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Transit Of Sun Across Constellations (Taurus And Gemini) And Variation Of Secondary Radiation Flux Energy In Month June, 2022 At Udaipur (Rajasthan), India.

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Abstract: Transit of Sun across constellations Taurus and Gemini experimental study was accompaniedat Udaipur (270 43' 12.00" N, 750 28' 48.01" E), India in month June 2022 using ground-based NaI (Tl) scintillation detector. Data were collected at intervals of half an hour. After analyzing data, we observed variation in energy of secondary radiation flux energy on comparison to other normal dates.

This study is carried out to observe secondary radiation flux energy at surface of Earth during transit of Sun in constellations.

We used ground based NaI (Tl) scintillation detector and dates of observations wereJune 14, 15, 16, 18, 20, 21, 22, 24, 25 and 27 (2022) in evening for half an hour. Variation of secondary radiation flux energy we observed. Energies on June 14- 1452keV, 15- 1439keV, 16 -1430keV, 18 –1399 keV, 20 – 1452 keV, 21 –1457keV, 22- 1459keV, 24- 1470keV, 25- 1483keV, 27- 1496 keV.

First time we reported, variation of secondary radiation flux energy during transit of Sun across constellations.

Keywords: Transit of Sun across constellations; Primary cosmic radiation; Constellations; Secondary radiation: Gravitational lensing; Gravitational pull

1 Introduction

Primary cosmic radiation has composition is about 89% protons, 10% of nucleus of helium, and about 1% of others heavier elements [1] and energy liesin range10^9eV- 10^{20}eV or more [2]. Secondary radiation formed when cosmic and solar radiation strike on atmosphere of the Earth resulting into formation of secondary particles known as secondary radiation [3]. Hence there is formation of shower of secondary particles in atmosphere [4]. This secondary particle shower comes down in atmosphere and increase rapidly [5]. In secondary particles there are presence of pions, muons, neutrinos gamma radiation, electrons and positrons and are able to reach on Earth's surface [6]. Secondary radiation has threeparts: electromagnetic component, nuclear fragments hadronic component and muonic- neutrinos component. This radiation can be detected using appropriate detector. When radiation passes near massive objects then bends due togravitational field of the object [7]. Astronomical objects may be Star, galaxy or a cluster of galaxies.

Many experimental studies were conducted during different events.

Astronomical event solar eclipses research studies were conducted [8-15] and observed variations of radiation flux. Lunar eclipses studies also carriedout and observevariation of radiation flux [16-18]. With help of scintillationcounterphases of Moon experimental study was conducted in the month of September 2000 and observed variation of radiation flux [19]. Another comet studies did by research groups [20-21]. Sun across different constellations experimental studies were conducted to observe variation of radiation flux [22-25].

Great conjunction on December 21, 2020 of Jupiter and Saturn, experimental study was conducted and about 2% decrement of radiation observed [26]. Variation of radiation flux observed during change of angular position of Sun and planet Venus in month of March, 2021[27]. Due to change of position of Moon in skyexperimental study was conducted in month of November, 2020 and observed variation of radiation flux [28]. Closest approach of Mars towards Earth on October 6 & 7, 2020, Mars at opposition on October 13, 2020 and transit of Moon across different constellations and planets experimental studies were done in month of October, 2020 [29].

In all of such studies Variation of radiation flux observed. During different celestial events and conditions happening in sky these events have modulated radiation flux. Therefore, after motivated from all above experimental studies we conducted this experimental study to observe secondary radiation flux energy on Transit of Sun across constellations astronomical event.

2 Experimental Set-up and Observations

Scintillation counter system of Nucleonix make (SD 152 F) flat type (Figure 1) used to detect the secondary radiation flux. Size of this detector [NaI (Tl)] crystal is 2" x 2". It is optically coupled with photo multiplier tube. Then 1k multichannel analyzer (MC 1000 with 1024 channel) of Nucleonix make is connected. It has high voltage and shaping amplifier. For this experimental study the Scintillation counter system 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. Size of detector [NaI (Tl) crystal] is 2" x 2" and optically coupled with photo multiplier tube. This gives excellent stability, superior performance as well as good resolution in the range of 8% - 9.5% using standard source Cs-137. The detector type is SD152F.

