TRAPPIST monitoring of comets C/2012 S1 (ISON) and C/2013 R1 (Lovejoy)

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We present the results of a dense photometric monitoring of comets C/2012 S1 (Ison) and C/2013 R1 (Lovejoy) using narrow-band cometary filters and the 60-cm TRAPPIST robotic telescope [1]. We were able to isolate the emission of the OH, NH, CN, C_2, and C_3 radicals for both comets as well as the dust continuum in four bands. By applying a Haser model [2] and fitting the observed profiles, we derive gas production rates. From the continuum bands, we computed the dust $Af\rho$ parameters [3]. We were able to follow the evolution of the gas and dust activity of these comets for weeks, looking for changes with the heliocentric distance, study the coma morphology, and analyze their composition and dust coma properties.

Comet C/2012 S1 (ISON) was observed about three times a week from October 12 ($r = 1.43$ au) to November 23, 2013. It was then at a heliocentric distance of 0.33 au, only five days before perihelion, when it disintegrated. This dense monitoring allowed us to detect fast changes of the cometary activity. We observed a slowly rising activity in October and early November, and two major outbursts around November 13 and November 19 [4], the gas and dust production rates being multiplied by at least a factor of five during each outburst and then slowly decreasing in the following days. These outbursts were correlated with changes in gas-production-rate ratios. The coma morphology study revealed strong jets in both gas and dust filters. Since the comet was very active in November, we were even able to detect OH jets in our images.

Comet C/2013 R1 (Lovejoy) was observed before perihelion from September 9 ($r = 1.94$ au) to November 16 ($r = 1.12$ au), 2013 when the comet was too far North. We recovered the comet post-perihelion on February 13 ($r = 1.24$ au), 2014 and planned to observe it until May ($r = 2.5$ au) with narrow-band filters. We compare the evolution of gas and dust activity as well as the evolution of gas production rates ratios on both sides of perihelion. The morphological study of both gas and dust coma we already performed on pre-perihelion images revealed structures in gas and dust filters. We compare the gas and dust features in all filters and study their evolution.

References: [1] Jehin et al., The Messenger, 145, 2–6, 2011. [2] Haser, Bull. Acad. R. Sci. Liège, 43, 740–750, 1957. [3] A'Hearn et al., The Astronomical Journal, 89, 579–591, 1984. [4] Opitom et al., CBET 3719.