**TRAPPIST Narrow Band Survey of Bright Long Period Comets in 2022-2023.** S. Hmiddouch[1,2], E. Jehin[1], M. Vander Donckt[1], Y. Moulane[3], J. Manfroid[1], A. Jabiri[2], and Z. Benkhaldoun[2]. [1]Space sciences, Technologies & Astrophysics Research (STAR) Institute, University of Liège, Belgium. [2]Oukaimeden Observatory, High Energy Physics and Astrophysics Laboratory, Cadi Ayyad University, Marrakech, Morocco. [3]Physics Department, Leach Science Center, Auburn University, AL 36832, USA.

**Introduction:** Comets are remnants of the early Solar System, as they formed from icy and dusty material 4.6 billion years ago. Therefore, their study provides valuable information on the physico-chemical environment of the early Solar System. The dynamical distribution of comets has evolved since then, most notably due to the migration of giant planets. Today, the main reservoirs are the Oort cloud, source of the isotropic Oort cloud comets (OCCs) or long period comets (LPCs) with orbital periods exceeding 200 years, and the Kuiper Belt, source of the Jupiter Family Comets (JFCs).

**TRAPPIST Observations:** We used both TRAPPIST-North (TN) and –South (TS) [1], to observe and follow LPCs along their orbits. These telescopes are equipped with standard Johnson-Cousin B, V, Rc, and Ic filters, as well as narrow-band filters optimized for observing emission bands of volatiles found in comets [2]. These filters isolate emission signature of OH (309.7 nm), NH (336.1 nm), CN (386.9 nm), $C_3$ (406.3 nm), $C_2$ (513.5 nm), and four continuum-free wavelengths (UC at 344.9 nm, BC at 445.3 nm, GC at 525.9 nm, and RC at 713.3 nm). TN and TS allow us to continuously monitor those comets in both hemispheres, before and after perihelion.

In this work, we investigated the activity and composition changes of the brightest LPCs between 2022 and 2023 using both TRAPPIST telescopes. The LPCs investigated are C/2022 E3 (ZTF), C/2020 V2 (ZTF), C/2019 U5 (Pan-STARRS), and C/2022 A2 (Pan-STARRS), some were also observed by other programs on large telescopes for detailed chemical composition analysis from the UV to the radio domains. We analyzed the evolution of production rates and chemical mixing ratios of OH, NH, CN, $C_2$, and $C_3$ at different heliocentric distances. Additionally, we computed A(0)fp, a proxy for dust activity, during the comets' journey towards the inner Solar System.

**C/2022 E3 (ZTF)** was discovered on March 2, 2022, by the Zwicky Transient Facility. It reached its closest distance to the Sun on January 12, 2023, at a distance of 1.11 au and passed closest to Earth on February 1, 2023, at 0.28 au. We started observing this comet with TS at the beginning of May 2022, when it was at 3.60 au, and with TN on August 6, 2022, when it was at a distance of 2.56 au from the Sun.

**C/2020 V2 (ZTF)** is a long-period comet discovered by the Zwicky Transient Facility on November 2, 2020. It reached perihelion on May 8, 2023, at 2.22 au from the Sun. We have been monitoring the comet with the TN telescope since January 11, 2022, when it was at 5.41 au and stopped in March 2023 when it was too close to the Sun.

**C/2019 U5 (PanSTARRS)** is a hyperbolic comet discovered on October 22, 2019, by the Pan-STARRS survey. It reached perihelion on March 29, 2023, at 3.62 au. We have been continuously observing this comet with both TN and TS telescopes since January 20, 2023, when it was at 3.67 au away, and we plan to continue our monitoring efforts for as long as the comet remains visible.

**C/2022 A2 (PanSTARRS)** is a nearly parabolic orbit comet discovered by the Pan-STARRS survey on January 10, 2022. We began observing its activity and composition with broad and narrow-band filters using the TN telescope on December 16, 2022, when it was at a distance of 1.92 au from the Sun.

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