Variation of Intensity Flux of Solar Secondary Gamma Radiation during Lunar Eclipse

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Abstract : Variation of intensity flux of solar secondary gamma radiation during the celestial events lunar eclipse was observed at Udaipur (Rajasthan). Data were collected with respect to time using the scintillation counter for one and half hour (90 Minutes). Analyzing data got information of variation of intensity flux of solar secondary gamma radiation (SSGR). On comparison to normal day and Lunar eclipse day drop in intensity flux of SSGR was about 11.50%.

Index Terms **- Lunar Eclipse, obstruction of solar radiation, solar secondary gamma radiation (SSGR)**

I. INTRODUCTION

Charged particles cosmic radiation travels at nearly the speed of light and coming towards the Earth from all directions. Composition of such radiation is about 89% of these nuclei are protons, 10% of helium, and 1% of others heavier elements [1]. There is another class of cosmic radiation and is called solar energetic particles (SEP) that are corresponded with energetic events on the sun. When radiation from sun reaching towards the earth atmosphere, strikes with atoms of the upper atmosphere of the Earth and there is production of "secondary" particles. Secondary particles consist of gamma radiation, pions, muons, and neutrinos. Produced secondary gamma radiation from SEP known as secondary solar gamma radiation (SSGR), which can be detected using appropriate detector on ground (Kodama, et al. 1983; Chilingarian, et al., 2010) [2].

During celestial event lunar eclipse 15th June 2011, data were collected using scintillation detector on dates 13, 14 and 16 June normal days and on lunar eclipse day 15 June 2011 from 1.00 A.M. to 2.30 A.M. every day. Maximum Lunar eclipse was at time 1.40 A.M. in India. During the Lunar eclipse the Earth comes between the Sun and the Mon and may produces obstruction effect. During maximum eclipse, the solar energetic particles (SEP) reaching towards the earth atmosphere are obstructed by the Earth. This fact was observed in this experimental study.

II. EXPERIMENTAL SET-UP AND OBSERVATIONS

In this experimental study scintillation detector of Model 802, make: Canberra Genie 2000 used to detect the secondary solar gamma radiation. Photo multiplier tube (PMT) Model 2007P coupled with NaI (Tl) crystal 50 mm thick and 44.5 mm in diameter with high tension voltage supply model 3102D of 1100 Volts DC was used. Using amplifier Model 2022 negative signal of about 0.5 Volts was amplified to 5 Volts positive pulse. Finally this signal was fed to multi channel analyzer having multi channel Buffer of all 1024 energy channels. This counter system was used to collect the counts as a function of time.

III. ANALYSIS AND RESULTS

Figure-1 shows the total integrated counts over one and half hour of secondary solar gamma radiation flux as a function of time on normal days 13, 14 16 June and lunar eclipse day 15 June 2011. Total counts of secondary gamma radiation on the normal day 13 June was 189740, on the date 14 June the counts were 176994, on the date 16 June the counts were 167994 and on the eclipse day 15 June the counts were 167910.

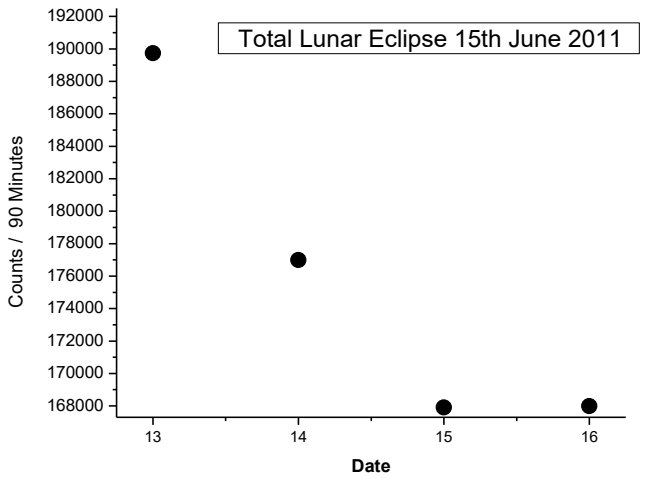

Fig. 1: Total integrated counts over the one and half hour of secondary solar gamma radiation flux as a function of time.

On comparison to 13 June (normal day) counts with eclipse day counts (15 June 2011) there was a drop of integrated counts to 21,830 i.e. about 11.50% decreases in the counts of solar secondary gamma radiation flux. The result clearly shows the obstruction effect by Planet Earth during maximum Lunar eclipse.

IV. DISCUSSIONS

The observed results of the present experimental study for the variation in secondary solar gamma radiation flux can be understood by the following argument:
The planet Earth produced obstruction to the solar energetic particles (SEP) reaching towards the earth atmosphere during Maximum Lunar eclipse. On the Lunar eclipse day the obstruction effect by the planet Earth becomes significant and it cuts radiation flux causing drop in the counts of secondary gamma radiation flux. The drop in flux was observed by us about 1150% during maximum lunar eclipse.

V. ACKNOWLEDGMENT

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