

Multiplicity Study of (Community) TESS Objects of Interest

M. Mugrauer, K.-U. Michel, L. Dürrenberg, A.-K. Kollak, J. Rück, J. Zander

Astrophysical Institute and University Observatory Jena

Abstract: In this poster we present the latest results from our ongoing multiplicity study of (Community) TESS Objects of Interest ((C)TOIs), i.e. stars photometrically monitored by the Transiting Exoplanet Survey Satellite (TESS) with promising dips in their light curves, possibly caused by exoplanets, orbiting these stars. With the accurate astro- and photometric data from the ESA-Gaia mission we search for stellar companions of these potential exoplanet host stars and determine their properties (mass, effective temperature, and projected separation). In total, 560 binaries, 30 hierarchical triples, and three quadruple stellar system were discovered among 3081 targets, whose multiplicity was investigated in the course of our survey, so far. This yields a multiplicity rate of the (C)TOIs of at least $19.2 \pm 0.7 \%$. The equidistance and the common proper motion of all identified companions and the (C)TOIs were proven with their precise Gaia astrometry. Companions with masses in the range between about 0.08 and 4.5 M_{\odot} were detected, which exhibit projected separations to the (C)TOIs between about 40 and 10000 au. Beside many low-mass main sequence stars also 15 white dwarf companions were discovered, whose true nature was revealed by their photometric properties. If eventually the transiting signals, found in the light curves of the investigated (C)TOIs, are confirmed to be caused by planets, these stars and their detected companions are all members of new exoplanet host multiple star systems.

The Properties of the Targets of this Survey

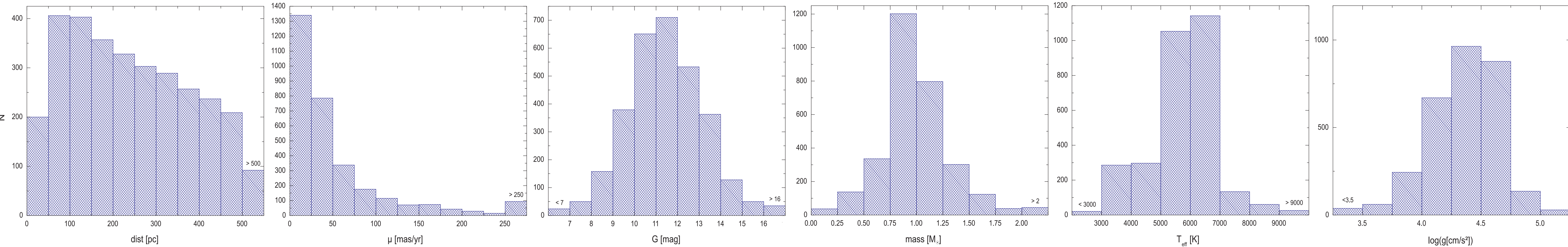


Fig. 1: On average, the targets of this survey are main-sequence stars, which are located at a distance of about 240 pc, exhibit a proper motion of 60 mas/yr, an apparent G-band magnitude of 11.4 mag, a mass of 1 M_{\odot} , and an effective temperature of 5740 K. Beside mainly solar-like stars the targets are low-mass M dwarfs, as well as evolved giant stars (see the histograms of the target properties above).