1k multi - channel analyzer (MC 1000 with 1024 channel) of Nucleonix make is connected with detector system. It has high voltage and shaping amplifier. This device is the important part for the nuclear of system. We used in our counter system MCA with 1K channel (MC-1000), it has 1024 channels.

This type of detector assembly gives excellent stability and has superior performance in the ranger of 8.0 to 9.5 for Cs-137 standard source. This detector is connected with photomultiplier tube EMI 9857 or its equivalent. It provides approx. 25 gain. Less than 5mV noise is generated with operating voltage of 700 to 900. It gives in output positive Tail Pulse and output impedance is about 90 Ohms. With help of ANUSPECT Software the data are collected in the laptop as the output of MCA.

Data were collected for half an hour on dates June 14, 15,16,18,20,21, 22, 24, 25, 27For calibration of scintillation detector we used standard source Co^{60} (Figure 2) and Applied voltage on detector was 390 volt with gain 30 for all observations dates. Always this set of value i.e. voltage and gain was kept constant.

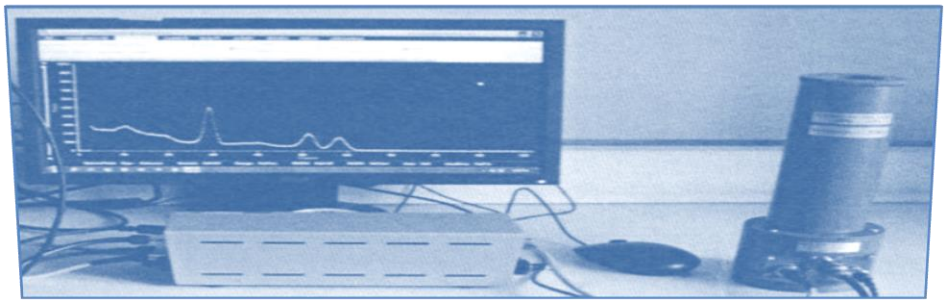


Figure 1 (Scintillation Counter System)

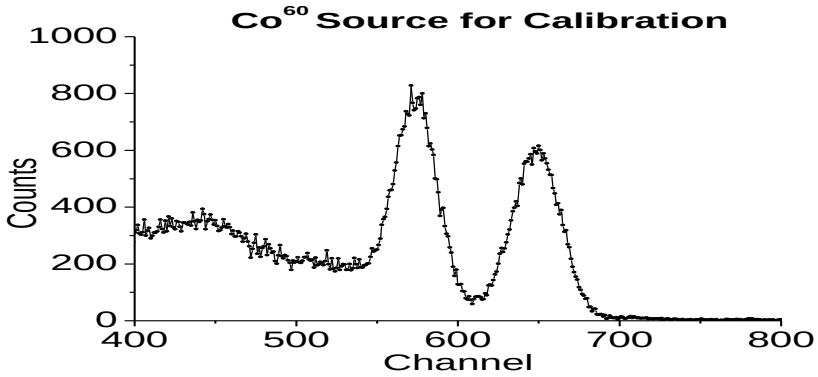


Figure 2 (Co ^{60} Source peaks for calibration)

3 Results and discussions

Data were collected for half an hour on dates June 14, 15, 16, 18, 20, 21, 22, 24, 25, 27 at Udaipur. As depicted in the panels of figures 3 and 4 the energy spectra of secondary radiation flux on June, 2022 in the energy rangebetween 1000 keV and 2000 keV

