CAMK PAN Annual Meeting

Sarang Shah

Postdoc under Bogumil Pilecki

Centrum Astronomiczne im. M. Kopernika PAN, Warsaw, Poland

Warszawa, 23rd January 2025

My background

- Ph.D. in Gravitational Microlensing from the University of Canterbury, Christchurch, New Zealand in 2020 - modelling the microlensing events and characterising the lens.
- First post doc with India-TMT Coordination Center at the Indian Institute of Astrophysics, Bengaluru, India to develop an “Infrared Guide Star Catalog for the Adaptive Optics Observations of the Thirty Meter Telescope”.
- Also, identified candidate hydrogen deficient stars in the Milky Way.
- Joined CAMK in September 2024 to work with Bogumil Pilecki on “Detection and characterisation of binary Cepheids”.

Publications

The Astronomical Journal, 168:59 (28pp), 2024 August https://doi.org/10.3847/1538-3881/ad517f

OPEN ACCESS

A Partial Near-infrared Guide Star Catalog for Thirty Meter Telescope Operations

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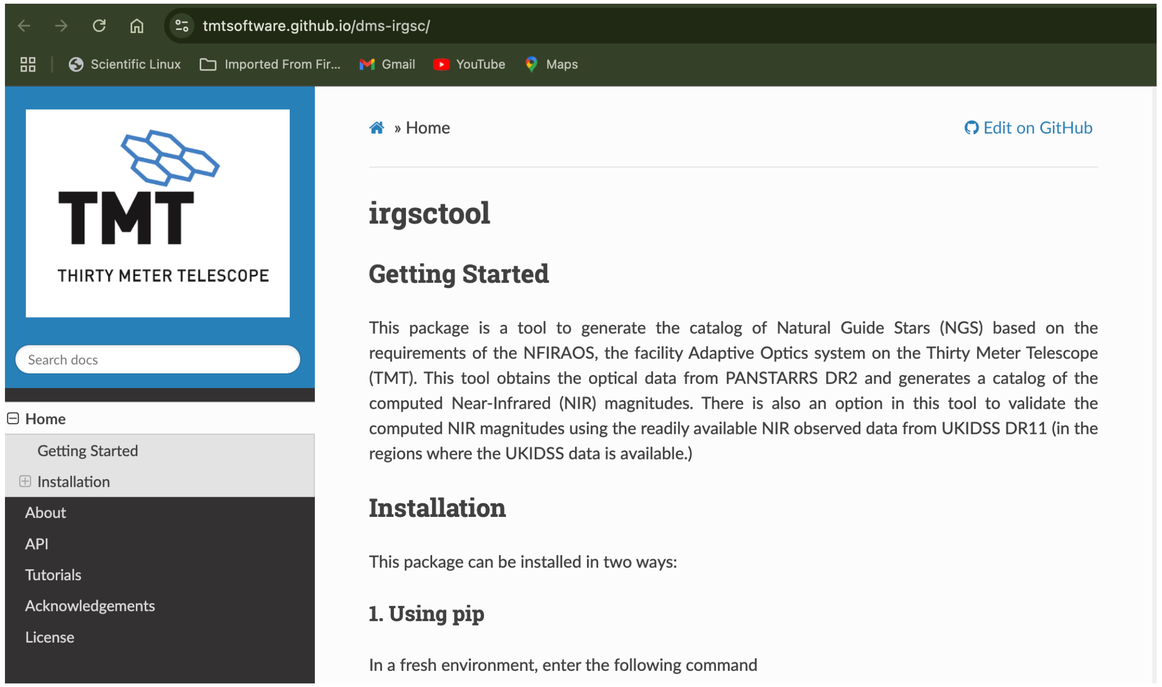
Abstract

