Abstract. Transiting planet systems offer an unique opportunity to observationally constrain proposed models of the interiors (radius, composition) and atmospheres (chemistry, dynamics) of extrasolar planets. The spectacular successes of ground-based transit surveys (more than 60 transiting systems known to-date) and the host of multi-wavelength, spectro-photometric follow-up studies, carried out in particular by HST and Spitzer, have paved the way to the next generation of transit search projects, which are currently ongoing (CoRoT, Kepler), or planned. The possibility of detecting and characterizing transiting Earth-sized planets in the habitable zone of their parent stars appears tantalizingly close. In this contribution we briefly review the power of the transit technique for characterization of extrasolar planets, summarize the state of the art of both ground-based and space-borne transit search programs, and illustrate how the science of planetary transits fits within the Blue Dots perspective.

1. Introduction

Within the framework of the Blue-Dots Team (BDT) initiative (http://www.blue-dots.net/), the primary goal of the Transits Working Group (TWG) is to gauge the potential and limitations of transit photometry (and follow-up measurements) as a tool

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to detect and characterize extrasolar planets, while emphasizing its complementarity with other techniques. Following the ‘grid approach’ agreed upon within the BDT, the mapping is to be performed as a function of depth of the science investigation, project scale, and detectable exoplanet class. In this review of the TWG activities, we first describe the main observables accessible by means of photometric transits. We then focus on the host of follow-up techniques that can be utilized to deepen our understanding and characterization of transiting systems, and briefly touch upon some key science highlights, while keeping in mind the primary difficulties and limitations inherent to the transit technique when applied to planet detection. Next, a summary of the present-day and future projects devoted to detection and characterization of transiting planets, both from the ground and in space, is presented. Finally, we use a ‘grid approach’ to properly gauge how the scientific prospects of photometric transits and follow-up techniques fit within the BDT perspective.

2. Planet Detection with Transit Photometry

2.1. Observables

The primary observable of the transit technique is the periodic decrease of stellar brightness of a target, when a planet moves across the stellar disk. The magnitude of the eclipse depth is defined as $\Delta F/F_0 = (R_p/R_\star)^2$, where $F_0$ is the measured out-of-transit flux, and $R_p$ and $R_\star$ are the planet’s and primary radius, respectively. Transits require a stringent condition of observability, i.e. the planetary orbit must be (almost) perpendicular to the plane of the sky. The geometric probability of a transit, assuming random orientation of the planetary orbit, is:

$$P_{tr} = 0.0045(1 \text{AU}/a)((R_\star + R_p)/R_\odot)((1 + e \cos(\pi/2 - \omega))/(1 - e^2)),$$

where $a$ is the orbital semi-major axis, $e$ the eccentricity, and $\omega$ the argument of periastron passage (e.g., Charbonneau et al. 2007). The duration of a central transit is $\tau = 13(R_\star/R_\odot)(P/1 \text{yr})^{(1/3)}(M_\odot/M_\star)^{(1/3)}$ hr, with a reduction for non-central transits by a factor $\sqrt{1 - b^2/R_\star^2}$, where $b = (a/R_\star) \cos i$ is the impact parameter for orbital inclination $i$ (e.g., Seager & Mallén Ornelas 2003). The transit method allows to determine parameters that are not accessible to Doppler spectroscopy, such as the ratio of radii, the orbital inclination, and the stellar limb darkening. When combined with available radial-velocity (RV) observations, actual mass and radius estimates for the planet can be derived, provided reasonable guesses for the primary mass and radius can be obtained.

