## Proposed MISSION 29P webpages

**Aims and objectives of MISSION 29P**
- Unique characteristics of Centaur 29P
- Maximising observational coverage
- Timing its outbursts and organising follow-up

**Blog of the current apparition (2024–25)**
- Link to 'Latest observations' textfile
- (topics, ordered by date, most recent at the top)

**Methodology and photometry**
- Development of *Astrometrica* software
- Astrometry
- Photometry
- Observing tutorial
- Standard photometric reductions
- Coma profile photometry and the brightness of the nucleus

**Historical summary**
- Discovery and early years
- Work of Fred Whipple
- Other investigators
- Space-borne observatories (HST, Herschel, JWST)

**Earlier apparitions of 29P**
- Visual and photographic coverage pre-2000
- Outburst database pre-2002
- **Intensive monitoring 2014 – 2024**
  - from **2023** 08 10.14– **2024** 06 26.17
    - Epoch around JWST observations of 2023 Feb 20
  - from **2022** 07 16.1 – **2023** 06 17.2
  - from **2021** 06 25.1 – **2022** 05 25.2
    - Super-outburst of late September 2021
  - from **2020** 05 22.4 – **2021** 04 25.9
  - from **2019** 05 13.1 – **2020** 03 19.8
  - from **2018** 04 03.4 – **2019** 02 20.8
  - from **2017** 03 01.4 – **2018** 01 19.7
  - from **2016** 02 20.7 – **2016** 12 03.0
  - from **2015** 01 11.4 – **2015** 11 18.0
  - from **2013** 12 13.4 – **2014** 11 06.0

**Types of cometary outburst in general**
- Perihelic outbursts
- Fragmentation
- Explosive / eruptive
- Proposed mechanisms for 29P
- The role of the amorphous-to-crystalline water ice transition

**Characterisation of outburst characteristics**
- Tracking the rise to maximum light
- **Evidence for two types of outburst**
  - Strong outbursts and the Pac-man coma morphology vs. mini-outbursts
  - The 57.7-day periodicity of strong outbursts and an ultra-slow rotation rate of the nucleus
  - Weak or mini-outbursts and their seasonal dependence / periodicity
- Triggered outbursts

Ejecta velocity and direction
Structured outflows revealed by rotational gradient filtering of images
Coma profiles and Inner coma absolute photometry

**Proposed physical interpretation of observed characteristics**

Underlying background activity

**Rise to maximum empirical modelling**

Coma when optically opaque
Coma expansion and optical thinning
Sublimation of water ice phase
Longer-term fragmentation of the outburst coma cloud

Absolute magnitude of the nucleus
Coma fallback phenomena

**Proposed underlying chemistry**

Hydrocarbons, hypervolatiles and the cryochemistry of outbursts
Scope for melting of ices within cometary nuclei
Heat transfer via gas flow and enthalpy heating by hypervolatiles within the nucleus
Hydrophobic chemistry of 29P vs. hydrophilic chemistry of 17P/Holmes
Influence of gravitational field and thermal gradients on fractionation of species within the nucleus
Exsolution of hypervolatile gases from hydrocarbon-rich cryomagma

**Stellar occultations by 29P**

Issues in determining an accurate orbit solution
Accurate JPL orbit based on 2.0-m Gaia astrometry
Summary results and the best size-shape model

**Literature publications and other media**

Journal publications
BAA articles
Presentations at meetings
Literature references for 29P
(including links to important articles)

**Contributing 29P observers**

Faulkes Telescopes / Las Cumbres Observatory / ***COMET CHASERS***
Spanish observers (Observadoras-cometas group) / Mark Kidger)
Andrea Aletti
Eric Bryssinck
Denis Buczynski
Luca Buzzi
Peter Carson
Matt Dawson
Kent DeGroff
Pieter-jan Dekelver
Alfons Diepvens
John Drummond
Joan Genebriera
Tim Haymes
Wayne Hawley
Eliot Herman
Nick James
Manos Kardasis
François Kugel
Pepe Manteca

Richard Miles
Martin Mobberley
Charles Morris
Mark Philips
Nick Quinn
Richard Sargent
Cai Stoddard-Jones
Jean-François Soulier / REMOTE29P robotic observatory
Dave Storey
Peter Tickner
Helen Usher
Americo Watkins
Guy Wells
Patrick Wiggins

**Data archive**

**Chronological list of apparent outbursts**

Discovery to 2002
Minor Planet Center data (2002-2014)
2014 onwards

**Events having complete / partial coverage (rise-to-maximum lightcurves)**

Event of 2017 Jul 02.054 (J.J. Gonzalez / J.-F. Soulier)
Event of 2019 Oct 07.913 (J.-F. Soulier)
Event of 2020 Aug 22.093 (J.-F. Soulier)
Event of 2020 Sep 09.593 (J. Drummond)
Event of 2020 Nov 19.763 (J.-F. Soulier)
Event of 2023 Feb 14.43 (R. Miles) caught late, start missed
Event of 2024 Mar 08.93 (C. Stoddard-Jones / A. Voitko)
Event of 2024 Mar 24.847 (M. Phillips)

**Successful 29P stellar occultations**

2022 December 05
2022 December 19
2022 December 27
2023 January 28
2023 May 07

**ASCII text data files**

Photometry
High-precision astrometry

**Excel files**

Outburst dates and photometry
Individual apparitions
Multi-aperture photometry and coma fallback

**Plots**

64 outbursts from MPC data, 2002–2014
Reduced magnitude plots for recent apparitions
Seasonal outburst time vs. Rotational phase, 2002 - present

**Selected images**

(Additional to those on rest of the website)

Topics in bold link to new page(s) with named subheadings and/or sub-pages

R. Miles
Updated on 2024 November 22