

Mars Dust Counter (MDC) on Board NOZOMI: Summary of Observation of Interplanetary and Interstellar Dust between 1998 and 2002

Sho Sasaki[1]; Eduard Igenbergs[2]; Hideo Ohashi[3]; Robert Senger[2]; Sho Sasaki MDC Group[4]

[1] Earth and Planetary Sci., Univ. Tokyo; [2] TU-Munich; [3] Dep. Ocean Sci., Tokyo Uni. Marine Sci. & Tech.; [4] -

The Mars Dust Counter (MDC) is an impact ionization dust-detector on board ISAS Mars mission NOZOMI. Although its weight is as small as 730g, MDC can determine mass (between 10⁻⁷ and 10⁻¹⁵ g), velocity, and direction of a dust particle using change of impact-induced charge. NOZOMI is a spin-stabilized satellite with high gain antenna on its top. Its spin axis is usually pointing to the Earth to keep high telemetry rate during the interplanetary cruising phase. The sensor aperture axis is 135 degrees from the spin axis of NOZOMI. Since the solar direction angle (Sun - NOZOMI - Earth) is always less than 45 degree, the MDC sensor box can thus avoid direct sunlight which would increase noise signals due to photoelectrons.

Just after the launch of NOZOMI in 1998 July, MDC started observation. The main purpose of MDC is to detect predicted Martian ring or torus whose dust particles would come from Phobos and Deimos. ISAS revised the NOZOMI orbital plan that leads to a prolonged transfer phase until Mars insertion in December 2003. MDC had been observing interplanetary dust particles until April 2002, when strong solar flare would have cause a trouble on a part of NOZOMI power system. The trouble was not recovered until the end of 2003; NOZOMI gave up observation around Mars.

Between 1998 and 2002, MDC has detected about 100 real impacts of dust particles. Among them, MDC has detected more than 20 impact signals during this circumterrestrial phase. In November 1998 around the Earth, NOZOMI encountered the Leonids meteoroid stream. MDC detected two dust impacts, but directional analysis showed that those particles probably did not belong to the Leonids stream particles.

In the interplanetary cruising observation from 1999, NOZOMI takes an elliptic orbit whose perihelion and aphelion are at the Earth orbit (1.0AU) and at the Mars orbit (1.5AU), respectively. From March 10, 1999, the spin axis of NOZOMI was pointing to the Earth on the ecliptic plane. MDC has detected about 80 interplanetary particles. From high velocity and direction, several particles are interpreted as interstellar origin. Very high velocity particles (higher than 40km/s) are detected only during the cruising phase. In 2000-2001 cruising season, MDC detected similar number of dust particles but fewer high velocity particles than 1999 cruising season. The difference between 1999 data and 2000-2001 data could be ascribed to the change of dust detection efficiency according to NOZOMI direction rather than the change of interstellar flux.

In 2003 we started new onboard impact selection algorithm and revised version of on board program with data compression. Using them, MDC could have stored more real impact signals without downloading for several months. This should have been useful during observation around Mars.

Group members and collaborators on MDC project:

Sho Sasaki (Co-PI), Eduard Igenbergs (Co-PI), Hideo Ohashi, Ralf Muenzenmayer, Walter Naumann, Robert Senger, Franz Fischer, Akira Fujiwara, Eberhard Gruen, Yoshimi Hamabe, Gerd Hofschuster, Heinrich Iglseider, Ingrid Mann, Hideaki Miyamoto, Tadashi Mukai, Ken-ichi Nogami, Hakan Svedhem.