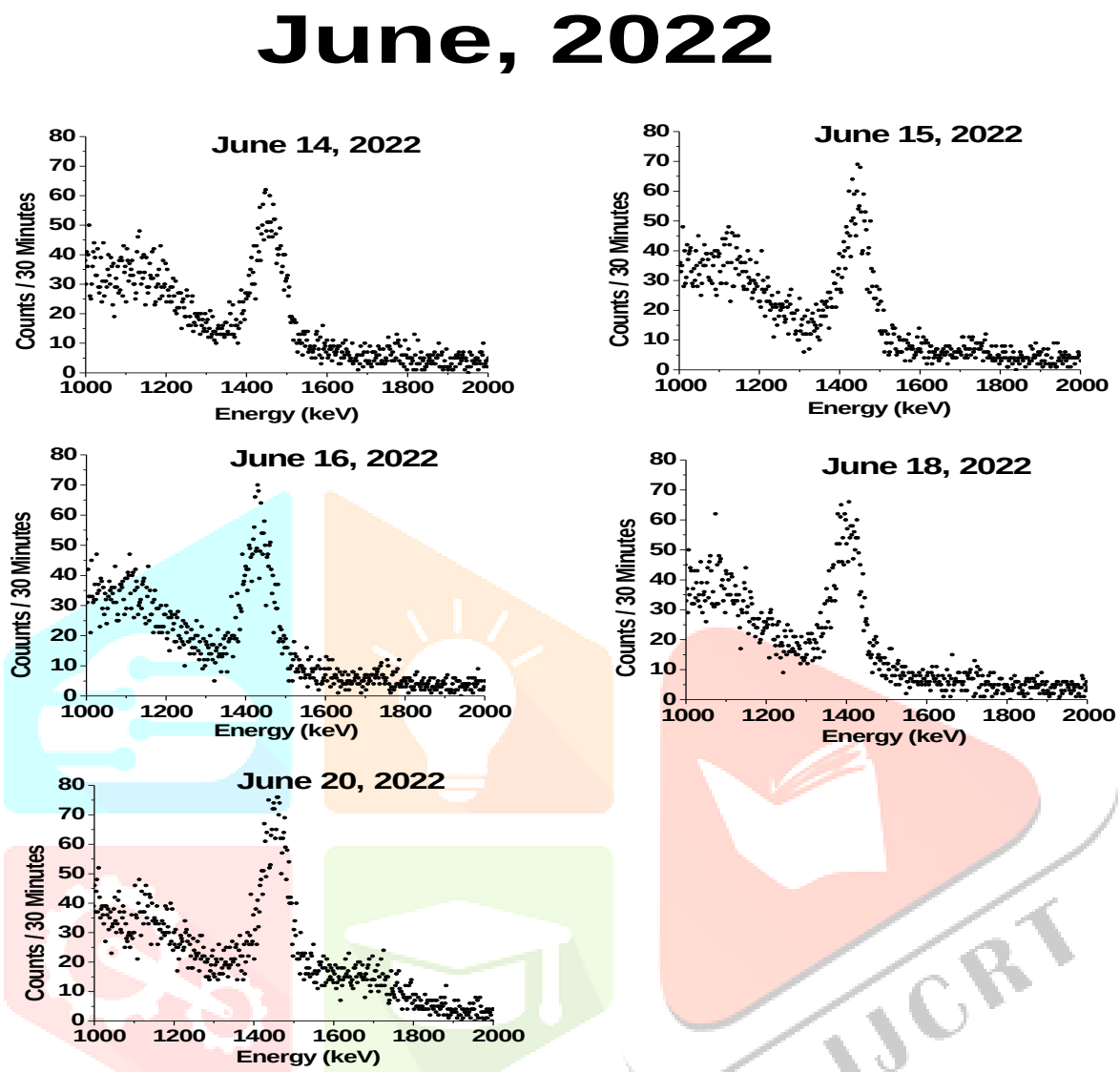


Figure 3 (Secondary radiation flux energy with counts)

