# High-Dispersion Spectroscopic Observations of Comet C/2012 S1 (ISON) with the Subaru Telescope

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Comet C/2012 S1 (ISON) was one of the Oort cloud comets and dynamically new. This comet was broken at its perihelion passage on UT 2013 November 28.1 (at Rh ~ 17 solar radius). We observed the comet C/2012 S1 (ISON) on UT 2013 November 15 with the High Dispersion Spectrograph (HDS) mounted on the Subaru Telescope atop Mauna Kea, Hawaii. Its heliocentric and geocentric distances were 0.601 and 0.898 AU, respectively. We selected the slit size of 0".5 x 9".0 on the sky to achieve the spectral resolution of R = 72,000 from 550 to 830 nm. The total exposure time of comet C/2012 S1 (ISON) was 1200 seconds. We detected many emission lines caused from radicals (e.g., CN, C2, NH2), ions (H2O+), atoms ([OI] and Na I) and also many unidentified lines in the spectra. We report the (1) the ortho-to-para abundance ratios (OPRs) of water and ammonia estimated from the high-dispersion spectra of H2O+ and NH2, (2) the green-to-red line ratio of forbidden oxygen emissions, (3) the isotopic ratios of C2 (the carbon isotopic ratio from Swan band) and CN (the carbon and nitrogen isotopic ratios from red band), (4) the sodium-to-continuum ratio of comet C/2012 S1 (ISON).