At first light, the Thirty Meter Telescope (TMT) near-infrared (NIR) instruments will be fed by a multiconjugate adaptive optics instrument known as the Narrow Field Infrared Adaptive Optics System (NFIRAOS). NFIRAOS will use six laser guide stars to sense atmospheric turbulence in a volume corresponding to a field of view of 2′, but natural guide stars (NGSs) will be required to sense tip/tilt and focus. To achieve high sky coverage (50% at the north Galactic pole), the NFIRAOS client instruments use NIR on-instrument wave front sensors that take advantage of the sharpening of the stars by NFIRAOS. A catalog of guide stars with NIR magnitudes as faint as 22 mag in the *J* band (Vega system), covering the TMT-observable sky, will be a critical resource for the efficient operation of NFIRAOS, and no such catalog currently exists. Hence, it is essential to develop such a catalog by computing the expected NIR magnitudes of stellar sources identified in deep optical sky surveys using their optical magnitudes. This paper discusses the generation of a partial NIR Guide Star Catalog (IRGSC), similar to the final IRGSC for TMT operations. The partial catalog is generated by applying stellar atmospheric models to the optical



The Astronomical Journal, 168:178 (14pp), 2024 October https://doi.org/10.3847/1538-3881/ad710d

Casting Light on Degeneracies: A Comprehensive Study of Lightcurve Variations in Microlensing Events OGLE-2017-BLG-0103 and OGLE-2017-BLG-0192

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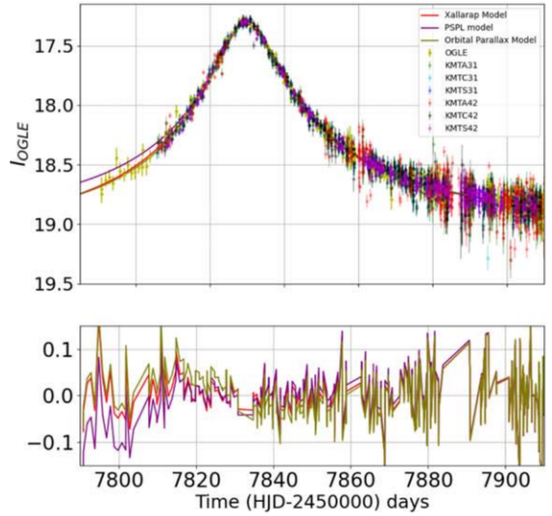
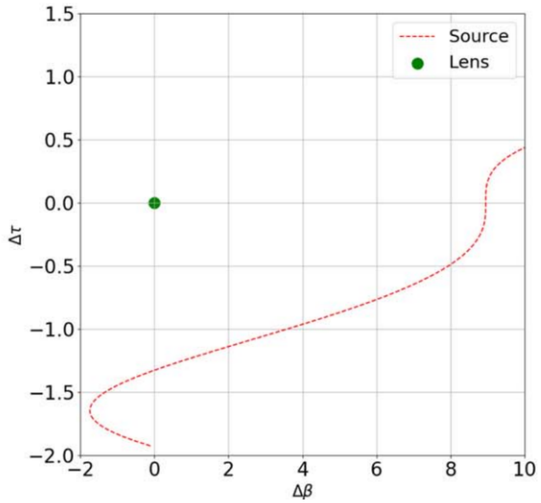
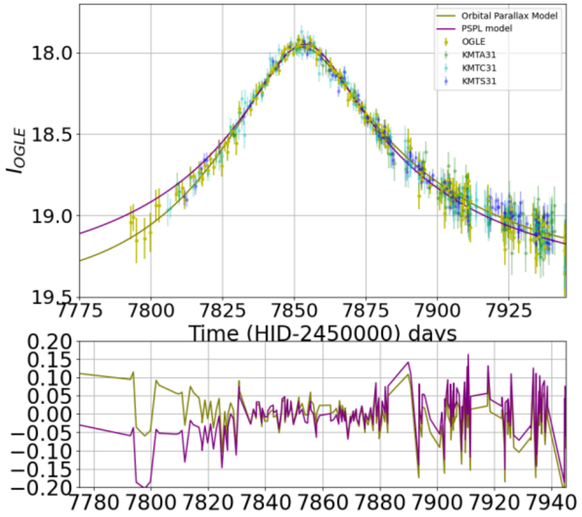
Abstract

