THE MULTIPLE ROUND TRIP MESAUREMENT OF COSMIC DUST FLUX COMPLETED BY IKAROS-ALADDIN IN THE INNER PLANETARY REGION. H. Yano[1,2], T. Hirai[1,3], C. Okamoto[2], M. Fujii[4], M. Tanaka[5], and IKAROS-ALADDIN Team[1,2], [1]JAXA/ISAS, (3-1-1 Yoshinodai, Chuo-ku, Sagamihara, Kanagawa 252-5210, JAPAN, e-mail: yano.hajime@jaxa.jp), [2] JAXA/JSPEC, [3]Graduate University for Advanced Studies, [4]FAM Science, [5]Tokai University.

Introduction: ALADDIN dust detector made of 0.54 m^2 PVDF sensors onboard the IKAROS solar sail spacecraft successfully detected more than 2500 cosmic dust impacts in 17 months since its deployment in June 2010. It made almost 1.5 round trip cruising between the Earth and Venus orbits during its dust detection and unveiled the finest dust flux structure above 1 micron size ever in the region compared to previous, rare spacecraft in 1970's and 1990's.

ALADDIN Description: In May of 2010, the world's first interplanetary solar sail demonstrator called the Interplanetary Kite-craft Accelerated by the Radiation of the Sun (IKAROS) was launched by an H-IIA rocket. On the anti-Sun face of its 7.5-micron thick polyimide sail membrane, a large-area but still light-weight dust detector made of 8 channels of 9-20 micron-thick PVDF were attached. This detector is called the Arrayed Large-Area Dust Detectors in INterplanetary Space (ALADDIN) and has effective detection area of 0.54 m^2 with in order to count and time hypervelocity impacts by micrometeoroids larger than micron size during its interplanetary cruise. The sensors filter electronic, thermal and vibration noises and record time, peak hold value, and relax duration of signals of micrometeoroid impacts.

The first objective of ALADDIN is to test this large PVDF array system on thin sail membrane in the interplanetary operation and the second objective is to measure heliocentric flux variance inside the orbit of the Earth (~1.0 AU) down to the vicinity of Venus (~0.7 AU) continuously, and opportunistic detections of possible fine dust structures (flux anisotropy)..

During the 16-month cruising between June 2010 and October 2011, ALADDIN has successfully measured more than 2500 dust impacts flux each of which separated by a 24-hour bin, thus enabling to discuss heliocentric dependency of the flux variation around >10^-12 g mass range in the finest detail among any previous spacecraft such as Helios-1/2 and Galileo.

This paper reports all of its detection results. The ALADDIN dust flux in 2010-2011 shows continuous raising of the flux about an order of magnitude between the Earth and Venus orbits, for both inward cruising to its perihelion and outward cruising to its aphelion; it is also generally consistent with flux trends of Helios in 1970's and Galileo in 1990's although temporal and spatial resolution of the IKAROS results are much finer than these previous spacecraft. Some fine structures in different location and epochal variations at the similar heliocentric distance but different orbital position seem evident, which may imply the infrared dust enhancement in the trailing edge of the Earth, unknown cometary dust trails, and a possible flux enhancement near Venus.

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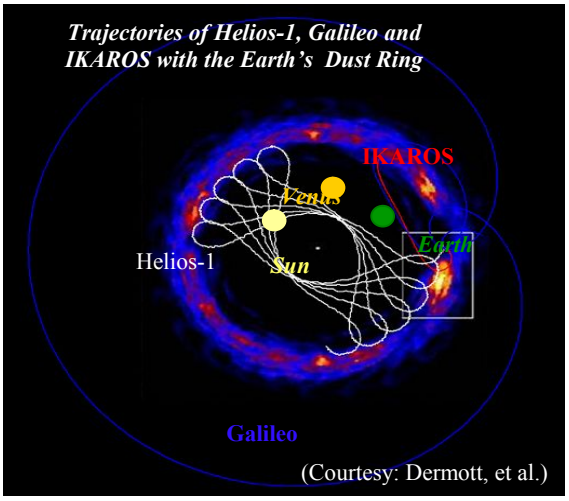

Fig.1 Trajectory comparison among IKAROS solar sail spacecraft and pervious spacecraft

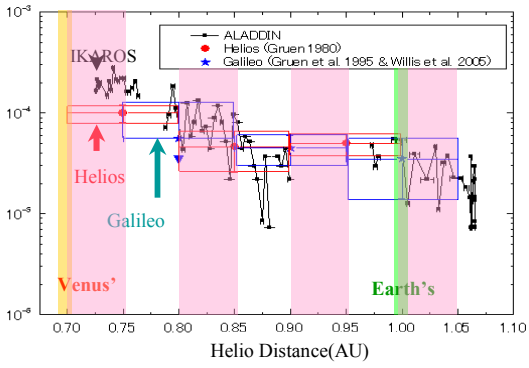

Fig.2 Dust flux comparison among IKAROS, Galileo and Helios-1.