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## Detection of transient ELF emission caused by the extremely intense cosmic gamma-ray flare

Yasuyuki Tanaka<sup>1\*</sup>, Masashi Hayakawa<sup>2</sup>, Yasuhide Hobara<sup>2</sup>, Kozo Yamashita<sup>3</sup>, Mitsuteru Sato<sup>3</sup>, Yukihiro Takahashi<sup>3</sup>, Toshio Terasawa<sup>4</sup>, Tadayuki Takahashi<sup>1</sup>

<sup>1</sup>ISAS/JAXA, <sup>2</sup>Univ. of Electro-Communications, <sup>3</sup>Hokkaido Univ., <sup>4</sup>ICRR

We report on the first clear detection of transient Extremely-Low-Frequency (ELF) signal caused by an extremely intense cosmic gamma-ray flare. On 2004 December 27, the brightest gamma-ray flare ever recorded was observed by numerous satellites. A transient ELF emission observed at Moshiri and Onagawa in Japan exactly coincided with the peak time of the flare, and its wide pulse width of ~40 ms disfavors the possibility of lightning origin. Furthermore, the two horizontal components of ELF magnetic field data recorded at ESRANGE in Sweden showed clear transient Schumann resonance waveforms. The source direction determined by the Lissajous method roughly corresponds to the subflare point. The chance probability that a sprite occurs within 30 ms of the peak flare time is ~0.025%, which again clearly excludes the sprite origin. Thus, a bright cosmic gamma-ray flare is a new source of transient ELF radio signals observed on the Earth.

Keywords: ionospheric disturbance, gamma-rays, ELF, Schumann resonance