This study investigates orbital parallax in gravitational microlensing events, focusing on OGLE-2017-BLG-0103 and OGLE-2017-BLG-0192. For events with timescales $\leqslant$60 days, a Jerk-Parallax degeneracy arises due to high Jerk velocity ($\tilde{v}_j$), causing a fourfold continuous parallax degeneracy. OGLE-2017-BLG-0103, after incorporating orbital parallax, reveals four discrete degenerate parallax solutions, while OGLE-2017-BLG-0192 exhibits four discrete solutions without degeneracy. The asymmetric lightcurve of OGLE-2017-BLG-0103 suggests a more probable model where Xallarap is added to the parallax model, introducing tension. The galactic model analysis predicts a very low-mass stellar lens for OGLE-2017-BLG-0192. For OGLE-2017-BLG-0103, degenerate solutions suggest a low-mass star or a darker lens in the disk, while the Xallarap+Parallax model also predicts a stellar lens in the bulge, with the source being a solar-type star orbited by a dwarf star. This study presents five degenerate solutions for OGLE-2017-BLG-0103, emphasizing the potential for confirmation through high-resolution Adaptive Optics observations with Extremely Large Telescopes in the future. The complexities of degenerate scenarios in these microlensing events underscore the need to analyze special single-lens events in the Roman Telescope Era.

Unified Astronomy Thesaurus concepts: Binary source microlensing (2141); Gravitational microlensing (672); Microlensing parallax (2144)







