of global telecommunication systems using satellites were put forward first in an article published in the British Magazine "Wireless World" in May 1945 by the science fiction author, Sir Arthur C. Clarke. From there onwards lot of space activities were carried out by globally, especially countries with technological capabilities. As a result satellites ranging from sizes of nano, micro, small to large depending on the applications, operating country technology capacity and orbit of interactions are common today. The Arthur C Clarke Institute for Modern Technologies is also planning to design, develop and test nano satellite technology as an initiative to embark into space technology, which operate at AMSAT Satellite telemetry frequency range and utilize UHF for uplink and VHF for downlink.

As a part of the master plan at present a research team of the institute is involving in setting up of a Ground Station for telemetry controlling of the nano satellite and data downloading setup.

For satellite communication, commonly used frequency bands and frequency ranges with specific satellite applications are as follows Table1.1.

Band	Frequency Range	General Application
VHF	136MHz-149MHz	AMSAT Satellite telemetry
UHF	433MHz-434MHz	AMSAT Satellite telemetry, MSS
L	1-2 GHz	Mobile Satellite Services (MSS)
S	2-4 GHz	MSS, NASA, deep space research
C	4-8 GHz	Fixed Satellite Service (FSS)
X	8-12.5 GHz	FSS military, terrestrial earth exploration, meteorological satellites
Ku	12.5-18 GHz	FSS, broadcast satellite service(BSS)
K	18-26.5 GHz	BSS, FSS
Ka	26.5-40 GHz	FSS

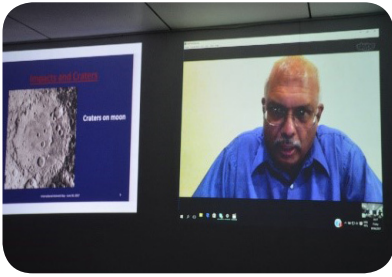
Table.1.1 Frequency, Band and general purpose

The design and implementation of a fully capable ground station at the ACCIMT is leading to facilitate communication requirements for nanosatellite missions which include Bird 3 cube sat in collaboration with Kyushu Institute of Technology, Japan and another two such initiatives with Samara University, Russia.

Nanosatellite missions by its very nature follow a philosophy of low cost and rapid development cycle and as such the ground station design is also fall within this same framework Fig1.1 shows the ground station antenna arrangement.



Fig.1.1 VHF/UHF Antenna with Rotation mechanism



### ලෝක ග්‍රහක දිනය

වික්සන් ජාතීන්ගේ සංවිධානය මගින් ජුනි 30 දින “ලෝක ග්‍රහක දිනය” ලෙස ප්‍රකාශයට පත්කර ඇති අතර මෙම වැදගත් දිනය සමරමින් විශේෂ දේශන, වැඩමුළු, චිත්‍රපට දර්ශන ඇතුළු විශේෂ සැමරුම් වැඩසටහනක් චදින ආතර් සී ක්ලාක් ආයතනයේදී පැවැත්වුණි.

මින් වසර මිලියන ගණනකට එතා දිවෙන අතීතයක් හිමි ග්‍රහක යනු. අභ්‍යවකාශයේ පවතින පාෂාණ කැබලි වේ. පෘථිවිය සූර්යයා වටා ගමන් කිරීමේදී මෙම ග්‍රහක හරහා ගමන් ගන්නා අතර එහිදී

පෘථිවි ගුරුත්වාකර්ශනයට හසුවී වේගයෙන් පෘථිවිය කරා පැමිණෙයි. ග්‍රහක මෙම ක්‍රියාවලිය තුළදී අධික රත්වීමකට භාජනය වී පහළ වායුගෝලය කරා පැමිණීමේදී වායුගෝලයේ ඇති ඔක්සිජන් සමඟ මුසු වී දැවීයයි.

ඒ අයුරින් 1908 ජුනි 30 දින ටින්ගුස්කා ප්‍රදේශයට කඩා වැටුණු ග්‍රහකයක් හිසා සිදු වූ විනාශය සමරනු වස් සෑම වසරකම ජුනි 30 දින “ලෝක ග්‍රහක දිනය” ලෙස නම්කර ඇති තවද, 2013 මීටර් 20ක් පමණ කුඩා ග්‍රහකයක් හේතුවෙන් පුද්ගලයන් 1500කට පමණ තුවාල සිදුවිය. ග්‍රහක යනු

මේ අයුරින් අප වෙසෙන පෘථිවියට තර්ජනයක්ව පවතින ආකාශ වස්තුවකි.

මෙම විශේෂ වැඩමුළුවේදී ඇමරිකාවේ සෞරග්‍රහ විද්‍යා ආයතනයේ ජ්‍යෙෂ්ඨ විද්‍යාඥ ආචාර්ය නලින් සමරසිංහ මහතා විසින් ස්කයිප් තාක්ෂණය ඔස්සේ දේශන පවත්වන ලදී. තවද මෙහිදී කොළඹ විශ්වවිද්‍යාලයේ භෞතික විද්‍යා අධ්‍යයන අංශයේ ජ්‍යෙෂ්ඨ කථිකාචාර්ය වන්දන ජයරත්න මහතා විසින්ද දේශන පවත්වන ලදී.

මෙම වැඩමුළුවේ විශේෂත්වය වන්නේ එහිදී ග්‍රහක නිර්මාණය, ග්‍රහක කොටස් පොළොවට වැටීමෙන් ආවාට සෑදෙන අයුරු නිරීක්ෂණය කිරීම පිළිබඳව මනා දැනුමක් මේ සඳහා සහභාගී වූ සැමට ලබාගැනීමේ මහඟු අවස්ථාව හිමිවීමයි.

### පාසැල් දුරදරුවන් සඳහා වැඩසටහන්

නවීන තාක්ෂණ පිළිබඳ ආතර් සී ක්ලාක් ආයතනය විසින් දැයේ පාසැල් දුරදරුවන්ගේ අභ්‍යවකාශ තාක්ෂණික දැනුම ඉහළ නැංවීම සඳහා දායක වනු වස් සංවිධානය කරන මෙම වැඩසටහන් මාලාව දේශන සහ ආයතනයේ ඇති දුරේක්ෂ භාවිතයෙන් අභ්‍ය නිරීක්ෂණය කිරීමට අවස්ථාව සලසාදීම ආදී ඉතා වැදගත් අංගයන්ගෙන් සමන්විත වේ.



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