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Enhancement Of Secondary Radiation Flux Energy About 2.22% During The Appearance Of The Super Moon On July 13, 2022, At Udaipur (Rajasthan), India.

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Abstract: To observe secondary radiation flux energy on the surface of Earth during perturbed and unperturbed conditions over Udaipur city in India.The appearance of Super Moon astronomical event (Perturbed condition) at Udaipur (270 43' 12.00" N, 750 28' 48.01" E), India was experimentally observed on July 13, 2022, using a ground-based NaI (Tl) scintillation detector. Dates of observations were, June 22, 23, 24, 25, 26, 27 (2022) and July 13, 14, 15, and 16 (2022) in the evening for half an hour.
A significant enhancement of secondary radiation flux energy of about 2.22 %on July 13, 2022,was noticed in perturbed condition (Super Moon event). Energies on unperturbed conditions dates (Normal Days) were: June 22- 1453keV, 23- 1401keV, 24 -1437keV, 25 –1443keV, 26 – 1453keV, 27 –1450keV and July 14 – 1459keV, 15 –1433keV, 16- 1443keV. On the perturbed date (Super Moon event) energy was 13 – 1473keV. During perturbed condition i.e., Appearance of the Super Moon astronomical event (July 13, 2022) with an enhancement in secondary radiation flux energy of about 2.22 % observed in the studied area.

Keywords: Super Moon; Primary cosmic radiation; Intense reflected solar radiation; Secondary emission radiation flux; Secondary radiation.

1 Introduction

Research studies elucidated that cosmic radiation (CR) is inherent in high-energy charged particles comprising nuclei of atoms ranging from the lightest to the heaviest elements in the periodic table and move through space at nearly the speed of light [1]. The energy of this radiation ranges from 10^9- 10^{20} eV or more. The composition of this CR is about 89% of protons, 10% of nuclei of helium, and about 1% of other heavier elements. When primary cosmic radiation and solar radiation strike the atmosphere, secondary radiation is formed. Secondary radiation has three components (A)electromagnetic component (B) nuclear fragments hadronic component (C) muonic- neutrinos component[2].Secondary radiation flux can be detected using an appropriate detector on the ground.
To ascertain the hidden secrets of astronomy, technical advances over more than half a century have been accomplished so that we could able to pinpoint how astronomical observations and physical concepts

interact. For this purpose, a large number of experimental studies were carried out to collect good-quality data on cosmic radiation and solar radiation with the help of advanced technologies by astronomers, for different astronomical events occurring at various points in time. However, due to these events, it is found that the characteristics of GCR (Galactic cosmic radiation) and SR (Solar radiation) are modulated and manifested in the ground-based observation for the terrestrial secondary radiation flux. These signals carrying the signatures of modulated GCR and SR are measured by efficient counter systems.Therefore,the research study was accompanied by an astronomical event solar eclipse to observe radiation flux [3],Lunar eclipse studies were also conducted and observed variation of radiation flux [4],[5].Also, other research studies related to celestial objects and comet were carried out [6], [7].During the transit of the Sun across different constellations many experimental studies were carried out and observed variations of radiation flux [8],[9],[10],[11]. Jupiter and Saturn great conjunction on December 21, 2020, an experimental study was navigated, and about a 2% decrement in radiation was observed [12]. Change of radiation flux observed during change of angular position of Sun and planet Venus in space with the presence of constellation Pisces in the sky in the month of March 2021 [13].The change of Position of the Moon in Sky research study was conducted month of November 2020 and observed variation in radiation flux[14]. The closest approach of Mars towards Earth on October 6 & 7, 2020, Mars at opposition on October 13, 2020, and the transit of Moon across different constellations and planets experimental studies were done in the month of October 2020 [15].In all of these studies illustrate the Variation of radiation flux observed. During different celestial events and conditions happening in the sky,these events have modulated radiation flux. In all these research studies radiation fluxes were observed and after getting inspired by the above studies we carried out an experimental study during super Moon astronomical event.
During the Super Moon astronomical event, the Moon was closest to the Earth on July 13. At the closest location of the Moon toEarth.

2 Methodology

A scintillation counter system of Nucleonix make (SD 152 F) flat type was used to detect the secondary radiation flux. The size of this detector [NaI (Tl)] crystal is 2” x 2”. It is optically coupled with a photomultiplier tube. Then 1k multichannel analyzer (MC 1000 with 1024 channels) of Nucleonix make is connected. It has a high voltage and shaping amplifier.High Voltage Unit (HV 501) has voltage variability from 0 to 1500 with an output current of about 1 mA. It supports unlimited over-load, and also secures short-circuiting, and has the capability of self-recovery. The output ripple is less than 20mV.It has integral assemblies with a built-in pre-amplifier. This combination gives excellent stability, superior performance as well as good resolution in the range of 8% - 9.5% using standard source Cs-137. This detector is connected to photomultiplier tube EMI 9857 or its equivalent. It provides approx. 25 gain with an operating voltage of 360 to 900. It gives an output positive Tail Pulse and output impedance is about 90 Ohms. With the help of ANUSPECT Software, the data of secondary radiation flux were collected in the Laptop from MCA.

