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Observations of chromospheric anemone jets with Hinode/SOT and Hida Ca II Spectroheliogram

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Abstract. Hinode/SOT Ca II H broadband filter observations discovered ubiquitous tiny jets in the active region chromosphere. These jets are generally associated with anemone-shape footpoints, which are suggestive of magnetic reconnection. We present the first simultaneous observations of chromospheric "anemone" jets in active regions with the Ca II H broadband filetergram on the Hinode/SOT and with the Ca II K spetroheliogram on the Domeless Solar Telescope (DST) at Hida Observatory. Using the spectroheliogram on DST, we can first derive the true Doppler velocity information and height information of the crhomospheric anemone jets. We made comprehensive analysis also using Hinode/SOT magnetogram data as well as Hida Hα filtergram to develop an observation-based physical model of the jet. During coordinated observation period, 9 chromospheric anemone jets were simultaneously observed with the two instruments. These observations revealed: (1) the jets are generated in the low chromosphere because these cannot be seen in Ca II K_3, (2) the length and lifetime of the jets are 0.4 – 5 Mm and 40 – 320 sec according to Hinode/SOT, (3) the apparent velocity of the jets with Hinode/SOT are 3–24 km/s, while Ca II K_3 component at the jets show blue shifts (in 5 events) in the range of 2–6 km/s. These jets are associated with mixed polarity regions which are either small emerging flux regions or moving magnetic features. It is found that the Ca II K line often show red or blue asymmetry in K_2/K_1 component: the footpoint of the jets associated with emerging flux regions often show red asymmetry (2–16 km/s), while the one with moving magnetic features show blue asymmetry ($\sim$ 5 km/s). Detailed analysis of magnetic evolution of the jet regions revealed that the reconnection rate (or canceling rate) of the total magnetic flux at the footpoint of the jets are of order of 10^{16} Mx/s, and the resulting magnetic energy

release rate $(0.8-3)\times10^{25}$ erg/s, with the total energy release $(2-7)\times10^{27}$ erg during lifetime of a jet, $\sim$200s. These may be compared with the estimated total energy, $\sim10^{26}$ erg, in a single chromospheric anemone jet. The relation to Ellerman bombs is also discussed.