2.2. False positives reconnaissance

The typical transiting system configurations known to-date (for a comprehensive list see for example http://exoplanet.eu) encompass jovian planets orbiting solar-type stars on a few-day orbits, resulting in eclipse depths of 0.3 – 3% and transit durations of 1.5 – 4 hr. A great variety of stellar systems can reproduce such signals in terms of depth and duration. These include grazing eclipsing binaries, large stars eclipsed by small stars, and ‘blends’ consisting of faint eclipsing binaries whose light is diluted by a third, brighter star (e.g., Brown 2003). Typically, such impostors constitute over 95% of the detected transit-like signals in wide-field photometric surveys datasets. Extensive campaigns
of follow-up observations of transit candidates must then be undertaken in order to ascertain the likely nature of the system. High-quality light curves and moderate precision ($\approx$ km s$^{-1}$), low signal-to-noise ratio (SNR) spectroscopic measurements are usually gathered to deepen the understanding of the primary, the consistency of the transit shape with that produced by a planet, and, via detailed modeling of the combined datasets (e.g., Torres et al. 2004), to rule out often subtle blend configurations. Only if the candidate passes all the above tests, does one resort to use 10-m class telescopes and high-resolution, high-precision Doppler measurements to determine the actual spectroscopic orbit (e.g., Mandushev et al. 2005). The plague of false positives contamination is however rather diminished for ground-based transit surveys targeting cool, nearby M-dwarf stars (Nutzman & Charbonneau 2008). This holds true also for space-borne transit programs, with very high photometric precision which allows to reveal many of the stellar companions via very shallow secondary eclipses, and/or ellipsoidal variations out of transit. Giant stars can be excluded beforehand by using a target catalog, such as the Kepler Input Catalog or Gaia data (as it’s envisioned for PLATO). Background eclipsing binaries can be instead identified efficiently if precision astrometry can be performed on the photometric times series themselves, to measure centroid shifts due to variability-induced movers (Wielen 1996). This technique is currently being applied with considerable success to Kepler data (Latham et al., this volume).

### 2.3. Transiting Systems Highlights

Sixty two transiting planets of main-sequence stars are known today. The direct measure of their masses and radii, and thus densities and surface gravities, puts fundamental constraints on proposed models of their physical structure (Charbonneau et al. 2007, and references therein). Figure 1 shows the $M_p$-$R_p$ relation for the known transiting systems. Strongly irradiated planets cover a
range of almost three orders of magnitude in mass and more than one order of magnitude in radius. The variety of inferred structural properties is posing a great challenge to evolutionary models of their interiors (e.g., Baraffe et al. 2008; Valencia et al. 2007; Miller et al. 2009). Among the most interesting systems found by photometric transit surveys, are a) those containing supermassive ($M_p \approx 7 - 13 M_J$) hot Jupiters such as HAT-P-2b (Bakos et al. 2007), WASP-14b (Joshi et al. 2009), XO-3b (Johns-Krull et al. 2008), and particularly WASP-18b (Hellier et al. 2009), the first planet to be likely tidally disrupted on a short timescale, b) very inflated ($\sim 1.8 \, R_J$) jovian planets such as WASP-12b (Hebb et al. 2009), TrES-4 (Mandushev et al. 2007), and WASP-17b (Anderson et al. 2009), c) the tilted, most eccentric planet, HD 80606b (Winn et al. 2009, and references therein), d) the first transiting planet in a multiple system, HAT-P-13b (Bakos et al. 2009), e) the first transiting low-mass brown dwarf, CoRot-3b (Deleuil et al. 2008), and f) the first transiting Super Earth, CoRot-7b (Léger et al. 2009), itself a member of a multiple-planet system (Queloz et al. 2009).

3. Transiting Planet Characterization: Follow-up Techniques

When the primary is sufficiently bright (see below), a host of follow-up photometric and spectroscopic measurements can be carried out over a large range of wavelengths, to deepen the characterization of the physical and dynamical properties of transiting systems (Charbonneau et al. 2007). At visible wavelengths, long-term, high-cadence, high-precision photometric monitoring can allow to detect additional components in a system (not necessarily transiting) via the transit time variation method (Holman & Murray 2005), while RV measurements collected during transit offer the opportunity to determine the degree of alignment between the stellar spin and the orbital axis of the planet (e.g., Winn et al. 2009). These data are powerful diagnostics for models of orbital migration and tidal evolution of planetary systems (e.g., Fabrycky & Winn 2009, and references therein). The technique of transmission spectroscopy opens the way to measurements of specific elements seen in absorption in the planet’s atmosphere (Charbonneau et al. 2002), including water (Tinetti et al. 2007). At infrared wavelengths, mostly thanks to the Spitzer Space Telescope, the photometric and spectroscopic monitoring over a wide range of planetary phases, and particularly during secondary eclipse, has allowed to study in detail the strongly-irradiated atmospheres of a few planets, with successful detection of the planet’s thermal emission (Charbonneau et al. 2005) and characterization of the longitudinal temperature distribution (e.g., Knutson et al. 2007; Charbonneau et al. 2007). The direct measurements of exoplanets’ atmospheric compositions and temperature profiles, atmospheric dynamics, and phase light curves are key inputs for models of atmospheric physics, chemistry, and dynamics (Burrows et al. 2008).

