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TNOs and u : Col-OSSOS, now in near-UV. N. J. Tan¹, M. T. Bannister², W. C. Fraser³, S. D. Benecchi⁴, J. J. Kavelaars³, S. D. J. Gwyn³, T. Burdullis³, M. Alexandersen⁵, Y.-T. Chen⁶, B. Gladman⁷, M. J. Lehner⁵, M. Marsset⁸, N. Peixinho⁹, J.-M. Petit¹⁰, R. E. Pike⁴, M. E. Schwamb¹¹, K. Volk¹², S.-Y. Wang⁶, ¹School of Physical and Chemical Sciences | Te Kura Matū, University of Canterbury (nicolejjeiyi.tan@pg.canterbury.ac.nz), ²School of Physical and Chemical Sciences | Te Kura Matū, University of Canterbury, ³NRC-Herzberg Astronomy and Astrophysics, National Research Council of Canada, ⁴Planetary Science Institute, ⁵Center for Astrophysics | Harvard & Smithsonian, ⁶Institute of Astronomy and Astrophysics, Academia Sinica, ⁷Department of Physics and Astronomy, University of British Columbia, ⁸Department of Earth, Atmospheric and Planetary Sciences, MIT, ⁹Instituto de Astrofísica e Ciência do Espaço, Departamento de Física, Universidade de Coimbra, ¹⁰Institut UTINAM UMR6213, CNRS, Univ. Bourgogne Franche-Comté, ¹¹Astrophysics Research Centre, Queen's University Belfast, ¹²Lunar and Planetary Laboratory, University of Arizona

Introduction: Most trans-Neptunian objects (TNOs) are too faint to be studied spectroscopically—their surface composition can only be inferred using broad-band colours, which to date have largely been measured in the optical and NIR. The Colours of the Outer Solar System Origins Survey (Col-OSSOS) [1] has provided $grJz$ photometry of over 90 TNOs. Col-OSSOS has shown that the cold classical Kuiper belt population has a unique $r-z$ colour [2]. More recently, Fraser et al. have shown a bifurcation in optical-NIR colours, and suggest a two-class model of TNO surfaces, with cold classicals largely falling within one of these surface classes [3].

TNOs have been little studied in the near-ultraviolet, because of the pronounced faintness of most minor planets at these wavelengths. The far- to near-ultraviolet holds potential for understanding how the ices and organic materials of minor planet surfaces are modified under the effect of UV and charged particles [4, 5]. Carbonaceous materials are also spectrally active in the ultraviolet, compared to the traditional visible and near-infrared wavelengths [5].

u -band Photometry of Col-OSSOS Targets: We extend the rich Col-OSSOS dataset by reporting u -band ($\lambda \sim 370$ nm) measurements for 66 of its target $m_r \leq 23.5$ TNOs from observations with MegaCam on the Canada-France-Hawaii Telescope (CFHT). This Col-OSSOS enhancement is a subset of the dataset that forms the first major near-UV survey of the outer Solar System, which comprises detections and upper limits on 165 OSSOS [6] objects in CFHT u imaging observed from August 2014 to July 2019. The targets sample the full range of TNO dynamical populations. As part of the Col-OSSOS program, the CFHT u -band data were acquired simultaneously with the $grJz$ observations from the Gemini-North telescope. Our u -band survey is the first to have regular and routine two-telescope simultaneous photometry by two major observatories.

Initial results: The $(u-r)$ and $(g-r)$ colours of 17 currently measured Col-OSSOS targets (Figure 1) suggest that dynamically excited objects tend to exhibit a compact range of $(u-r)$ colour centred around $(u-r) \sim$

2. A few dynamically excited objects that are redder in $(g-r)$ show as $(u-r)$ outliers from the majority, and are perhaps indicative of a surface composition that is more carbonaceous. Cold classicals both have a broader range of $(u-r)$ colours, and also skew redder in $(u-r)$. Their overall $(u-r)$ redness is expected, given the reddening of cold classicals in optical bands. However, the existence of dynamically excited objects that have similar $(g-r)$ colours to the cold classicals, yet are much bluer in $(u-r)$, hints at a compositional distinction between these two dynamical populations that is only apparent in the near-UV.

Acknowledgments: This research has made use of the IAU's Minor Planet Center. The observations were obtained at the CFHT and were performed with care and respect from the summit of Maunakea which is a significant cultural and historic site.

References: [1] Schwamb, M. E., Fraser, W. C., Bannister, M. T., et al. (2019) *ApJS*, 243, 12. [2] Pike, R. E., Fraser, W. C., Schwamb, M. E., et al. (2017) *AJ*, 154, 101. [3] Fraser, W. C., Pike, R. E., Marsset, M., et al. (2023) *PSJ*, in press. [4] Applin, D. M., Izawa, M. R. M., Cloutis, E. A., et al. (2018) *Icar*, 307, 40. [5] Hendrix, A. R., Vilas, F., Li, J.-Y. (2016), *M&MPS*, 51, 105. [6] Bannister M. T., Gladman B. J., Kavelaars J. J. et al. 2018 *ApJS*

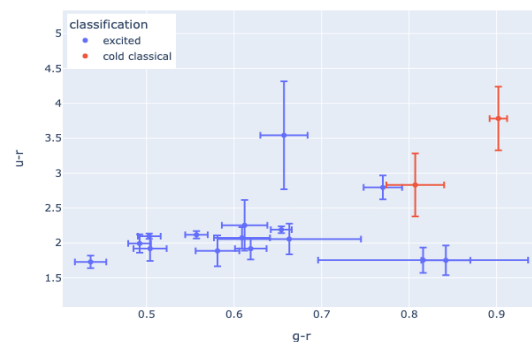


Figure 1: $(u-r)$ and $(g-r)$ colours of currently measured Col-OSSOS targets