MINIBIN and Power Supply (MB 403)

It is built up of 6/8 single-bit modules. It is designed for the reason of conserving bench space. Bussed Wiring is used to the power connector to provide ± 12V and ± 24V. It has an *on-and-off* switch. The power supply has one out of the two types of devices i.e., 2½bit Module or Compact box type enclosures which is fixed at the end of this bin and is used for generating highly regulated D.C. voltages. Thus, such specifications make this system with better stability of about ±0.5% at constant line load and ambient temperature once it is warmed up for 24 hours, with less than 3mV noise.
For this experimental study, the Scintillation counter system was kept open to collect the counts as a function of time at Udaipur (270 43’ 12.00” N, 750 28’ 48.01” E)(Rajasthan) India. Data were collected for half an hour on dates June 22, 23,24,25,26,27 and July 13,14,15,16 in the evening. On date July 13, 2022, there was an astronomical event Super Moon.The applied voltage on the detector was 390 volts with a gain of 30 for all observations dates. Always this set of value i.e., voltage and gain were kept constant.
To obtain the result we average all secondary radiation flux energy of unperturbed days (normal days) and compare with secondary radiation flux energy on Super Moon event. By doing so we are able to find out clear enhancement of secondary radiation flux energy on event day (Perturbed condition). For calibration of the scintillation detector, we used standard source Co^{60} (Figure 1). The standard source cobalt gives two

specific peaks of energy 1172 keV and 1335 keV. We calibrated the scintillation counter using the concept:the value of peak energy / corresponding channel and it was about 2 keV / Channel.

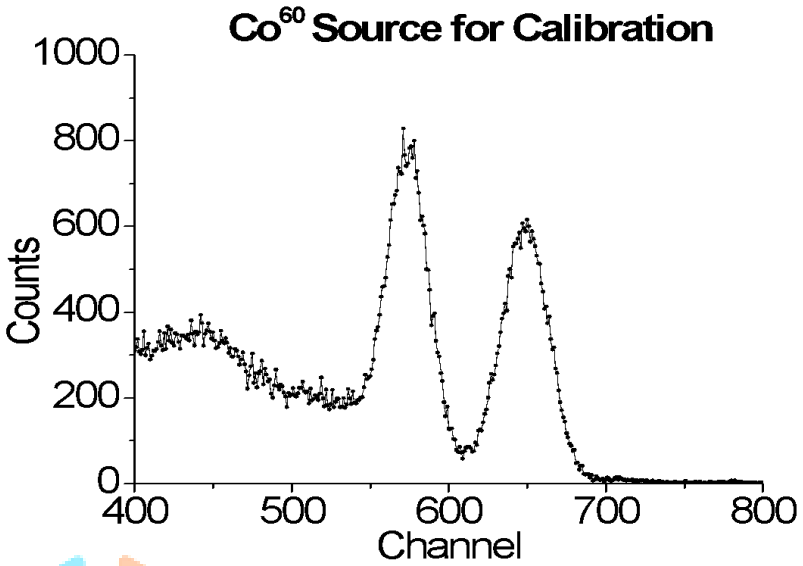

Figure 1. Cobalt source peaks for calibration of scintillation counter

3 Results and discussions

Data were collected for half an hour on dates June 22, 23, 24, 25, 26, 27, and July 13,14,15,16 in the evening. On date July 13, 2022, there was an astronomical event Super Moon in the sky at Udaipur. As depicted in the panels of Figures2 and 3 the energy spectra of secondary radiation flux on June 2022 and July 2022 in the energy range between 800 keV to2000 keV.