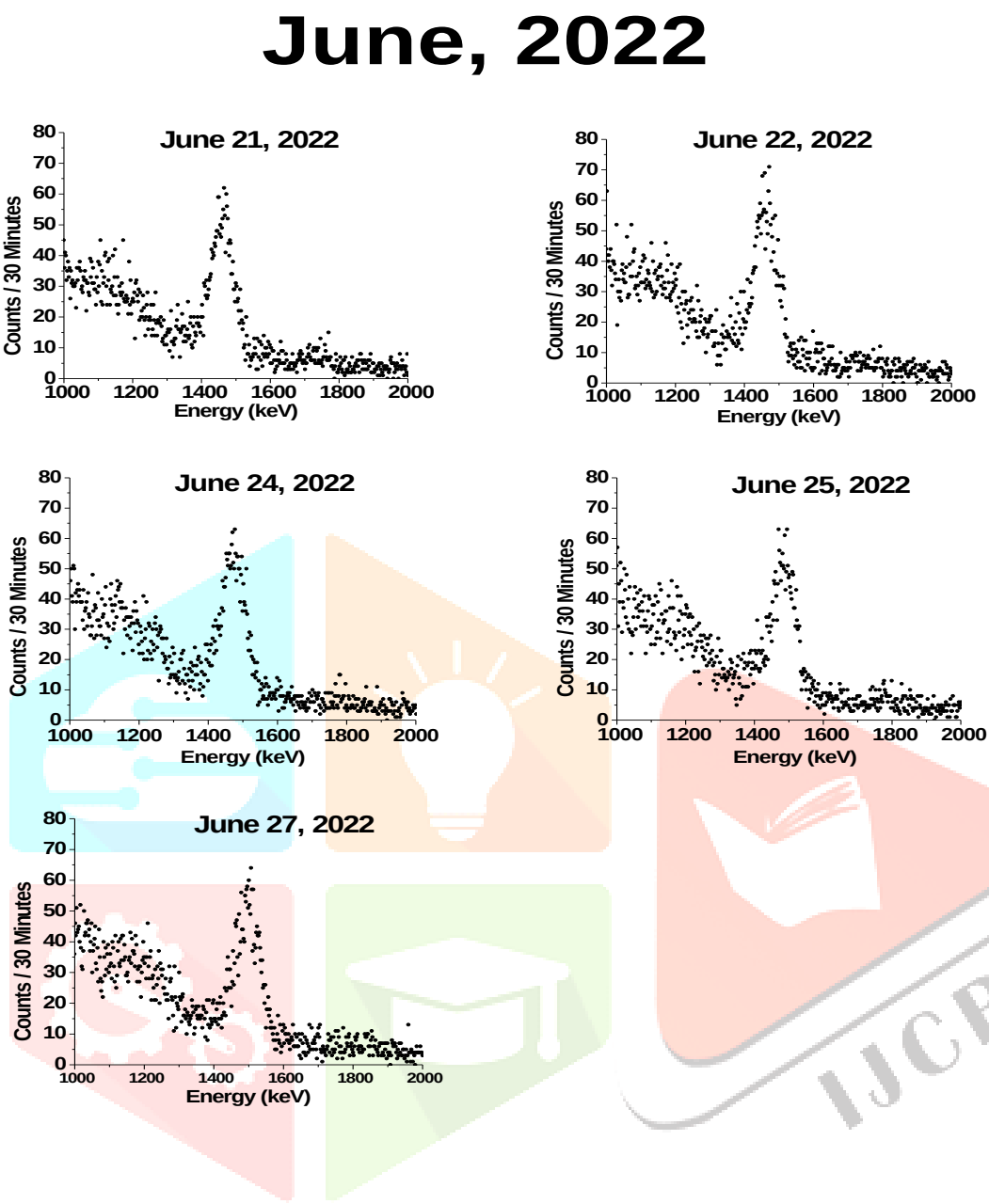


Figure 4(Secondary radiation flux energy with counts)

Figures of 3 and 4 show the existenceof specific peaks of secondary radiation flux. We used Lorentz peak fitconcept in order to understand the characteristicsand energy variation of SR flux peaks in theenergy range from 1300 keV to 1600 keV as shown in below figures 5 and 6