4. Ground-based and space-borne projects

The success of (wide-field) ground-based photometric transit surveys bears upon two distinct approaches, the first adopting moderate-size telescopes to search relatively faint stars, the second utilizing small-size instrumentation for searches
| Survey          | Location          | Apert. (mm) | CCD      | FOV (deg\(^2\)) | Range (mag) | Scale (") | Since | Nr. stars | Filters   |
|-----------------|-------------------|-------------|----------|------------------|-------------|------------|-------|-----------|-----------|
| OGLE\(^a\)     | Las Campanas     | 1300        | 8K×8K   | 0.34             | 0.26        | 1992       | >10\(^c\) |           | UBVRI     |
| APT\(^b\)      | Australia         | 500         | 2K×2K   | 6.0              | 9.4         | 10-15      | 1995   |           | B,V,R,I    |
| Vulcan\(^c\)   | Lick Obs.         | 120         | 4K×4K   | 49               | <13         | 1999       | 6000   | V, R      |           |
| STARE\(^d\) (TrES) | Tenerife       | 99          | 2K×2K   | 32               | 10.8        | 1999       | >24000 | V, I      |           |
| ASAS-3\(^e\)   | Las Campanas     | 2\times71, 250, 50 | 2\times2K×2K | 64, 4.8, 936  | 2002        |           |       |           |           |
| SuperWasp\(^f\) | S. Africa, La Palma | 2\times8\times111 | 2K×2K   | 16×61            | <13         | 2002       | >100K  |           |           |
| BEST\(^g\)     | OHP               | 195         | 2K×2K   | 9.6              | 10-14       | 5.5        | 2002   | 100K      | clear     |
| XO\(^h\)       | Haleakula         | 2\times110 | 1K×1K   | 51.84            | 12          | 2003       | >100K/year | 400-700 nm |
| WHAT\(^i\)     | Wise Obs.         | 110         | 2K×2K   | 67.24            | 10-14       | 14         | 2004   | 15000     |           |
| HATNet\(^j\)   | Hawaii, FLWO     | 6\times110 | 2K×2K   | 67               | <14         | 2003       | 96K    |           | I         |
| VulcanSouth\(^k\) | Antarctic         | 200         | 4K×4K   | 120              | 2004-2005   |           |       |           | 600-700nm |
| SLEUTH\(^l\) (TrES) | Palomar         | 100         | 2K×2K   | 36               | <14         | 2003       | 10000  |           | r',g,i,z   |
| PSST\(^m\) (TrES) | Arizona          | 100         | 2K×2K   | 36               | 10-13       | 10         | 2004   | 4000-12000 | B,V,R,VR  |
| BEST II\(^n\)  | Aramazones       | 250         | 4K×4K   | 2.8\(^o\)       | 10-16       | 1.5        | 2007   | 100K      | clear     |
| TEST\(^o\)     | Tautenburg       | 300         | 4K×4K   | 4.8              | 10-15       | 2         | 2007   | 50000     |           |
| ASTEP-South\(^p\) | Antarctic       | 100         | 4K×4K   | 48               | 2008        |           |       |           |           |
| MEarth\(^q\)   | FLWO             | 2\times400 | 2K×2K   | 0.18             | <9          | 2008       | 4131   |           |           |
| FAST\(^r\)     | Haleakula        | 4\times1800 | 1.44 kpix. | 49             | <24         | 0.3       | ongoing | 6000/night | g.r.i.y   |
| VISTA-BOPACS\(^s\) | Paranal         | 4000        | 8K×8K   | 0.339            | 13.5-17.5   | 2010       |       |           | Z,Y,J,I,K, |
| ASTEP          | Antarctic         | 400         |         |                  |             |           |       |           |           |
| PASS\(^w\)     | Antarctic         | all sky    |         | 5.5-10.5         |             | 250K      |       |           |           |
| ICE-T\(^y\)    | Antarctic         | 2×600      |         | 65               |             | 2012      | 1.3M   | yes       |           |
| OmegaTrans\(^w\) | Paranal          | 2600       | 16K×16K | 1                | 13.5-17.5   | 200K      |       |           | R         |
around brighter targets (see Figure 2). Most of the projects have focused on high-cadence, visible-band photometry of tens of thousands of stars, and only recently near-infrared filters have started being contemplated. Solar-type stars have been so far the main focus of all searches, but in recent times the MEarth project (Nutzman & Charbonneau 2008; but see also Damasso et al., this volume) and the UKIRT WFCAM Transit Survey (WTS) program (star.herts.ac.uk/RoPACS/) have identified as targets nearby, bright M dwarfs and fainter, more distant low-mass stars, respectively. Transit discovery programs typically achieve photometric precisions of 3-5 mmag. The best-case performances of ∼1-2 mmag are mostly obtained with dedicated follow-up programs at 1-2m class telescopes.