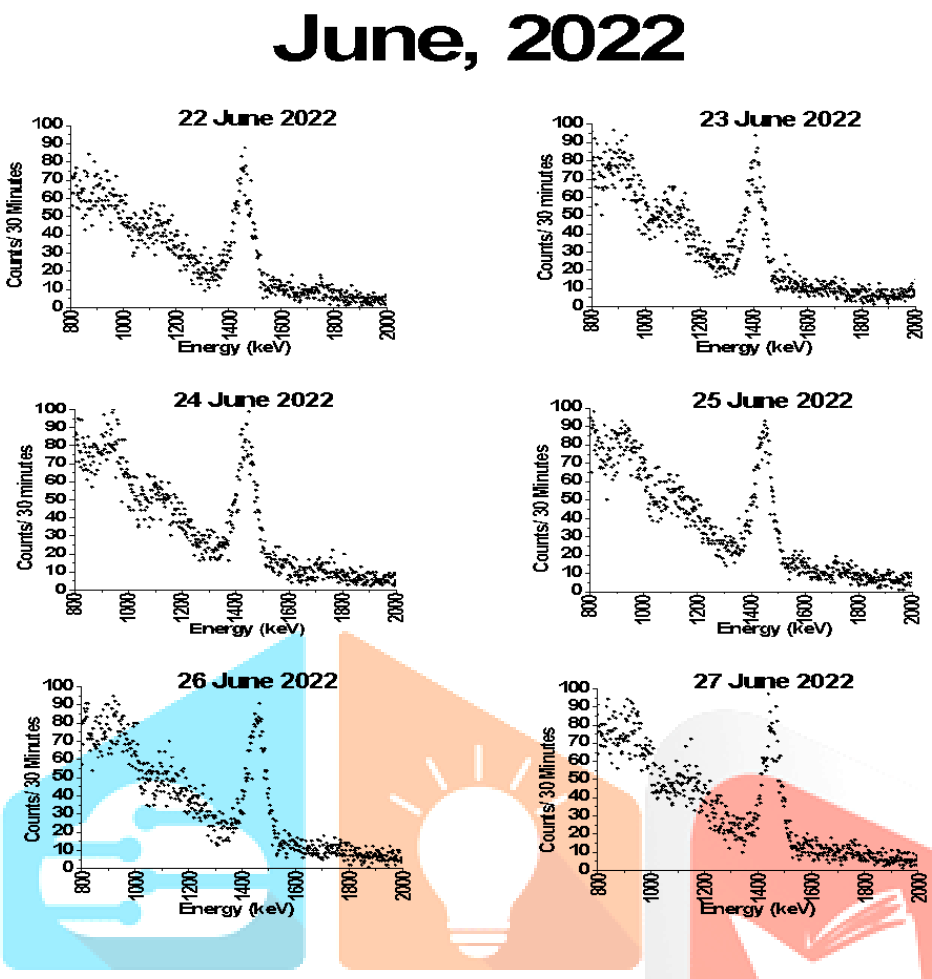

Figure 2. Panels of energy spectra of secondary radiation flux

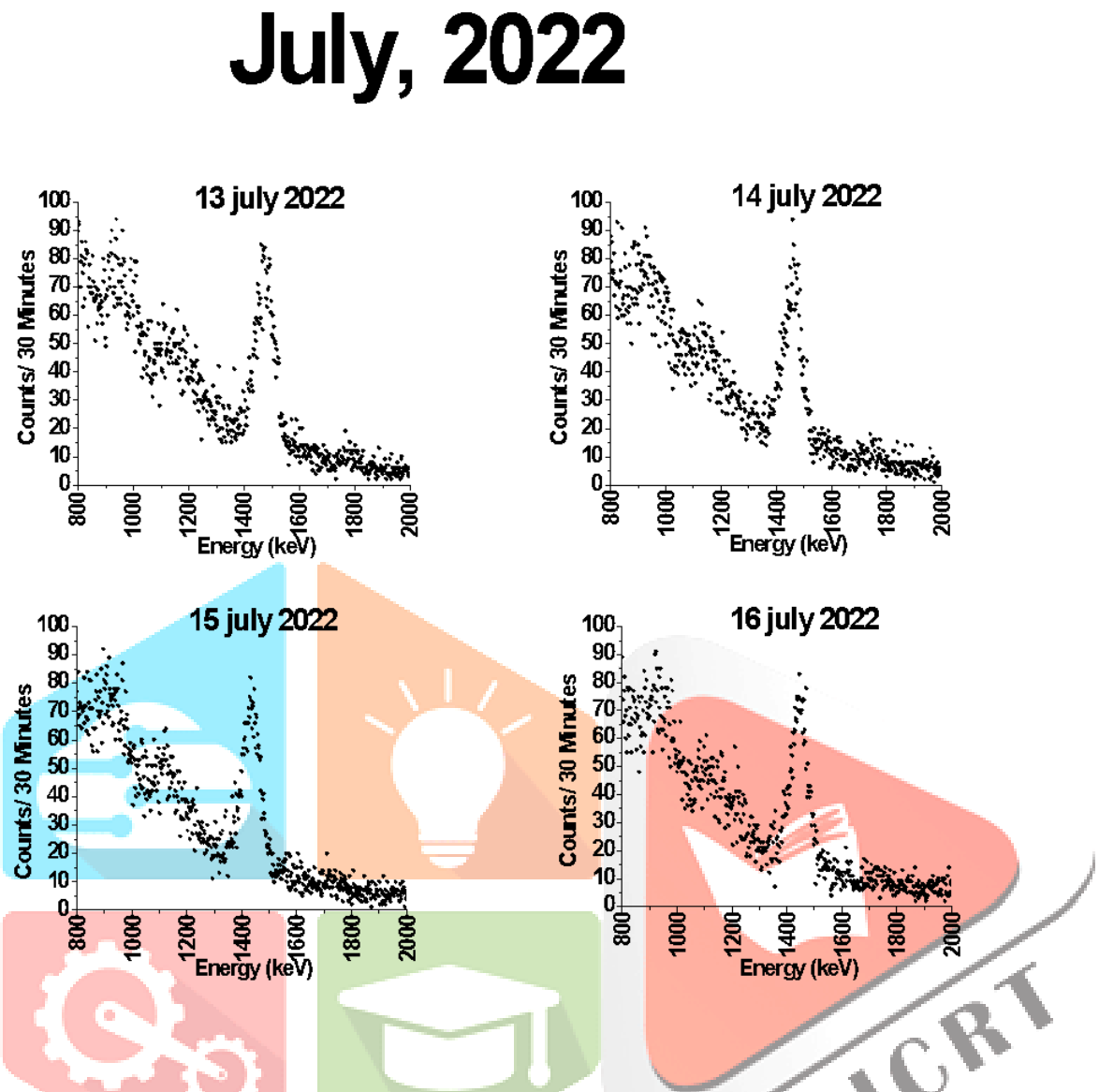

Figure 3. Panels of energy spectra of secondary radiation flux

Figures of 2 and 3 show the existence of specific peaks of secondary radiation flux. We used the Lorentz peak fit concept in order to understand the characteristics and energy variation of SR flux peaks in the energy range from 1300 keV to 1600 keV as shown in Figures 4 and 5.

