USING INDIAN TELESCOPES FOR TRANSIT FOLLOW-UP: PROSPECTS FOR IMPROVED LONGITUDINAL COVERAGE. A. Chakrabarty[1] and S. Sengupta[2]. [1]Indian Institute of Astrophysics, 100 Feet Road, Koramangala, Bangalore 560034, Karnataka; aritra@iiap.res.in, [2]Indian Institute of Astrophysics, 100 Feet Road, Koramangala, Bangalore 560034, Karnataka; sujan@iiap.res.in.

Introduction: Transit photometry is a key tool for the detection and characterization of exoplanets [1,2]. A challenge with observations of transient events like transit is longitudinal coverage: it is important to ensure 360° longitudinal coverage around the globe, to make sure that events can be observed regardless of when they occur. This is especially important for potentially habitable planets whose temperate conditions require wide orbits with infrequent transits [3].

We describe here new transit observation capacity in India, which fills in crucial missing longitudinal coverage from. To our knowledge, there is a 54° gap in the coverage of ≥2m class telescopes from 48°35´E (2m telescope, Shamakhi Astrophysical Observatory, Azerbaijan) to 102°47´E (2.4m telescope, Yunnan Astronomical Observatory, China). With telescopes such as 2m Himalayan Chandra Telescope (HCT), 78°57´E, 3.6m Devasthal Optical Telescope (DOT), 79°41´E and 1.3m Jagadish Chandra Bhattacharya Telescope (JCBT), 78°50´E India is well-positioned to provide the missing longitudinal coverage.

The transit capacity of Indian observatories was most recently demonstrated with observation of the transit of TRAPPIST-1b using the 2m HCT. We discuss this observation as a case study, and seek partnership for further observation programs.

Observed Transit Event and Results: TRAPPIST-1 b was observed using HCT as part of a coordinated campaign lead by [4]. We secured the raw data obtained by [4], reduced and analyzed them using the DAOPHOT package and retrieved the transit light curve. We modeled the transit (Fig. 1) using an MCMC algorithm in conjunction with the analytic transit model from [2]. The planet/star radius ratio, orbital distance, impact factor and mid-transit time we derived were consistent with the values derived by [4].

Future Observations: Based on the demonstrated capacity of HCT to detect small planets transiting M-dwarfs, we have begun a program to search nearby M-dwarfs for transits. We are also planning for observation of G and K dwarfs using JCBT. The observations are aimed at finding new close-in short-period planets around selected targets not known to host planets. With collaboration with other teams we can do coordinated observations of targets, especially of K or M spectral type, continuously for ~3-4 days.

In 2013 [5] searched for planets orbiting brown dwarfs using HCT. However, their SNR was insufficient for detection of habitable planets with $P_{HZ\ out} \leq 8$ hr (corresponding to the outer edge of the liquid water "habitable zone"). Building on the insight of [5] that J-band observations with a ≥3.5m class telescope could detect such planets with $P_{HZ\ out} \leq 8$ hr, we have initiated a program on the 3.6m DOT to do so. We are open to collaborating with other teams to coordinate searches for close-in habitable planets around brown dwarfs and other stars using transit photometry [5,6]. India can contribute to this search by coordinating follow-up transit observations with other teams for the sake of planet confirmation and parameter refinement, leveraging its newly demonstrated transit detection capability and unique longitudinal coverage.

References: [1] Perryman M. (2011), The Exoplanet Handbook, Cambridge University Press. [2] Mandel K. and Agol E. (2002) ApJ, 580, L171-L175. [3] Kane S. R., Hill M. L. et al. (2016), ApJ, 830, 1. [4] Gillon M. et al. (2016) Nature, 533, 221. [5] Belu A. R. et al. (2013) ApJ, 768, 125. [6] Apai D. (2012) Astron. Nachr., *334, 57-62*.

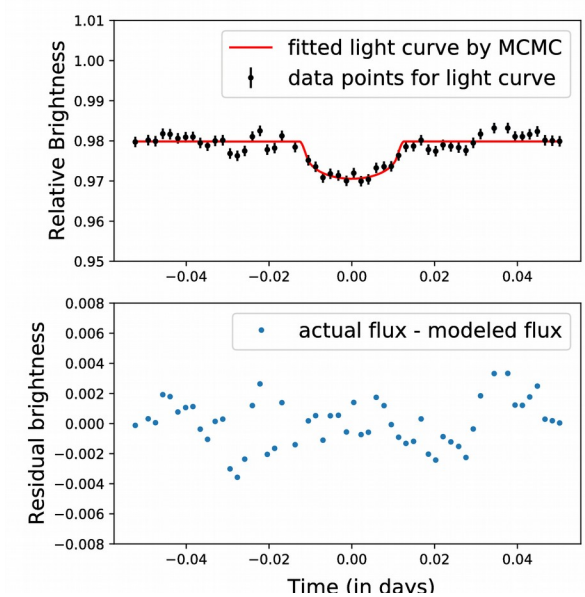

Fig. 1: The transit light curve of TRAPPIST-1b observed by [4] using HCT and reduced and analyzed by us. The upper panel shows the light curve model fitted to the data, and the lower panel shows the residuals of the fit.