June, 2022

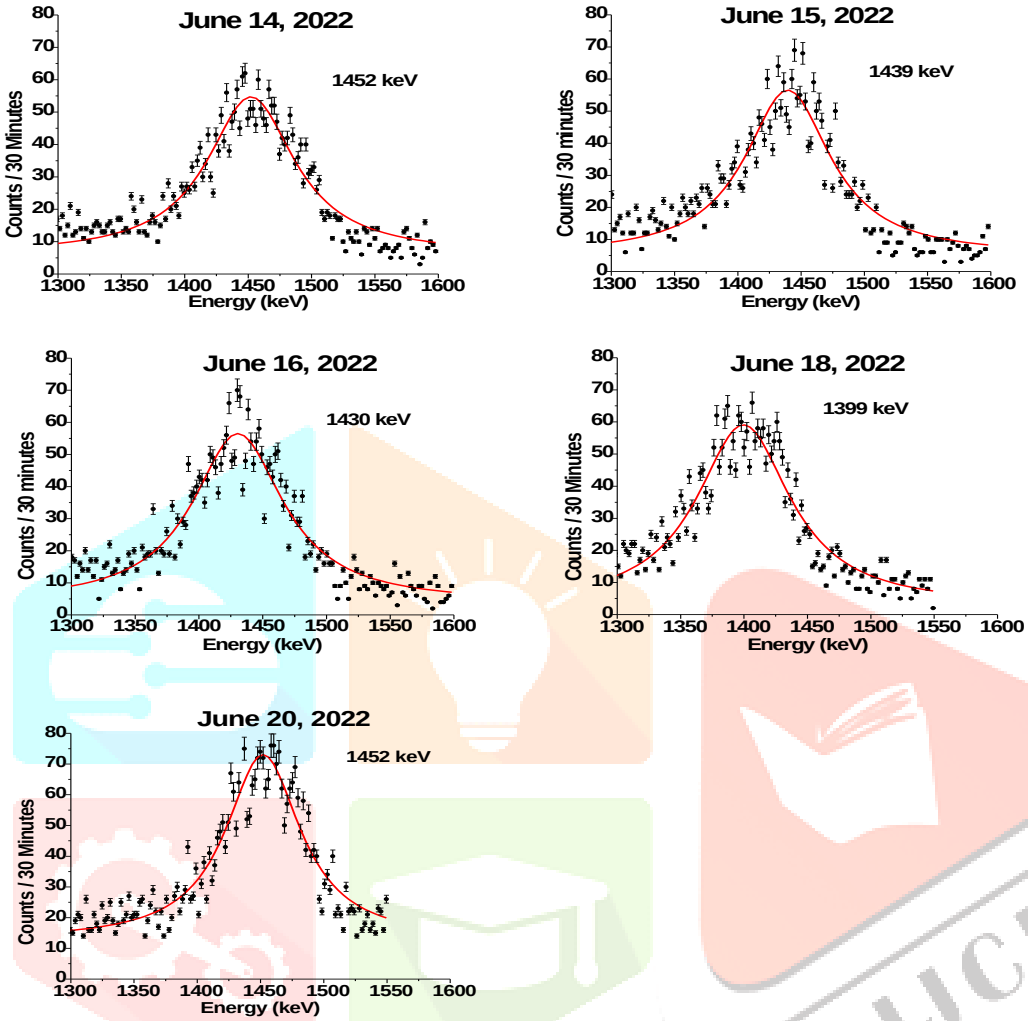


Figure 5 (Existence of specific peaks of secondary radiation flux energy)

