

はやぶさリエントリ観測：惑星間空間からの史上3例目の人工火球イベント

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Observation of HAYABUSA reentry: at the third opportunity of man-made fireball from interplanetary orbit

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After 7 years challenging cruise in the solar system, JAXA's spacecraft HAYABUSA (MUSES-C) did come back to the Earth on June 13, 2010. HAYABUSA, the first sample-return explorer to a minor planet, landed on Itokawa (25143) in 2005 (Fujiwara et al., 2006), capturing surface particles on the S-type minor planet into its SRC. Following to the reentries of NASA's GENESIS in 2004 (Jenniskens et al., 2004) and STARDUST in 2006 (Edwards et al., 2007), the return of HAYABUSA SRC (Sample Return Capsule) was the third reentry event directly from the interplanetary transfer orbit to the Earth at a velocity of over 12 km/s. It was the first opportunity of such kind of return for Japanese spacecraft. After the successful resumption of the SRC, it was carefully sent to ISAS/JAXA, and at present, small particles expected to be the first sample-return materials from the minor planet are carefully investigated.

In order to obtain precise trajectory information to ensure the quick procedure for JAXA's SRC resumption team, we observed the HAYABUSA SRC reentry by optically in Australian night sky. High-resolution imaging and spectroscopy were carried out with several high-sensitivity instruments to investigate thermal-protection process of TPA (Thermal Protection Ablator) as well as interaction process between SRC surface materials and upper atmospheric neutral and plasma components. Moreover, shock waves were observed by infrasound and seismic sensor arrays on ground to investigate propagation process of supersonic waves as well as air-to-ground coupling process at the extremely rare opportunity.

With respect to nominal trajectory of the HAYABUSA SRC reentry, four optical stations were set inside and near the WPA (Woomera Prohibited Area), Australia, targeting on peak-heat and/or front-heat profiles of ablating TPA for engineering aspect. Infrasound and seismic sensors were also installed on three arrayed stations and three single stations to realize direction findings of any point sources of the shock waves from SRC and explosion processes of the mother ship as well as investigate precise parameters of pressure waves, their propagation processes in atmosphere, and energy transforming processes through the air-to-ground couplings.

At 23:21 LT (13:51 UT) on June 13, 2010, the reentry of HAYABUSA SRC and mother ship was successfully operated on the exact schedule and trajectory, giving us fruitful images and signals on almost all cameras and data loggers. Moreover, several audible sound signals were detected at an observation site about 70 km apart from the trajectory.

In this talk, preliminary results of ground-based observation of HAYABUSA reentry by JAXA and collaborative scientists group will be introduced to discuss about what was observed in upper atmosphere at the third opportunity of man-made hypersonic fireball from the interplanetary space.

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