Detected stellar Companions

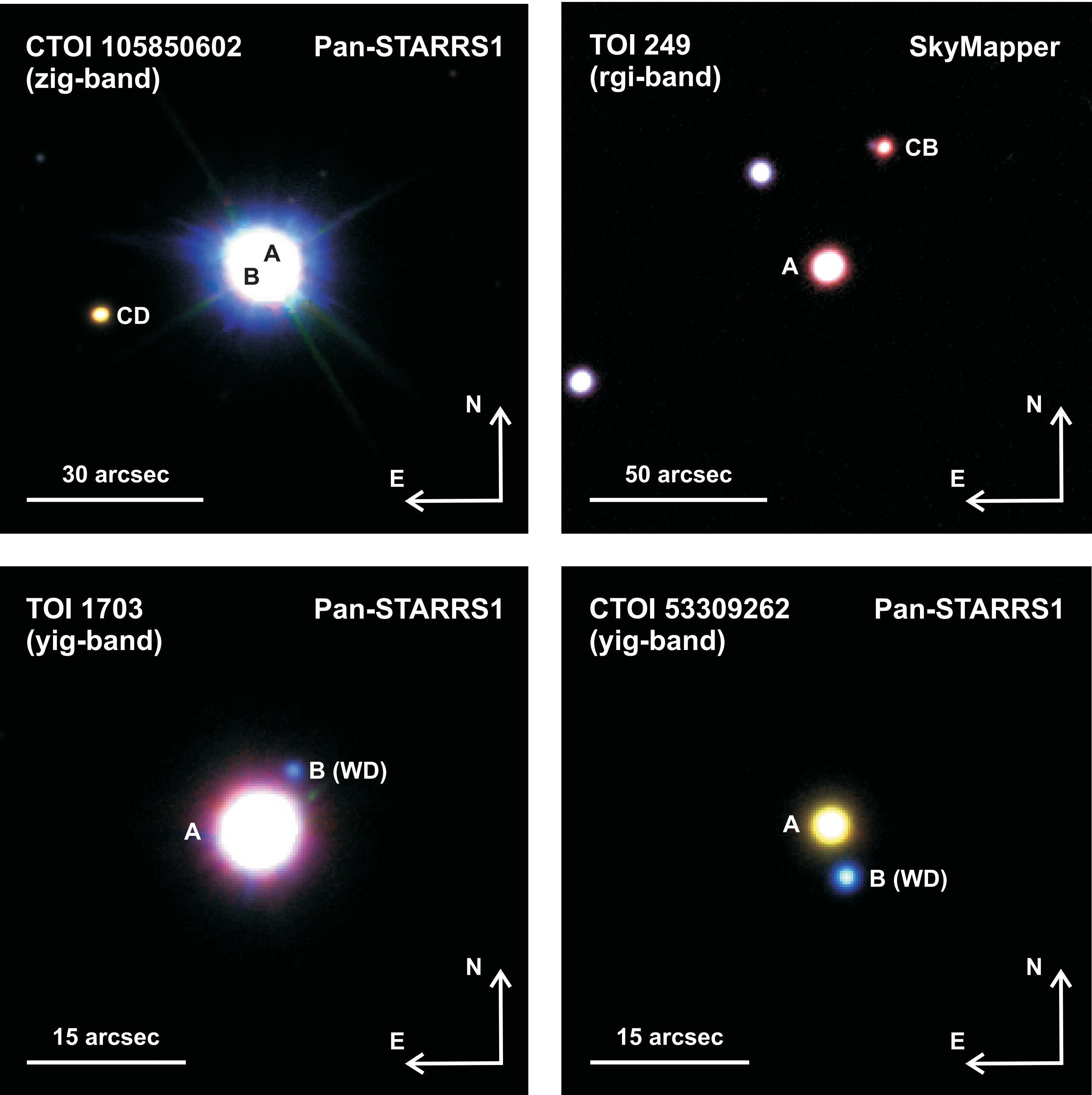


Fig. 2: Examples of companions of (C)TOIs, which were detected in the course of this survey.