J. Astrophys. Astr. (2022) 43:86
https://doi.org/10.1007/s12036-022-09867-y

OBSERVATIONAL FACILITIES

India-TMT project—science instrumentation program

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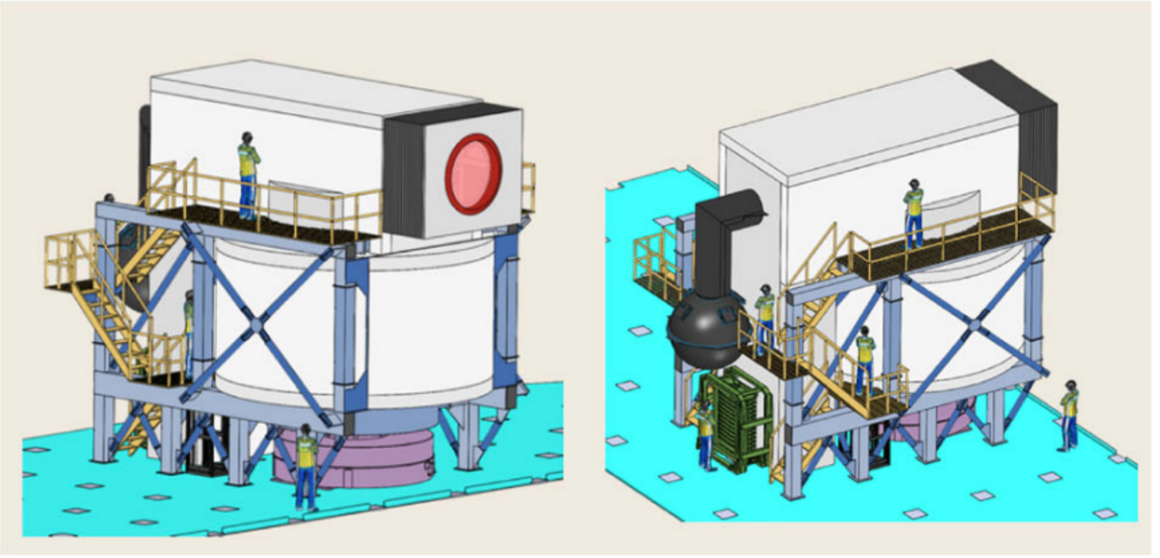
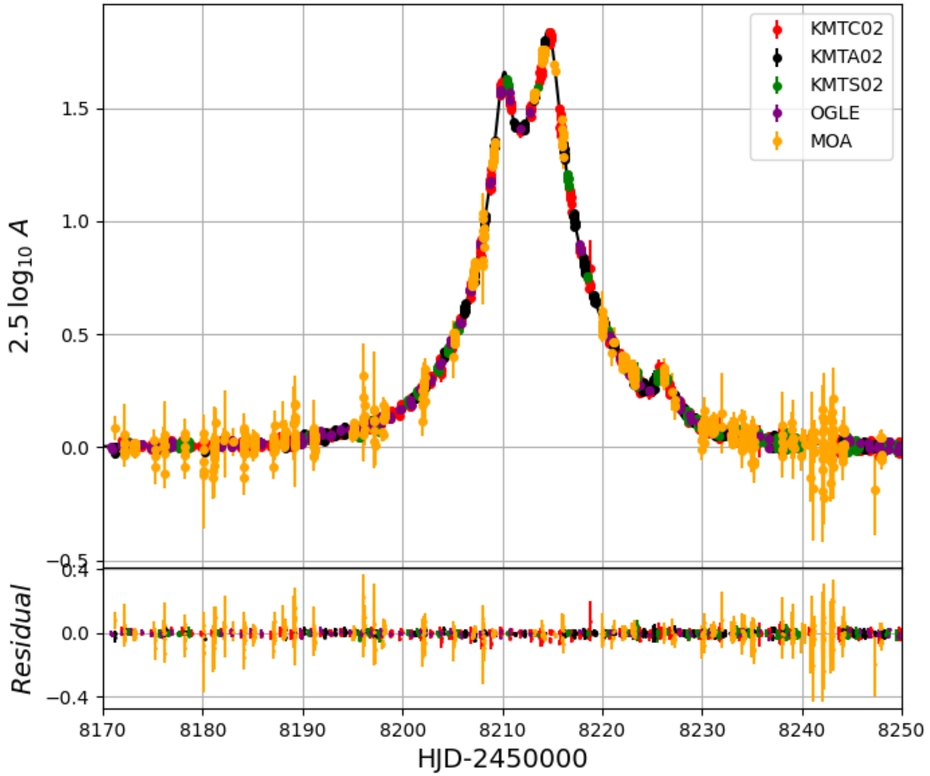
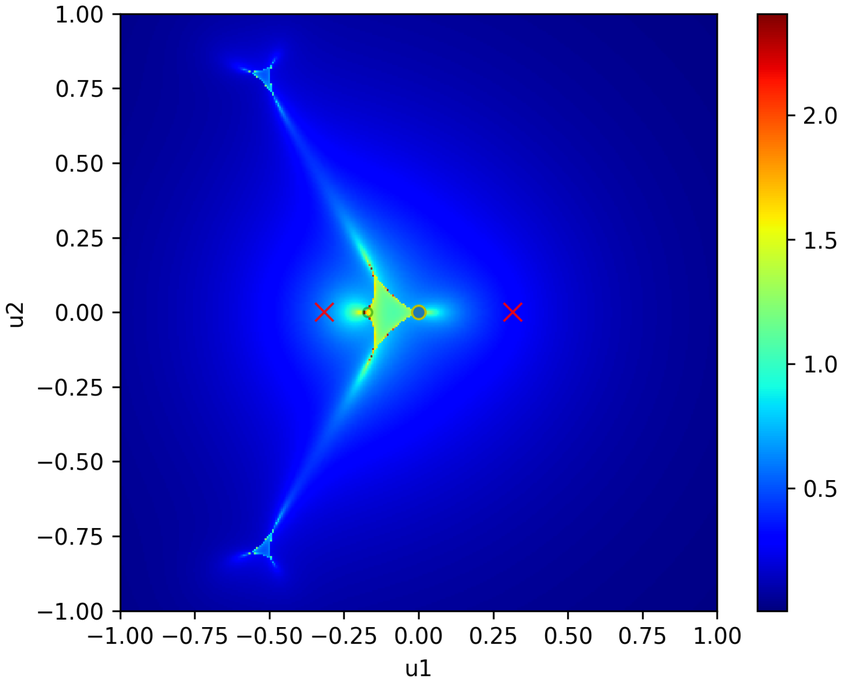