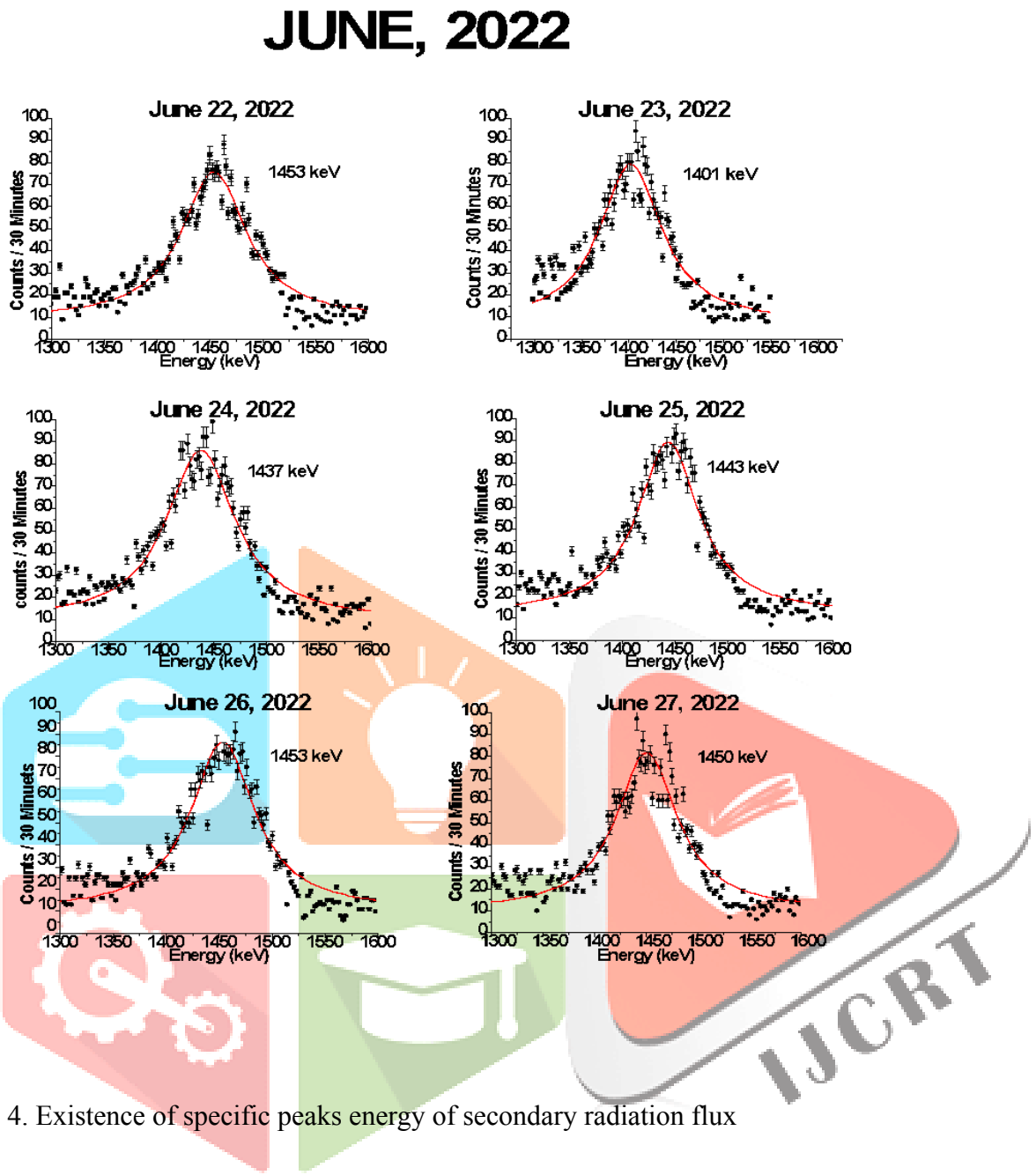

Figure 4. Existence of specific peaks energy of secondary radiation flux

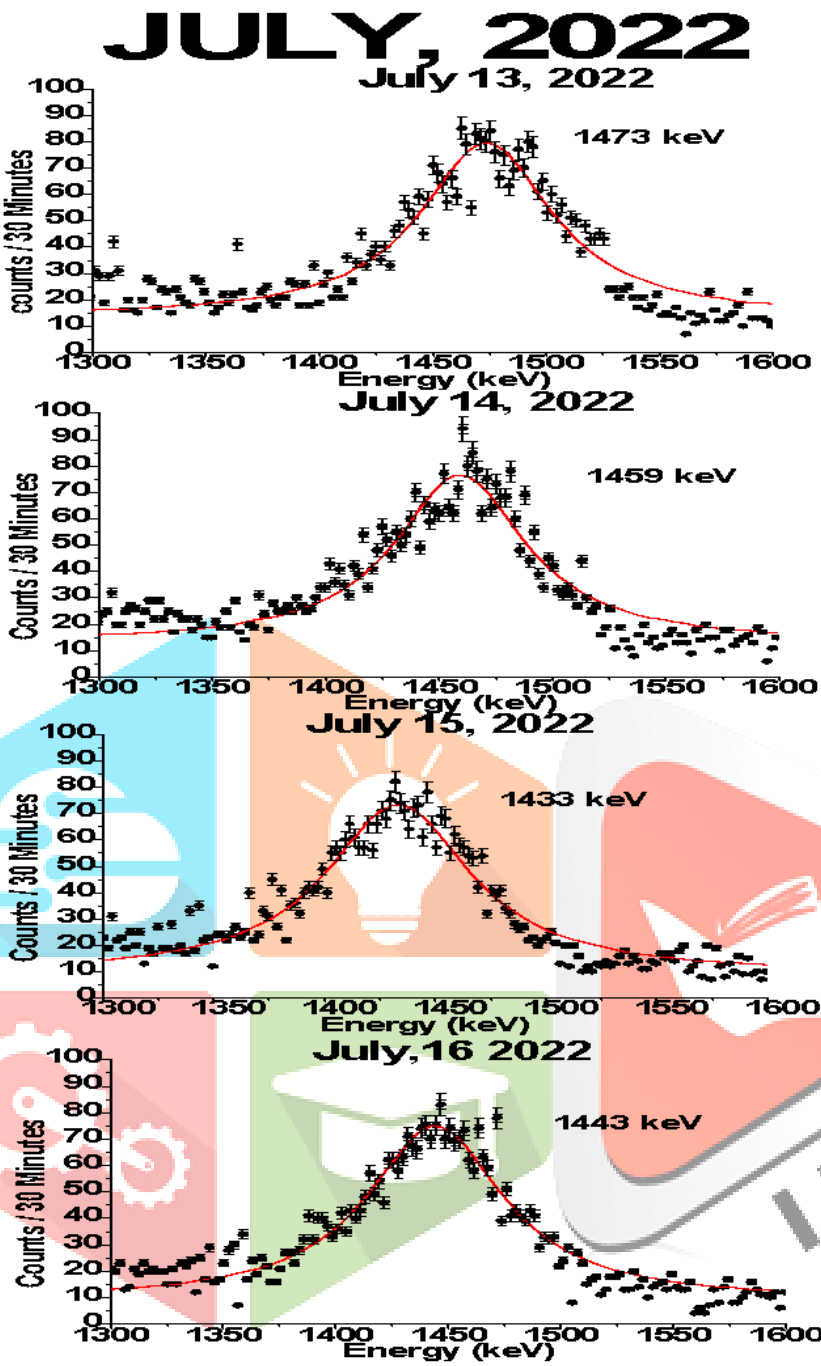

Figure 5. Existence of specific peaks energy of secondary radiation flux

Using the above panels (Figures 4 and 5) of secondary radiation flux energy we derived figures6 and 7 between date and energy in keV for the months of June and July 2022.

