The Zwicky Transient Facility

A COLLABORATIVE AGREEMENT

Among

California Institute of Technology, Caltech Optical Observatories, USA

Oskar Klein Centre, Stockholm University, Sweden

Weizmann Institute of Science, Israel

University of Maryland (on behalf of the Joint Space-Sciences Institute), USA

Deutsches Elektronen-Synchrotron, Germany

University of Wisconsin, Milwaukee, USA

This Collaborative Agreement is entered into by and among the California Institute of Technology, through its Caltech Optical Observatories, USA (COO or Caltech); the Oskar Klein Centre, Sweden (OKC); the Weizmann Institute of Science, Israel (WIS); the University of Maryland, on behalf of the Joint Space-Sciences Institute, USA (UMD/JSI); Deutsches Elektronen-Synchrotron, Germany (DESY) (in close collaboration with the Kowalski group at Humboldt University (HU), Berlin, Germany); and the University of Wisconsin, Milwaukee, USA (UWM); collectively "Partners," "Partner institutions," or "Parties."

The Partners hereby establish The Zwicky Transient Facility (ZTF) Consortium, to develop and operate a new wide-field, high-cadence optical transient survey on the Samuel Oschin (P48) Telescope at Palomar Observatory (the ZTF Project). Building on the technical infrastructure and scientific achievements of the Palomar Transient Factory (PTF) and Intermediate Palomar Transient Factory (iPTF), the ZTF Project will be able to systematically chart the transient and variable sky at an unprecedented survey speed, more than ten times faster than PTF. ZTF will emphasize high cadence observations and follow-up observations of Targets of Opportunity and will thus be uniquely positioned to uncover rare and ephemeral transients and variables. ZTF surveys may include large-area surveys; small-area, high-cadence surveys; and/or triggered or Target-of-Opportunity observations.

The PTF (2009—2012) and iPTF (2010—2016) operated as consortia among several research institutions. Using the Samuel Oschin (P48) and 60-inch (P60) telescopes at Palomar Observatory as survey instruments, PTF and iPTF made numerous discoveries of new transient phenomena, such as a large number of supernovae of various types, gap transients, relativistic transients, variable stars of many types, and solar system bodies. More details on PTF and iPTF are available at http://www.ptf.caltech.edu/.

ZTF will be a follow-on survey to the PTF and iPTF that will continue to use many of the same assets (including but not limited to, the P48; the Palomar 60-inch (P60) telescope augmented with the new SED Machine integral-field spectrograph; and the IPAC PTF Data Center). The ZTF Consortium intends to develop and employ a new wide-field mosaic CCD survey camera, the Zwicky Transient Facility Camera (ZTFC) and associated infrastructure, for the P48 to discover transients, variables, and moving objects at a greater rate than currently possible. Development of the ZTFC is led by COO.

ZTF will use eighty percent (80%) of the science observing time at the P48 Telescope at Palomar Observatory and sixty-five percent (65%) of the science observing time at the P60 Telescope at Palomar Observatory for dedicated follow-up observations of ZTF-identified targets. The ZTF operational phase is targeted to commence on or about 1 July 2017 and run at least three years. The targeted 2017 survey date for ZTF provides a five-year window for science investigations in advance of the beginning of the Large Synoptic Survey Telescope. Moreover, advanced gravitational wave interferometers will be coming online at that time, providing an opportunity to search for electromagnetic counterparts to gravitational wave sources.

In order to accomplish the scientific and technical purposes outlined above, and in consideration thereof, the Partners agree as follows:

I. Partners

A. Founding Partners

The ZTF Consortium will consist initially of the Founding Partners, which may be designated as either Principal or Minor Partners, as defined below.

1. Principal Partners

Partners who have committed to make significant financial contributions to ZTF. COO, OKC, WIS, and UMD/JSI are Principal Partners.

2. Minor Partners

Minor partners are those who participate in ZTF within topical areas proscribed by the Board. DESY (in close collaboration with the Kowalski group at Humboldt University (HU), Berlin, Germany) and UWM are Minor Partners.

B. New Partners

New Partners may be admitted as either a Principal or Minor Partner by invitation of the ZTF Principal Investigator (PI) subject to a two-thirds (2/3) ratification vote of the entire ZTF Board, and subject to such terms and conditions as set forth herein or as may otherwise be established by the Partners. New Partners must sign this agreement.