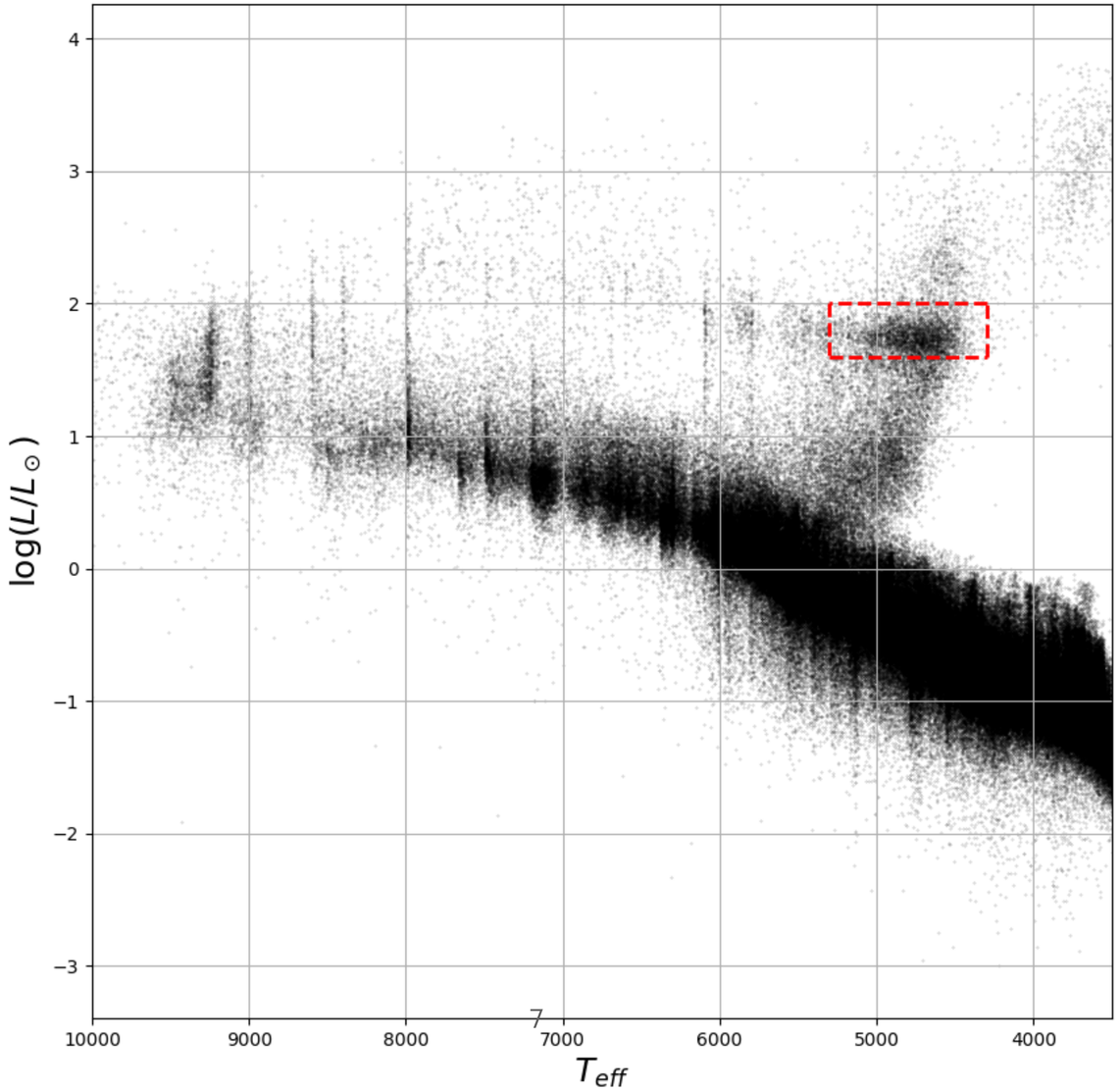
Upcoming publications..

