TRAPPIST bright comets production rates: 62P/Tsuchinshan 1, 103P/Hartley, C/2023 H2 (Lemmon), and the 14 November huge outburst of 12P/Pons-Brooks

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The authors report that they obtained from TRAPPIST-South and TRAPPIST-North robotic telescopes (Jehin et al. 2011) recent observations under clear skies using cometary HB narrowband filters (Farnham et al. 2000) for the following comets and computed preliminary production rates at 10.000 km using a Haser Model (Vp=Vd=1km/s) (Haser 1957). The dust production rates proxy A(0)f(rho) were estimated by profile fitting at 10.000 km (A'Hearn et al. 1984) and corrected for the phase angle (Schleicher 2007).

62P/Tsuchinshan 1
Date UT=2023-11-12, r_h=1.36 au, Delta=0.72 au, DT=-42 days
Q(OH) = 3.93 +/- 0.79 E27 s-1
Q(CN) = 1.21 +/- 0.04 E25 s-1
Q(C3) = 2.39 +/- 0.18 E24 s-1
Q(C2) = 1.34 +/- 0.06 E25 s-1
A(0)fp(RC) = 107 +/- 8 cm
A(0)fp(BC) = 88 +/- 7 cm

Comet 62P is approaching perihelion and getting more active. All the gaseous species are now detected easily.

103P/Hartley
Date UT=2023-11-12, r_h=1.15 au, Delta=0.51 au, DT=+31 days
Q(OH) = 2.21 +/- 0.41 E27 s-1
Q(CN) = 7.89 +/- 0.29 E24 s-1
Q(C3) = 1.37 +/- 0.13 E24 s-1
Q(C2) = 1.03 +/- 0.03 E25 s-1
A(0)fp(RC) = 80 +/- 11 cm
A(0)fp(BC) = 71 +/- 8 cm

Comet 103P is one month after perihelion and its activity is decreasing progressively.

C/2023 H2 (Lemmon)
Date UT=2023-11-11, r_h=0.93 au, Delta=0.2 au, DT=+13 days
Q(OH) = 4.82 +/- 0.77 E27 s-1

Q(CN) = 1.72 +/- 0.12 E25 s-1
Q(C3) = 3.47 +/- 0.43 E24 s-1
Q(C2) = 2.23 +/- 0.20 E25 s-1
A(0)fp(RC) = 42 +/- 3 cm
A(0)fp(BC) = 39 +/- 1 cm

Two weeks after perihelion, the comet came to its closest distance to the Earth (0.20 au) and shows an impressive large gaseous coma. The production rates are still increasing post perihelion.

12P/Pons-Brooks
Date UT=2023-11-12, r_h=2.61 au, Delta=2.78 au, DT=-160 days
Q(OH) < 2.00 E28 s-1
Q(CN) = 6.66 +/- 0.30 E25 s-1
Q(C3) = 1.04 +/- 0.15 E25 s-1
Q(C2) = 6.11 +/- 0.40 E25 s-1
A(0)fp(RC) = 1932 +/- 30 cm
A(0)fp(BC) = 2045 +/- 95 cm

A new large outburst happened on November 14.5 UT. We obtained two datasets with all the narrow band and broad filters on November 15 between 18:30 and 20:30 UT with TRAPPIST-North and we found an increase of 4.3 mag in all the BVRI filters compared to pre-outburst data taken on Nov. 12 (R mag of 10.1 versus 14.4 in a 5 arcsec aperture). The comet displays a compact, round and well defined dusty coma of 30 arcsec in the narrow band dust continuum filters. The Q(OH) are above 1E29 molecules/s and Afrho is above 100000 cm. This is the 4th large outburst since the return of the comet which is still about 2.6 au from the Sun and 3 months from perihelion.

12P/Pons-Brooks
Date UT=2023-11-15, r_h=2.57 au, Delta=2.75 au, DT=-157 days
Q(OH) = 1.41 +/- 0.33 E29 s-1
Q(CN) = 9.53 +/- 0.39 E26 s-1
Q(C3) = 2.69 +/- 0.24 E26 s-1
Q(C2) = 7.64 +/- 0.41 E26 s-1
A(0)fp(RC) = 118061 +/- 587 cm
A(0)fp(BC) = 115188 +/- 2782 cm

Notations: rh= heliocentric distance (in au), Delta=geocentric distance (in au), DT= Time to perihelion. OH, NH, C3, CN, C2 are the HB gaseous narrowband filters for the corresponding species, and BC, GC, RC are the blue, green and red dust continuum filters (Farnham et al. 2000).

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