Properties of the detected Companions

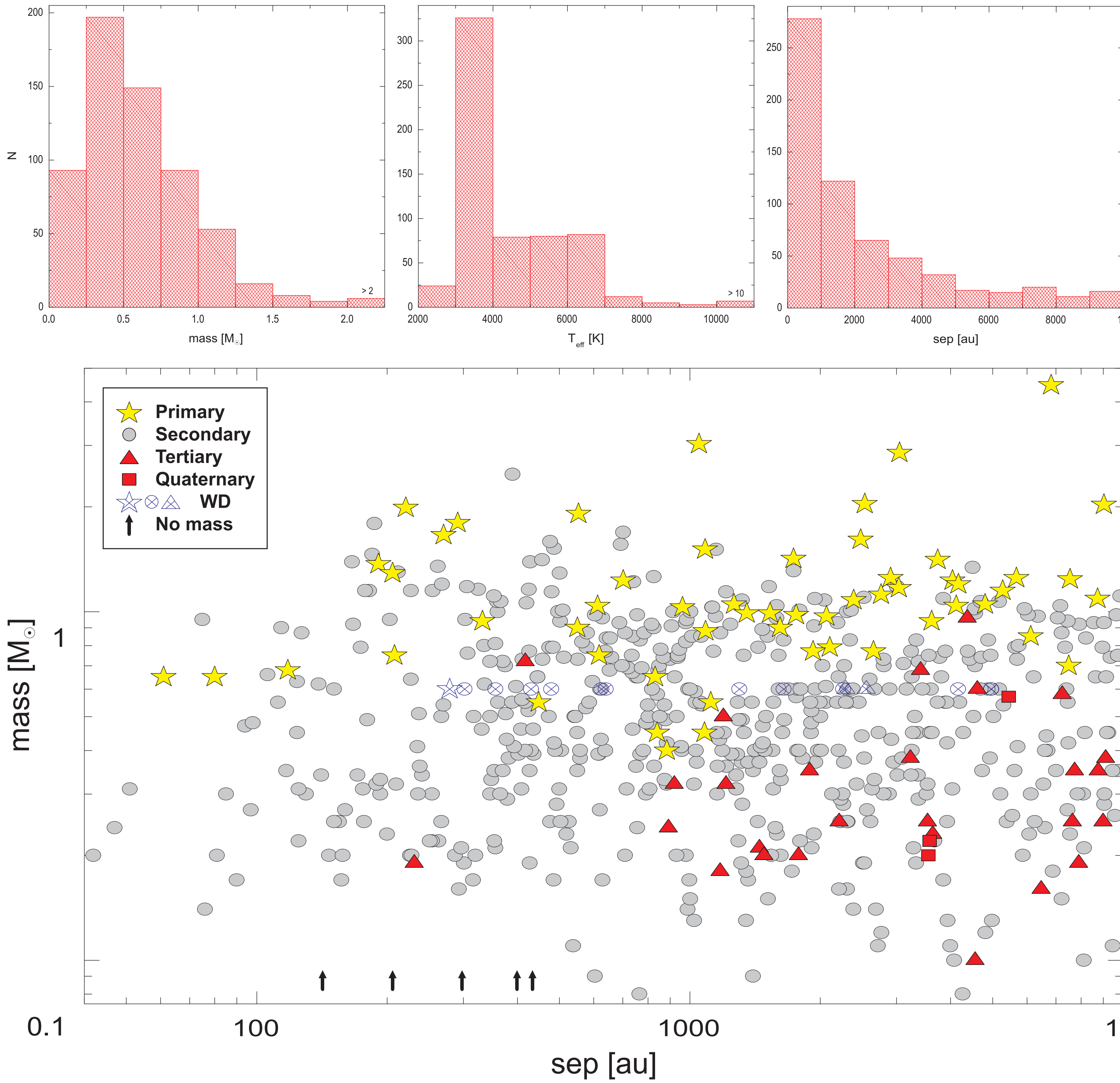


Fig. 3: Property histograms and separation-mass diagram of the detected companions.