- A counter-rotating and tightly packed JUMBO discovered using microlensing.





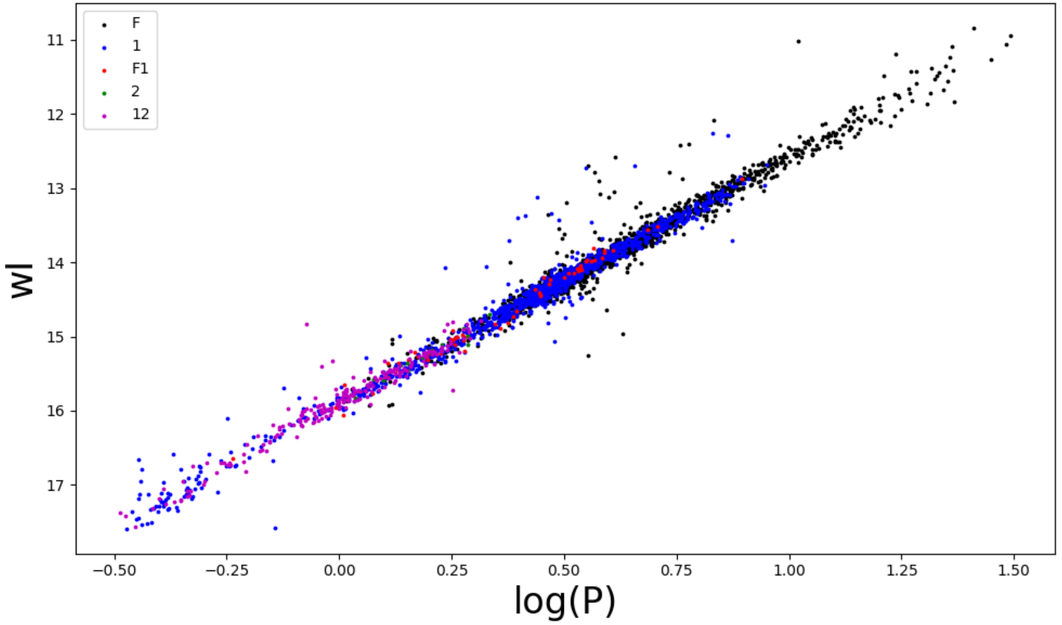
Can red giants drop suddenly?