A photometric precision of ∼3 mmag is enough to detect Jupiter- and Saturn-sized companions in transit across the disk of solar-type stars, or 2 − 4 R⊕ planets transiting M dwarfs (see the definition of ∆F/F0 above). If the goal becomes the detection of transits of Earth-sized planets around solar-type primaries, it is necessary to go to space, in order to achieve 0.0001 − 0.00001 mag photometric accuracy. The CoRoT satellite (Baglin et al. 2009), the Kepler mission (Borucki et al. 2009; Latham et al., this volume), and the PLATO mission, currently under study by ESA (Catala 2009; Catala et al., this volume), have been designed to reach the above performances (we direct the reader to the above contributions for details on the science). The first transiting Super-Earth of a solar-type star was recently announced by the CoRoT team (Léger et al. 2009; see also Rouan et al., this volume).

As mentioned above, the spectroscopic characterization of transiting systems has been carried out primarily from space, by HST and Spitzer. In the future, the prospects for detailed atmospheric characterization of transiting planets will rely on the James Webb Space Telescope (JWST), the SPICA satellite, and the proposed THESIS concept. We refer to the contributions by Clampin, Enya, and Swain in this volume for details on these projects and their potential.

4.1. The star’s the limit

It is not uncommon to believe that main-sequence, solar-type stars astrophysics is a solved problem, for practical purposes. In reality, when it comes to transiting planetary systems, the knowledge of the central star is oftentimes the limit for the accurate determination of the most sensitive planetary parameters. The precise characterization of transiting planets is intimately connected to the accurate determination of a large set of stellar properties (activity levels, age, rotation, mass, radius, limb darkening, and composition). Some of them (activity, rotation) can critically limit the possibility to successfully determine the spectroscopic orbit of the detected planets. Others (mass, radius, age) are strongly model-dependent quantities, and the correct evaluation of their uncertainties is not trivial (e.g., Brown 2009). Furthermore, precise measurements of the stellar characteristics become increasingly more challenging for fainter targets.

As discussed in Section 2.2, follow-up observations of transiting planet candidates can be very time-consuming (the RV campaign for CoRoT-7 required over 100 spectra, a total of more than 70 hrs of observing time distributed over 4 months). For CoRoT, Kepler, and PLATO confirmation via RV measurements may not even be feasible below a certain radius size, depending on spectral type (for reference, the semi-amplitude of the RV motion induced by
the Earth at 1 AU on the Sun is $\sim 9 \text{ cm s}^{-1}$, way below the currently best-achievable precision of 50-100 cm s$^{-1}$ with the HARPS spectrograph). Devices for ultra-stable wavelength calibration such as laser combs can in principle allow to push towards $<10 \text{ cm s}^{-1}$ precision (Li et al. 2008), provided the star cooperates (Walker 2008; Makarov et al. 2009). Achievable SNR for a given host’s spectral type make also complicated the problem of atmospheric characterization of transiting rocky planets via transmission spectroscopic or secondary-eclipse observations (Kaltenegger & Traub 2009; Deming et al. 2009).

