



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

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We study effect of the solar wind (SW) proton entry deep into the near-Moon wake that was recently discovered by the SELENE mission. Because previous lunar-wake models are based on electron domination, 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. Acceleration of the absorbed electrons up to ~ 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.