Gaia Detection Limit

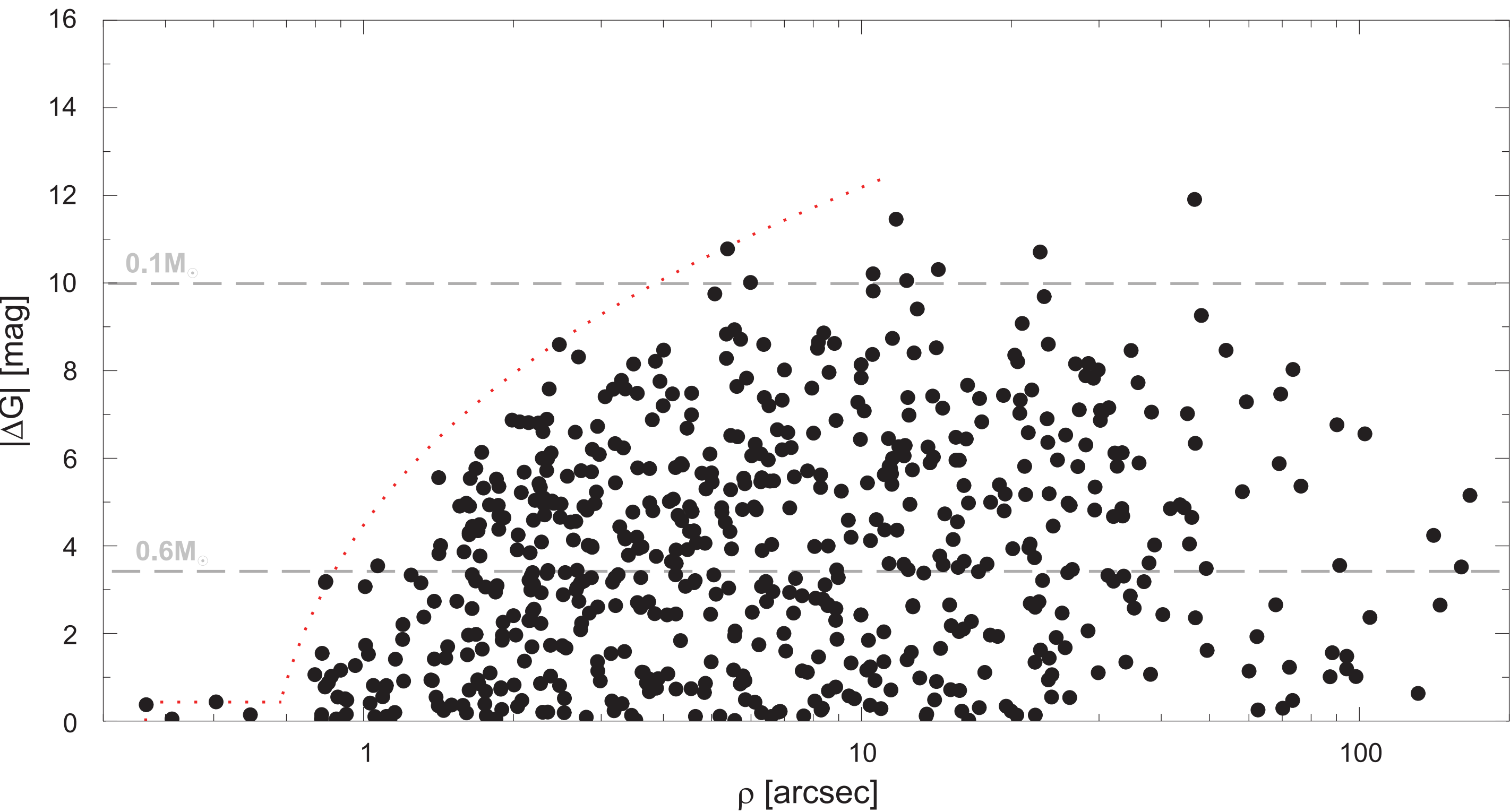


Fig. 4: The G-band magnitude difference between the detected companions and the (C)TOIs. The estimated Gaia DR3 detection limit for companions is illustrated as dotted red line.

Latest Results

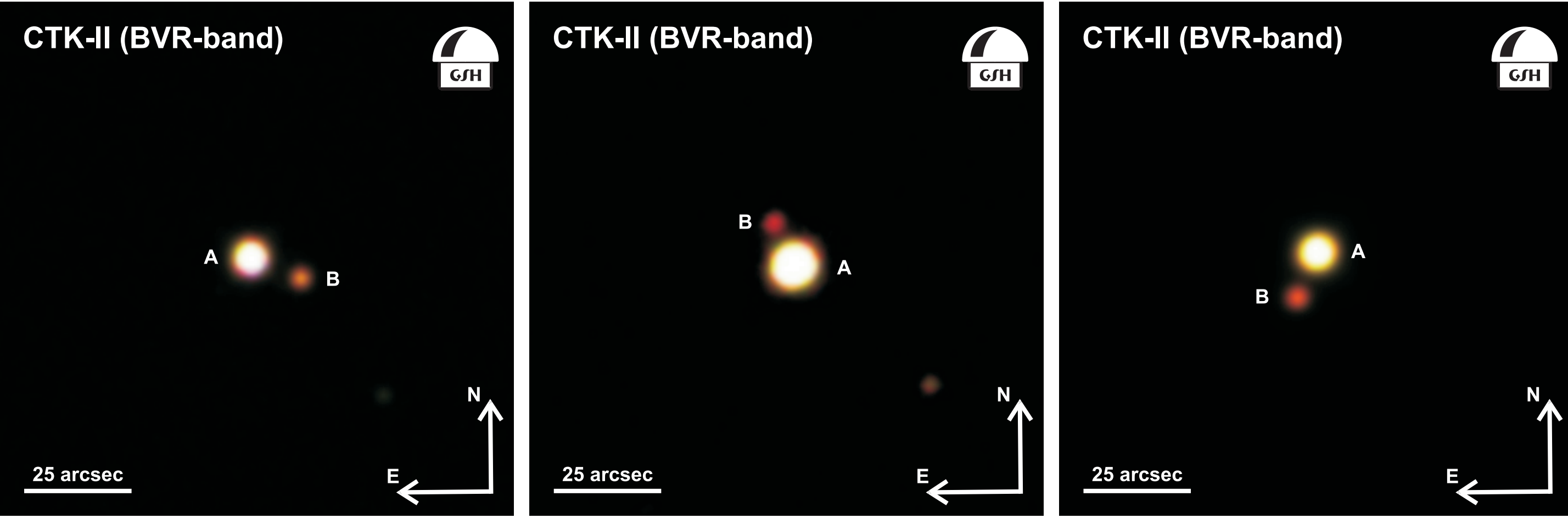


Fig. 5: This survey is an ongoing project, as its target list is continuously growing. Its first results have already been published (see references below). Since then, many more stellar companions of (C)TOIs could be detected (some examples are shown above), whose companionship with these potential exoplanet host stars was proven with their accurate Gaia DR3 astrometry, and whose properties were determined with Gaia & NIR photometry (further publications are in preparation).

References:

Mugrauer & Michel 2020, AN 341, 996
Mugrauer & Michel 2021, AN 342, 840
Mugrauer, Zander & Michel 2022, AN 343, e24017
Mugrauer, Rück & Michel 2023, AN 344, e20230055