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# Effect of the solar-wind proton entry into the deepest lunar wake

Masaki N Nishino[1*], Masaki Fujimoto[1], Yoshifumi Saito[1], Shoichiro Yokota[1], Yoshiya Kasahara[2], Yoshiharu Omura[3], Yoshitaka Goto[2], Kozo Hashimoto[3], Atsushi Kumamoto[4], Takayuki Ono[4], Hideo Tsunakawa[5], Masaki Matsushima[5], Futoshi Takahashi[5], Hidetoshi Shibuya[6], Hisayoshi Shimizu[7], Toshio Terasawa[8]

[1]ISAS/JAXA, [2]Kanazawa University, [3]RISH, Kyoto University, [4]Tohoku University, [5]Tokyo Institute of Technology, [6]Kumamoto University, [7]ERI, University of Tokyo, [8]ICRR, University of Tokyo

We study effect of the solar wind (SW) proton entry deep into the near-Moon wake that was recently discovered by the SELENE mission. It has been accepted that the high-speed electrons in the ambient SW determine the lunar night-side environment. Therefore, previous lunar-wake models are based on the electron domination, and no effect of SW proton entry on the near-Moon wake environment has been taken into account so far. Recent SELENE observations revealed that a part of the SW protons are reflected at the lunar dayside surface and picked-up by the SW electric field (Saito et al., GRL, 2008), and some of them access the deepest lunar wake; this process is called type-II entry (Nishino et al., GRL, 2009). Here we show that the type-II entry of SW protons forms proton-governed region (PGR) to drastically change the electromagnetic environment of the lunar wake. Broadband electrostatic noise found in the PGR is manifestation of electron two-stream instability, which is attributed to the counter-streaming electrons absorbed from the ambient SW to maintain the quasi-neutrality. An acceleration of the absorbed electrons up to about 1 keV means a superabundance of positive charges of $10^{-4}$- $10^{-7}$$cm^{-3}$in the near-Moon wake, which should be immediately canceled out by the incoming high-speed electrons. This is a general phenomenon in the lunar wake, because PGR does not necessarily require peculiar SW condition for its formation.

Keywords: Lunar wake, Solar wind plasma, Plasma waves, Particle acceleration