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ARD (Alpha-Ray Detector) on board SELENE: Design, in-orbit performance and scientific outcome

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Measurement of alpha-particles from ^{222}Rn and ^{210}Po in the decay series of ^{238}U on the moon provides informaton on sub-surface distribution of uranium, gas emisson on the lunar surface, and hence the crustal structures. Radon alpha-particles were detected by the experiments on board Apollo 15, 16, and Lunar Prospector. They revealed radon emanantion in the Aristarchus region during the observation periods. Indirect evidence of time variation of the gas emanation sites, and radon emanation in the last several decades at sites on the edges of mare regions. However, the spatial resolution was limited, and time variation was not directly observed because of the insufficient statistics of the data in both experiments and relatively short observation periods in the case of Apollo. Alpha-Ray Detector (ARD) on board of the Japanese lunar explorer SELENE was designed to observe the alpha-particles with improved statistics. It is an array of 48 SSD chips with anti co-incidence to reduce the cosmic-ray background. The effective area is 326 cm^2 which is more than an order of magnitude larger than the detectors in the previous missions. This paper introduces the design of the ARD and reports its in-orbit performance and the scientific outcome. Although the anti co-incidence function did not operated properly in the orbit, the large area of the detector made it possible to map the radon alpha-particle intensity distribution with improved spatial resolution and detect time variation of the radon emanation. Concentration of radon emanation in the last several decades was observed at craters in Aristarchus and Kepler regions.

Biography

Masayuki Itoh is a Professor at the Graduate School of Human Development and Environment of Kobe University. He recieved PhD from the University of Tokyo in 1988. His research field is observational astrophysics. He participated in the Japanese X-ray astronomy missions including Ginga, Asuka, and Suzaku. He is a member of the SELENE/ARD and is playing leading role in the in-orbit calibration and analysis of the data.

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