A TRAPPIST SURVEY OF THE ACTIVITY OF 14 COMETS. D. Gardener[1], C. Snodgrass[1] and E. Jehin[2], [1]Institute for Astronomy, University of Edinburgh, Blackford Hill, Edinburgh EH9 3HJ, UK (dgar@roe.ac.uk), [2]STAR Institute, University of Liège, B-4000 Liège 1, Belgium.

Introduction: Comets are the primitive building blocks of the Solar System. In order to understand the extent of the pristine nature of comets, we must understand the mechanisms that affect their surfaces and comae – their activity.

Activity can be tracked in a variety of ways, such as observing dust production in the coma and tail. We can study the activity in a quantitative way through photometry of the reflected sunlight, as flux is proportional to the reflecting area of the dust lifted off the comet by its activity. Activity varies from comet to comet so we must try to distinguish whether these differences in activity are because of ageing or reflect primordial differences. The most obvious of which is the production of comae and tails, caused by escaping gas and dust lifted off the surface of the comet. All processes that physically and chemically alter a cometary nucleus can be regarded as ageing [1].

Distinguishing the effects of ageing from primordial differences is important since the wide range of formation scenarios should imply significantly different observational qualities. Once the differences are established, it will allow us to use the comets as time capsules of the chemical and physical conditions in the early Solar System.

Methods: We have developed a pipeline to calibrate and measure photometry of comets to a common photometric system. This pipeline and methodology has been successfully applied to photomety data of 67P [2]. We aim to apply this methodology to a much larger sample of comets observed by the TRAPPIST telescope.

Observations: TRAPPIST is a 60 cm robotic telescope at La Silla observatory designed for the detection and characterisation of exoplanets but also the study of comets and other minor Solar System bodies [3]. The telescope observes relatively bright comets about twice a week. Such regular measurements of comets are rare because of the lack of telescope time on larger telescopes, yet are very valuable as they show how the gas and dust production rate evolves with respect to heliocentric distance on a much larger timescale. Broadband photometry is performed once a week for fainter comets, usually far from the Sun, in order to measure the dust production rate in the R-band. Since this programme has been running for over 10 years, it provides a good sample of cometary activity from a variety of comets. We use broadband photometry from these data to analyse the dust activity of comets.

Aims: This work will follow the pattern of cometary activity for a sample of 14 comets (Table 1), including comets of different types and at different stages of their evolution. The comets were chosen to provide a good variety of different comet properties such as perihelion distance, age and activity levels.

This work aims to shed insight into how cometary activity evolves over the course of a comet's perihelion passage and what differences exist between different comet families and if any common patterns or trends can be found which could be used for predictions of future comet observations.

Table 1: Comets targeted in this study and their observational parameters.

Designation	Comet type	orbital period (yrs)	q (au)	e	i (deg)
9P/Tempel 1	JFC	5.58	1.54	0.510	10.5
46P/Wirtanen	JFC	5.44	1.06	0.659	11.7
88P/Howell	JFC	5.48	1.36	0.563	4.38
103P/Hartley 2	JFC	6.46	1.06	0.695	13.6
246P/NEAT	JFC	8.08	2.88	0.285	16.0
C/2009 F4	DNC	--	5.45	1.002	79.3
C/2009 P1	DNC	--	1.55	1.001	106.2
C/2011 L4	DNC	--	0.30	1.000	84.2
C/2012 F6	LPC	10,752	0.73	0.999	82.6
C/2012 K1	DNC	--	1.05	1.000	142.4
C/2013 A1	DNC	--	1.40	1.000	129.0
C/2013 R1	LPC	11,705	0.81	0.998	64.0
C/2013 US_{10}	DNC	--	0.82	1.000	148.9
C/2015 ER_{61}	LPC	7,494	1.04	0.997	6.35

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