June, 2022

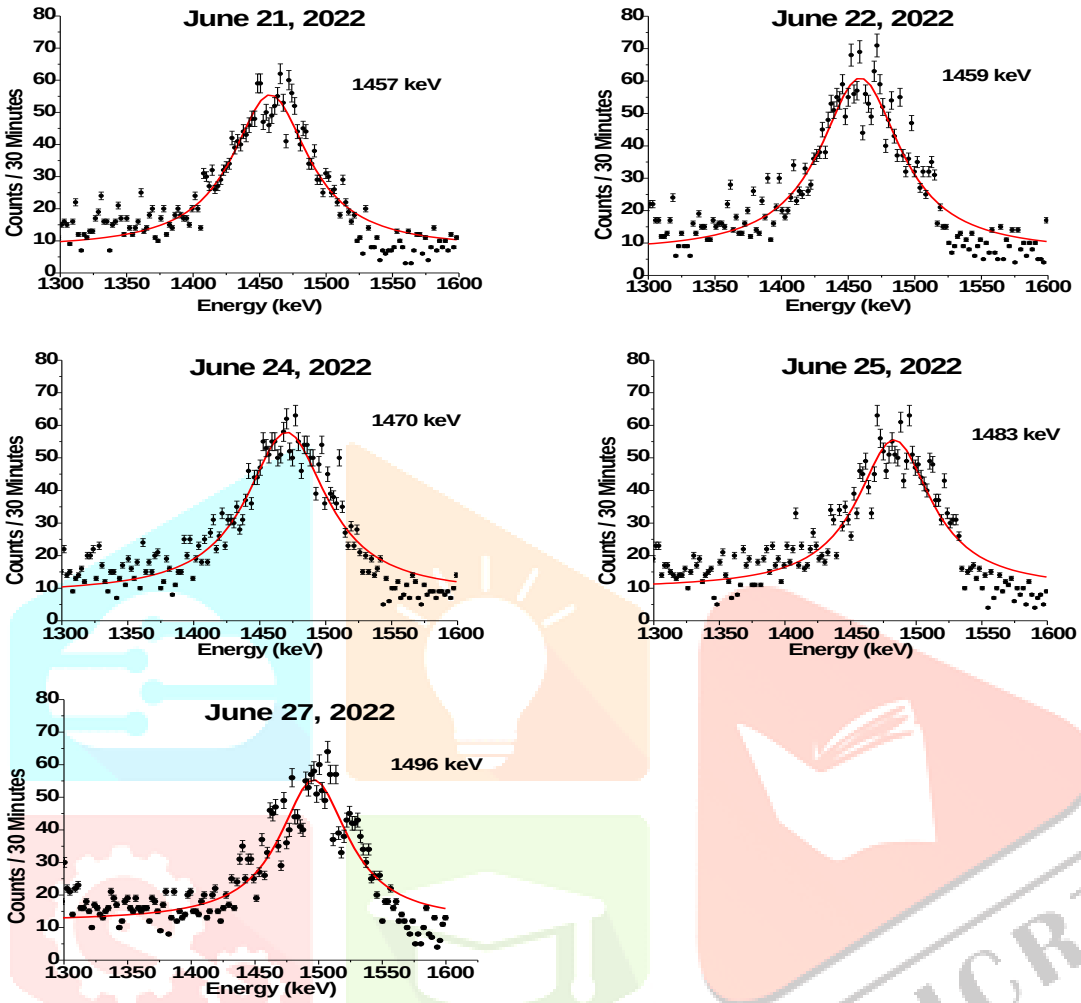


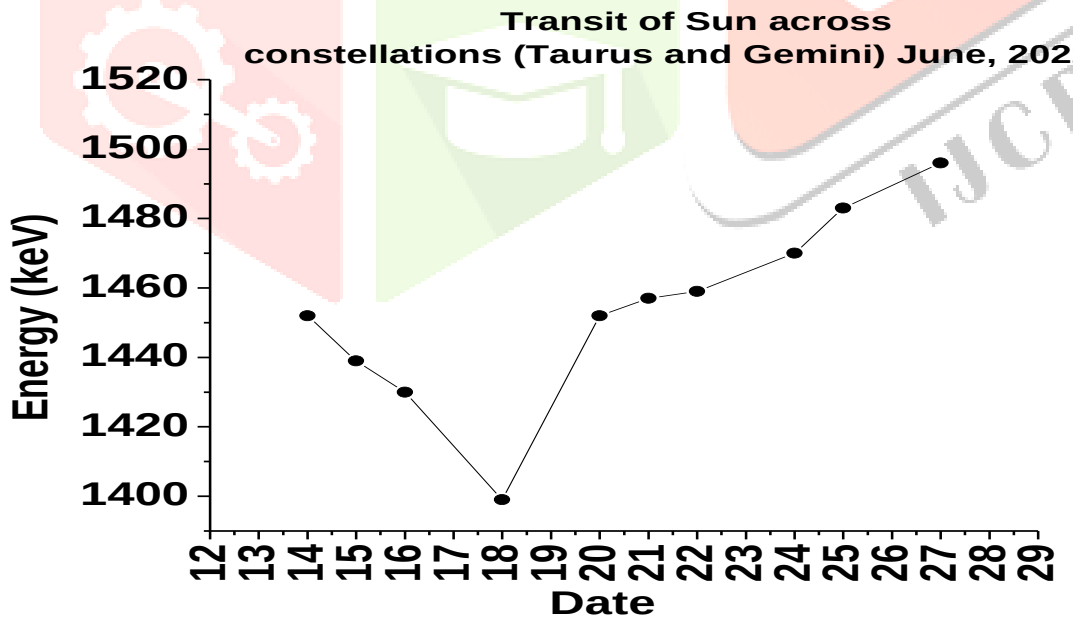
Figure 6(Existence of specific peaks of secondary radiation flux energy)

Using above panels of SR flux counts data with energy files, we made Table 1 which represents secondary radiation flux energy with respect to dates in month of June, 2022 for half an hour.