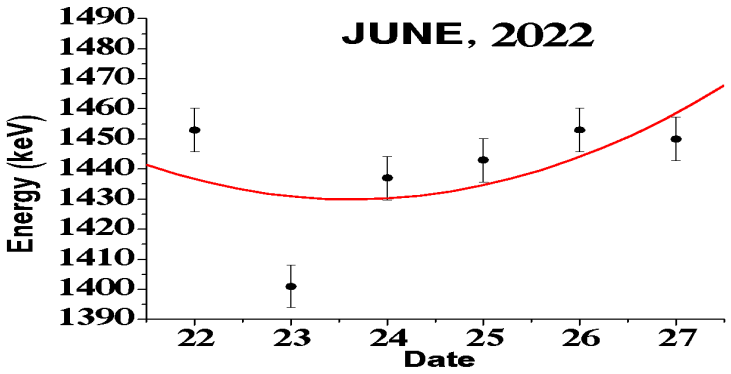

Figure 6. Secondary radiation flux peak Energies with dates

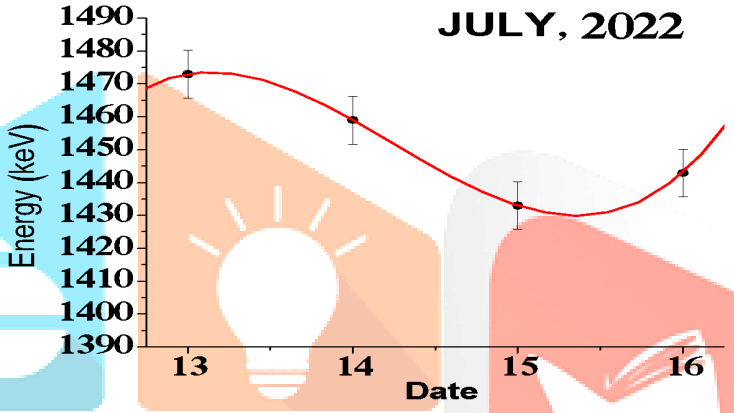

Figure 7. Secondary radiation flux peak Energies with dates

We combined figures 6 & 7 for the months of June and July 2022 between the date and Energy of secondary radiation flux to understand clear enhancement in secondary radiation flux energy on July 13, 2022 (Super Moon):

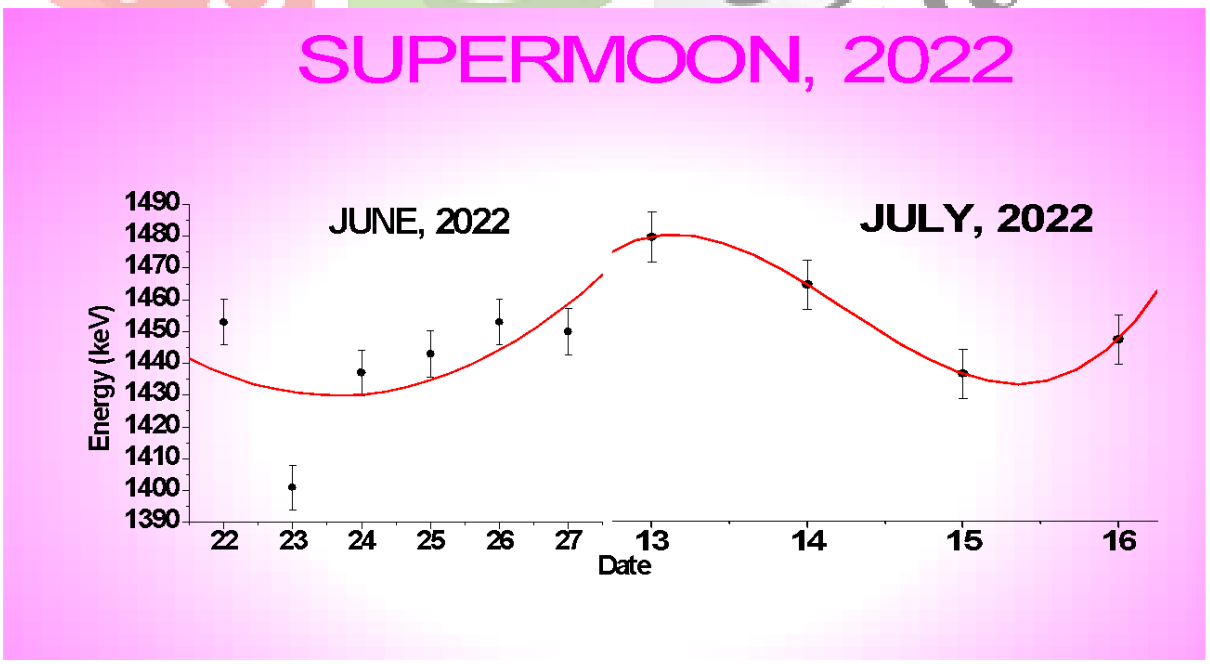

Figure 8. For the month of June and July 2022 between the date and Energy

Figure 8 signifies that on date July 13, 2022, there was a significant enhancement of secondary radiation flux energy i.e.,during perturbed condition (Super Moon). Observed energy during unperturbed conditions dates (Normal Days) were: on June 22- 1453keV, 23–1401keV, 24 – 1437keV, 25 – 1443keV, 26 – 1453keV, 27 – 1450keV and on July 14- 1459keV, 15 – 1433keV, 16 – 1443keV. On perturbed date (Super Moon) secondary radiation flux energy was July 13 –1473 keV. When we average all normal dates secondary radiation flux energy (Unperturbed Condition) then it is equal to 1441 keV.
To see the enhancement in secondary radiation flux energy on July 13, 2022, we used the following formula:

$$\% \text{ of Enhancement of Energy} = \frac{\text{Energy on July 13, 2022} - \text{Average of energy on normal dates}}{\text{Average of energy on normal dates}} \times 100$$

Using the above formula, we observed about 2.22 % Enhancement in secondary radiation flux energy on July 13, 2022.
The research study was accompanied by an astronomical event solar eclipse to observe radiation flux (Pareek D. and Sengar P. 2022). Lunar eclipse studies also conducted and observed variations of radiation flux (Pareek D. and Sengar P. 2021), (Pareek D. and Sengar P. 2022). Also, other research studies related to celestial objects and comet were carried out (Pareek, D. 2022), (Baregma. D. and Pareek, D. 2022). During the transit of the Sun across different constellations many experimental studies were carried out and observed variations of radiation flux (Pareek D. and Sengar P. 2022),(Pareek D and Purohit, P. 2021), (Purohit P. and Pareek D 2021), (Pareek D. 2022). Jupiter and Saturn great conjunction on December 21, 2020, an experimental study was navigated, and about a 2% decrement in radiation was observed (Pareek D. 2022). Change of radiation flux observed during change of angular position of Sun and planet Venus in space with the presence of constellation Pisces in the sky in the month of March 2021 (Purohit P. and Pareek D. 2022). The change of Position of the Moon in the Sky research study was conducted month of November 2020 and observed variation in radiation flux(Pareek D. 2022). The closest approach of Mars towards Earth on October 6 & 7, 2020, Mars at opposition on October 13, 2020, and the transit of Moon across different constellations and planets experimental studies were done in the month of October 2020 (Pareek D. and Sengar P. 2022). In all of these studies illustrate the Variation of radiation flux observed.

In this astronomical event (Super Moon) we observed enhancement of radiation flux emery which is significant. We found enhancement in energy of secondary radiation flux during the appearance of Super Moon.

Our Earth, a little corner of space is not a closed system, and the photon flux that sweeps around it originates from far beyond its outer limits. These Photon fluxes of several different components have an extraordinary penetrating power that enables it to reach the surface of the Earth ionizing the air and producing secondary flux. In an atmosphere above 50 km, the intensity of primary flux is almost the same as in interstellar space but at about 20 km secondary cosmic & solar flux produces a denser ionization. During different celestial events happening in the Sky modulated terrestrial secondary flux of cosmic & solar radiation.
In this unique experimental study, the obtained result can be understood as follows:

(A) During the Super Moon event the Moon was closest to Earth, therefore more intense reflected solar radiation entered in the atmosphere of Earth. Due to this more secondary radiation flux energy formed in the atmosphere as we observed at the surface of Earth during the Super moon astronomical event.

(B) The strong impact of primary high-energy solar and cosmic radiation flux on the surface of the Moon produces secondary emissions (mostly gamma rays, high energy photo electron, hard x-rays, muons, Protons, and neutrons) in the range of several hundred keV to MeV. The energy of this secondary emission flux is so large that gives such enhancement in energy at the closest approach of the Moon towards Earth.

4 Conclusions

A significant enhancement of secondary radiation flux energy of about 2.22 % was observed on date July 13, 2022. Such unique enhancement signifies for two reasons. The Moon is a reflector of Solar Radiation and at the time of the Super Moon,more intense radiations were reflected from the Moon surface. Also, secondary emissions from Moon surface entered in atmosphere of Earth and produced more energy from secondary radiations. Therefore, we observed more energy of secondary radiation flux in this Astronomical event.This experimental study gave the conclusion that during super Moon event on the surface of Earth, a significant enhancement of secondary radiation flux energy can be observed.The results of our experimental study gave a clue to researchers to conduct the similar study and verify it with advanced scientific methods and models. Also results of our study can help to understand the effect of the super Moon event on another branch of sciences Viz Botany, Chemistry, Zoology, etc. to conduct various such experimental studies in their respective branch and make models. In the future, such models will be helpful for astronomer's stay in space.