Given the above issues, it is clear that bright ($V \leq 12$) stars are the privileged targets for transit searches. The challenge is then designing a survey capable of covering large areas of the sky to maximize the yield of good targets. This is planned for PLATO, thanks to its step & stare mode (Catala et al., this volume) and, in all-sky fashion, by TESS (Deming et al. 2009).

5. The BDT Perspective

As discussed in detail by Coudé du Foresto et al. (this volume), the BDT has devised a strategy to gauge the interplay between families of techniques, project scale, scientific potential, and detectable exoplanet class within the context of the multi-step approach recognized necessary in order to reach the final goal of detection and characterization of terrestrial, habitable planets. Following the ‘grid methodology’ agreed upon within the BDT, and outlined in detail by Coudé du Foresto et al. (this volume), the TWG has attempted to gauge the potential and limitations of transit photometry (and follow-up measurements) as a tool to detect and characterize extrasolar planets, while emphasizing its complementarity with other techniques. Overall, our preliminary conclusion is that transit-discovery observations can crucially contribute to statistical studies of planetary systems (science potential 1) and to identify systems suitable for follow-up (science potential 2). Follow-up observations of known transiting systems have the potential to achieve their full spectroscopic characterization (science potential 3). However, the full potential of the technique might not be realized for all classes of extrasolar planets encompassed in this exercise. In particular (see Figure 3):

**Hot giant planets**: Ground-based, wide-field transit surveys with typical photometric accuracy $<0.01$ mag, have allowed to detect several tens of hot Jupiters. The ongoing CoRoT mission is also providing many detections of close-in Giants, and the prospects with Kepler are very encouraging too. The Spitzer and Hubble Space Telescopes have been utilized as follow-up tools for the
(broad-band) spectral characterization of several hot Jupiters at visible, near, and mid IR wavelengths, with several molecules identified).

**Giant planets at large orbital radii:** CoRoT and Kepler are capable to achieve an accuracy of $10^{-4} - 10^{-5}$ mag, respectively, in the visible. They will provide a census of transiting giant planets out to 1 AU based on $\sim 10^5$ targets. The proposed TESS all-sky survey ($\sim 2012$) could achieve a photometric precision similar to that of CoRoT, and could provide a census of transiting giants with periods up to several tens of days around bright stars. While not a truly all-sky survey, the PLATO mission ($\sim 2017$) could achieve, on a statistically significant sample of bright stars, a photometric precision exceeding Kepler’s. It will be sensitive to Jupiters on orbital periods similar to those accessible by Kepler. Statistical information on the rate of occurrence of longer-period giant planets will also be collected by ongoing and upcoming large-scale ground-based surveys, such as LSST and PANSTARRS (see Figure 2). For the sample of relatively bright stars, several very efficient space- and ground-based facilities will become available in the near future for characterizing spectroscopically the discovered planets. These include JWST and SPICA (and possibly THESIS) for infrared photometry and spectroscopy, and the ELTs for high-resolution spectroscopy in the optical and near IR.

**Telluric Planets in and out of the Habitable Zone of M dwarfs and solar-type stars:** CoRoT and TESS have the potential to detect Super-Earth planets around all targets, and at a range of orbital radii, including the Habitable Zone of low-mass stars (CoRoT has recently announced its first detection). Kepler has the potential to provide the first statistically sound estimate of $\eta_{\oplus}$. The ultra-high-precision photometry delivered by PLATO will also allow the detection of Earth-sized planets in the Habitable Zone of F-G-K targets. For low-mass stars, the ongoing ground-based MEarth cluster of telescopes is optimized to search for transiting Super-Earths in the Habitable Zone of nearby M dwarfs, while the WTS survey will target a large sample of low-mass stars, searching for transiting rocky planets with periods of a few days. Theoretical studies are now maturing, which can predict the range, and strength, of spectral fingerprints of terrestrial, habitable planets (e.g., Grenfell et al. 2007; Kaltenegger et al. 2009). The proposed SPICA mission, JWST, and the THE-SIS concept will be capable to perform spectral characterization (broad bands, spectra) in the near- and mid-IR possibly down to telluric planets in the HZ of bright M dwarfs. The proposed SIMPLE instrument for the E-ELT would also be able to perform transmission spectroscopy of low-mass planets transiting M dwarfs.