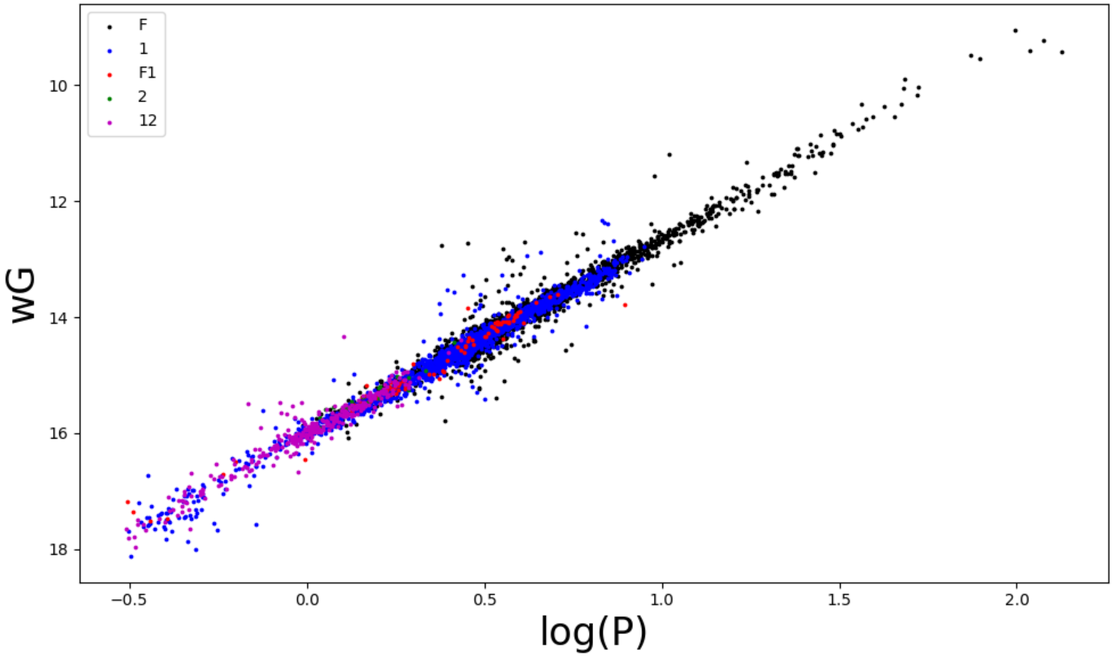


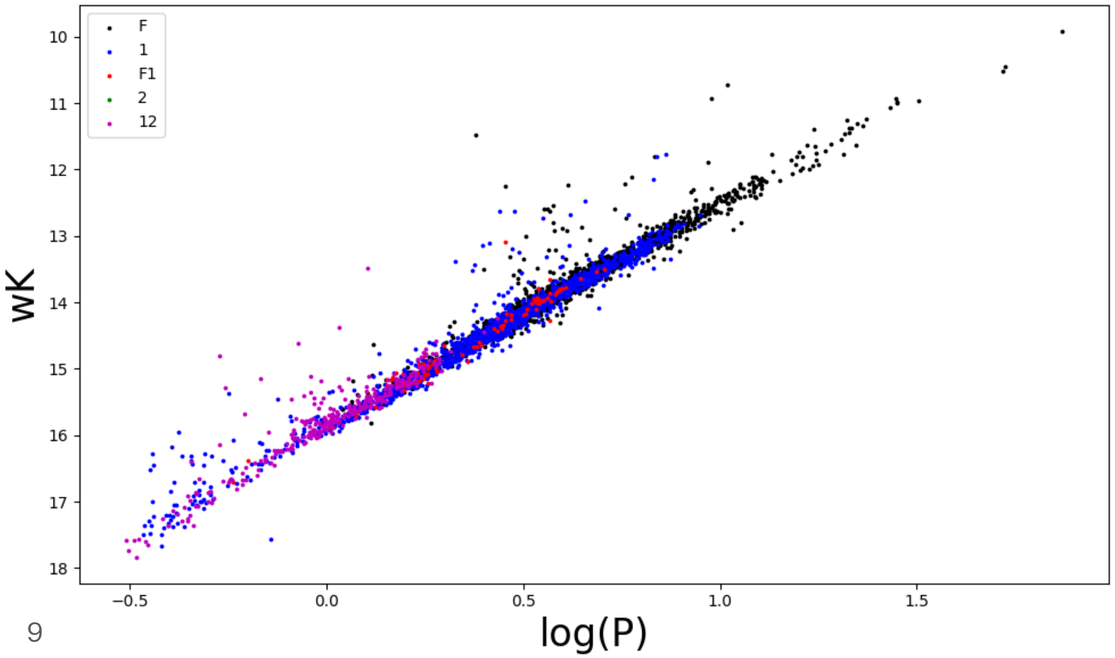
My work at CAMK

- To increase the sample size of binary Cepheids in MW, LMC and SMC.
- To characterise them photometrically and spectroscopically.
- Double-line Cepheids in the Milky Way especially important (only a few are known so far).

- Using different surveys
- New candidates found mostly in SMC, and Milky Way, but also some in LMC from other surveys.
- Characterisation of the components.







Thank You