5 Acknowledgements

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6 References

1) Buchvarova, M. 2021.Galactic cosmic rays above the Earth's atmosphere. Journal of Physics Conference Series, 2255
Doi 10.1088/1742-6596/2255/1/012003
2) Inozemtsev, Ko., Kushin,V.V., StradiA., Ambrozova,I., KodairaS. SzaboJ, Tolochek R.V., Shurshakov V.A. 2018.Measurement of different components of secondary radiation on board international space station by means of passive detectors.Radiation protections dosimetry,181 **(4)**:412-417
https://doi.org/10.1093/rpd/ncy043
3) PareekD. and Sengar P.2022.Decrement of Secondary Gamma Radiation flux during Solar Eclipses January 4, 2011 and December 26, 2019 at Udaipur, India.Jordan Journal of Physics,**15(2):** 201- 206.
Doi: https://doi.org/10.47011/15.2.10
4) Pareek D. and Sengar P. 2021. Decrement of Secondary Gamma Radiation Flux during Lunar Eclipse June 16, 2011. Indian Journal of Science and Technology,**14(3)**: 245–250
https://doi.org/ 10.17485/IJST/v14i3.2232
5) Pareek D. and SengarP. 2022.Enhancement of Secondary Gamma Radiation Flux Energies in the Energy region 1400 keV to 1500 keV during Lunar Eclipse on June 16, 2011 at Udaipur, India. Jordan journal of Physics, 15**(2)**:125-136
Doi: https://doi.org/10.47011/15.2.3
6) Pareek, D. 2022.Enhancement of Secondary Gamma radiation Flux during Perihelion approach of Comet C/2020 S3 (Erasmus) Towards Sun on December 12, 2020 at Udaipur, India. "Sustainable Development for Society, Industrial Development, Material, Energy and Environment: Key Issues, Opportunities and Challenges". ISBN: 978-81-953847-8-5, pp 146-151
Doi: 10.5281/zenodo.6774781
7) Baregma, D. and Pareek, D.2022. Enhancement of secondary radiation flux during perihelion approach of comet c/2021 a1 (leonard) towards earth in month of December, 2021 at Udaipur, India, International Journal of Advance and Applied Research**. 9 (5)**: 701- 705
URL http://ijaar.co.in
8) Pareek, D. and Sengar,P. 2022. Transit of the Sun across Constellations Libra, Virgo and variation of Secondary Gamma Radiation Flux in Month November, 2018 and September, 2019 respectively at Udaipur, India. Jordan journal of Physics,**15 (2) 22**: 195-25.
Doi: https://doi.org/10.47011/15.2.9
9) Pareek, Dand Purohit, P. 2021. Transit of the Sun across constellation Libra and variation of secondary gamma radiation flux in the month of October and November, 2020 at Udaipur, India. Indian Journal of Science and Technology.**14(8)**: 718-724.

https://doi.org/10.17485/IJST/v14i8.263

10) Purohit, P. and Pareek, D. 2021. Transit of Sun across constellation Sagittarius and variation of Secondary Gamma Radiation Flux in January, 2021 at Udaipur India.*Nepal Journal of science and Technology (NJST)*. **20 (1)**: 29 – 34.
https://doi.org/10.3126/njst.v20i1.43351

11) Pareek,D. 2022. Transit of Sun Across Constellations Capricorns, Aquarius and Variation of secondary Gamma Radiation Flux in Month of February, 2021 at Udaipur, India, "Sustainable Development for Society, Industrial Development, Material, Energy and Environment: Key Issues, Opportunities and Challenges"., ISBN: 978-81-953847-8-5, pp 36-41
Doi: 10.5281/zenodo.6774781

12) Pareek, D. 2022. Decrement of Secondary Gamma Radiation Flux during Great Conjunction of Jupiter and Saturn on December 21, 2020 at Udaipur, India published in the international book "Sustainable Development for Society, Industrial Development, Material, Energy and Environment: Key Issues, Opportunities and Challenges". ISBN: 978-81-953847-8-5pp 51-56

13) Purohit, P. and Pareek D.2022. variation of secondary gamma radiation flux due to change of relative positions of Sun, Planet Venus and presence of constellation Pisces in month of March, 2021 at Udaipur, India published in the international book "Sustainable Development for Society, Industrial Development, Material, Energy and Environment: Key Issues, Opportunities and Challenges". ISBN: 978-81-953847-8-5 pp 140-145
Doi: 10.5281/zenodo.6774781

14) Pareek, D.2022. Change of Position of Moon in Sky and Effect on Secondary Gamma Radiation Flux in Month of November, 2020 at Udaipur, India published in the international book "Sustainable Development for Society, Industrial Development, Material, Energy and Environment: Key Issues, Opportunities and Challenges"., ISBN: 978-81-953847-8-5 pp 165-168.
Doi: 10.5281/zenodo.6774781

15) Pareek, D. and Sengar, P. 2022. Variation of secondary gamma radiation flux during closest approach of Mars towards Earth, Mars at opposition and transit of Moon across different constellations, planets in month of October, 2020 at Udaipur, India. Jordan journal of Physics. **15 (4)**: 409-416

Doi: https://doi.org/10.47011/15.4.10