6. **Summary**

On the ‘bright’ side, transit photometry allows to characterize the bulk composition of a planet, and it identifies systems suitable for atmospheric characterization. Such studies are more difficult to undertake for non-transiting systems. In order to fully exploit the potential of this technique (and follow-up measurements), there does not seem to be a clear need for a facility devoted to planetary transits which would require investments on the order of an ESA’s flagship (L-class) mission. On the other side, this technique requires large amounts of
follow-up work, and the stellar host can often be the limiting factor in the precision with which the crucial physical parameters of the planets are determined.

The relevant technology for transit detection of terrestrial-type planets is already available. Ongoing and future programs have the potential to nail the occurrence rate of habitable planets around main-sequence stellar hosts, and, provided some degree of further technological development, characterize those around stars with favorable spectral type.

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References

Anderson, D. R., et al. 2009, ApJ submitted (arXiv:0908.1553)
Baglin, A., et al. 2009, Proc. IAU Symp. 253, 71
Bakos, G.A., et al. 2007, ApJ, 670, 826
Bakos, G.A., et al. 2009, ApJ, in press (arXiv:0907.3529)
Baraffe, I., Chabrier, G., & Barman, T. 2008, A&A, 482, 315
Borucki, W., et al. 2009, Proc. IAU Symp. 253, 289
Brown, T.M. 2003, ApJ, 593, L125
Brown, T.M. 2009, ApJ submitted
Burrows, A., Budaj, J., & Hubeny, I. 2008, ApJ, 678, 1436
Catala, C. 2009, Experimental Astronomy, 23, 329
Charbonneau, D., Brown, T.M., Noyes, R.W., & Gilliland, R.L. 2002, ApJ, 568, 377
Charbonneau, D., et al. 2005, ApJ, 626, 523
Charbonneau, D., et al. 2007, in Protostars and Planets V, B. Reipurth, D. Jewitt, and K. Keil (eds.), University of Arizona Press, Tucson, 701
Deleuil, M., et al. 2008, A&A, 491, 889
Deming, D., et al. 2009, PASP, 121, 952
Fabrycky, D.C., & Winn, J.N. 2009, ApJ, 696, 1230
Grenfell, J.L. et al. 2007, PSS, 55, 661
Hebb, L., et al. 2009, ApJ, 693, 1920
Hellier, C., et al. 2009, Nat, 460, 1098
Holman, M.J., & Murray, N.W. 2005, Sci, 307, 1288
Joshi, Y.C, et al. 2009, MNRAS, 392, 1532
Johns-Krull, C.M., et al. 2008, ApJ, 677, 657
Kaltenegger, L., et al. 2009, Astrobiology, in press (arXiv:0906.2263)
Kaltenegger, L., & Traub, W.A. 2009, ApJ, 698, 519
Knutson, H.A., et al. 2007, Nat, 447, 183
Léger, A., et al. 2009, A&A, 506, 287
Li, C.-H., et al. 2008, Nat, 452, 610
Makarov, V.V., et al. 2009, ApJ, 707, L73
Mandushev, G., et al. 2005, ApJ, 621, 1061
Mandushev, G., et al. 2007, ApJ, 667, L195
Miller, N., Fortney, J.J., & Jackson, B. 2009, ApJ, 702, 1413
Nutzman, P., & Charbonneau, D. 2008, PASP, 120, 317
Queloz, D., et al. 2009, A&A, 506, 303
Seager, S., & Mallén-Ornelas, G. 2003, ApJ, 585, 1038
Tinetti, G., et al. 2007, Nat, 448, 169
Torres, G., Konacki, M., Sasselov, D.D., & Jha, S. 2004, ApJ, 614, 979
Valencia, D., Sasselov, D.D., & O’Connell, R.J. 2007, ApJ, 665, 1413
Walker, G. 2008, Nat, 452, 538
Wielen, R. 1996, A&A, 314, 679
Winn, J.N., et al. 2009, ApJ, 703, 2091