Sr. No.	Date	Energy (keV)
	June, 2022	
1	14	1452
2	15	1439
3	16	1430
4	18	1399
5	20	1452
6	21	1457
7	22	1459
8	24	1470
9	25	1483
10	27	1496

Table 1(Secondary radiation flux energy with date)

Using Table 1 we made following figure 7 between date and energy in keV for month of June, 2022



7 (Variation of secondary radiation flux energy with date)

Table 1 and Figure 7 clearly showed the variation of secondary radiation flux energy during Transit of Sun across constellations. On date June, 14 the Sun was just in constellation Taurus after this date Sun started to move away from this constellation and started to approach towards constellation Gemini. Therefore, energy of secondary radiation flux starts to increase and it became maximum on date June, 27. On date June 18 the energy

of SRF was 1399 keV, while on date June 27 the energy was 1496. Therefore about 6.93 % increases in energy of secondary radiation flux.
On Date June 14 the Sun was just in constellation Taurus and we observed secondary radiation flux energy 1452keV. After this date the Sun was shifted away to this constellation and we observed less energy up to date June 18. On date June 18 the energy of SRF was 1399 keV, while on date June 27 the energy was 1496. Therefore, on comparison thedate June 18, with date June 27 about 6.93 % increases in energy of secondary radiation flux energy.

4 Conclusions

From Figure 7 and Table 1we conclude that from date June 14, 2022 to June 18 there was decrease in energy of secondary radiation flux and then from June 20 to June 27 energy started to increase. On date June 27 we observed highest energy in this observation.
Many experimental studies were conducted to observe variation of secondary radiation flux at surface of Earth during transit of Sun across different constellations (Pareek, D. et al. 2022; Pareek, D. et al. 2021: Purohit, P. et al. 2021; Pareek, D. 2022).
In previous experimental studies (Pareek, D. et al. 2022) observed variation of SGR fluxduring transit of Sun across constellations Librain month November, 2018 andVirgo constellation in month September, 2019at Udaipur. As a function of time data were collected using ground based NaI (Tl) scintillation detector. Results of this study revealed that in month November 2018, secondaryradiation flux decreases from dates 13November to 20 November. On date November 13 the Sun was in the constellation Libra while onanother dates of observations the Sun was shifted away from thisconstellation, therefore decreasedinsecondary radiation flux observed. For the MonthSeptember, 2019 we started observation from 4September and secondaryradiation flux increased. From4 September onwards the sun was approachingtowards Virgo constellation.
Another research experimental study (Pareek, D.et al. 2021) was conducted from November 2, 2020when the Sun wasapproaching towards Libra Constellation. On dateNovember 12 the Sun was in the constellationLibra, and we reported highest counts in thisexperimental study.
In the research study (Purohit, P. et al., 2021), cadences of data werecollected at interval of half an hour. The data fileswere stored in computer for half hour duration aroundon January 8, 9, 11, 13,14, 17 and 18. The objective in this study is to observesecondary gamma radiation flux during transit of the Sunacross the constellation Sagittarius. Analyzed data revealsignificant variation of secondary gamma radiation flux (SGR). On the date January 8the Sun was in constellation Sagittarius andwe observed the highest counts in this study. Further on date January 14 we again observedslight increase in the counts. On this date fiveCelestialobjects close to each other.
Experimental study was conducted during transit of Sun across constellations Capricorns and Aquarius in month of February, 2021 (Pareek, D., 2022) using ground based NaI (Tl) Scintillation detector. Data files were stored in computer for half hour duration from time 17.00 IST to 17.30 IST on the dates February 9, 11, 12, 13, 15, 16, 17 and 19. Analyzed data showed that on February, 9 there were highest counts in this experimental study. On this date the Sun, planets Jupiter, planet Saturn, Planet Venus were in the constellation Capricorns. Planets Mercury was close to constellation Capricorns. After February, 9 the Sun started to shift away from this constellation Capricorns and we observed decrease in counts on the comparison with February, 9.

Such type of effects one canunderstand with help of combined gravitationallensing effect and gravitational pulling effect onthe background radiation due to Constellation, Sun and radiation from constellation. Collectively these celestial bodies produce more gravitationallensing and more radiation bent. Therefore, moresecondary flux is produced in the atmosphere ofthe Earth.
In all above experimental studies observed variation of secondary radiation flux due to transit of Sun in constellations. Results of above experimental research studiesencouraged us to conduct the present experimental study.
In this study we observed variation of secondary radiation flux energy first time and the findings are:
Variation of secondary radiation flux and significant enhancement about 6.93 % we observed. Probable reasons of this type findings is combined gravitational lensing effect and gravitational pulling effect on the background radiation due to Constellation, Sun and radiation from constellation. Collectively these celestial bodies produce

more gravitational lensing and more radiation bent. Therefore, moresecondary flux energy is produced in the atmosphere ofthe Earth.

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