C. TANGO Consortium

Some institutions provided early, at-risk contribution of resources to the ZTF Project but cannot yet commit to deliver their full share. Acknowledging previous bilateral agreements, the Founding Partners agree that the following institutions may be admitted to the Consortium as Minor Partners on commitment to deliver a net value of $750K to the project:

- TANGO Consortium/University System of Taiwan, Republic of China

D. Los Alamos National Laboratory

Recognizing previous bilateral agreements and early contributions of hardware resources and funds to ZTF, the Los Alamos National Laboratory (LANL) may participate in ZTF science activities as it would if it were a Minor Partner under the direction of the PI. LANL may send a non-voting observer to ZTF Board meetings.

II. Term of Agreement

Upon the last signature of the Founding Partners, this Collaborative Agreement shall be effective as of 1 November 2014 (Effective Date), and shall extend to 1 July 2020 or three years after commissioning is completed, whichever is later. Terms of this agreement may be modified or its duration extended by unanimous written agreement of the Parties.

III. Consortium Governance Structure

A. Principal Investigator

The ZTF Principal Investigator (PI) is Prof. Shrinivas Kulkarni (COO). The PI provides overall scientific and programmatic leadership for the ZTF project. The PI defines the requirements and scope of the ZTFC and the ZTF datacenter and supervises their implementation by COO and IPAC. The PI directs the NSF MSIP public surveys to be conducted by ZTF.

B. ZTF Board

The ZTF Board shall act as a board of governors for the ZTF Consortium and shall consist of one (1) Representative from each of the Principal and Minor Partners, with the exception of Caltech, which shall have two (2) Representatives. Caltech's Representatives will typically be the ZTF Principal Investigator (PI) and the COO Director; however, in the event that the PI is also serving as the COO Director, Caltech shall appoint another individual as its second Representative. The Board will be chaired by the PI or his or her designated alternate.

C. Voting

Each Representative of each Principal Partner shall each have two (2) votes, while each Representative of each Minor Partner shall each have one (1) vote. Except as otherwise specified in this Collaborative Agreement, decisions will be made by simple majority vote. At least two-thirds (2/3) of the total number of Partners must be represented to constitute a quorum.

D. Roles and Responsibilities

The ZTF Board shall be the controlling authority in the operation of ZTF according to the terms of this Collaborative Agreement. The ZTF Board shall convene at least semi-annually to evaluate ZTF operations and progress, and address ZTF Consortium business. The PI may appoint a non-voting Executive Officer to assist with Board organizational matters.

In particular the ZTF Board shall have the following explicit roles:

1. Consistent with this Collaborative Agreement, the ZTF Board may establish such policies for the governance and operation of the ZTF Consortium as the ZTF Board deems reasonably necessary and practical.
2. The ZTF Board shall have governing authority to determine Consortium membership status, and determine appropriate action should a Partner be in material breach.
3. The ZTF Board shall have the authority to address and resolve all disputes among individuals and Partners within and relating to the ZTF Consortium. Any judgments rendered by the ZTF Board concerning disputes within the Consortium are binding and

final insofar as they relate to ZTF financing, operations, data, and/or science.

4. The ZTF Board is responsible for defining ZTF science publication policies.
5. The ZTF Board may advise the PI on science priorities that may inform the requirements defined by the PI for the ZTF Camera and/or datacenter.
6. The ZTF Board may advise the PI on the effect of the MSIP public surveys on collaboration science priorities and suggest strategies for optimizing the net scientific return of the public and private surveys.
7. The ZTF Board shall designate the ZTF Science Steering Committee, which will be empowered to authorize and monitor ZTF science projects.
8. The ZTF Board may advise the Science Steering Committee on overall ZTF science priorities.
9. The ZTF Board, by a 2/3 vote of the entire Board, may elect Associates.
10. The ZTF Board approves the Builders' list.

E. Science Steering Committee

The role of the ZTF Science Steering Committee (SSC), which shall be the principle advisory body to the ZTF Board, shall be to advise the ZTF Board regarding formulation of the detailed survey strategy. The ZTF's science programs will be directed by the SSC. Annually, each ZTF Principal and Minor Partner will nominate one Member to serve on the SSC. The composition of the SSC will be ratified by the ZTF Board. The SSC chair is appointed by the ZTF PI.

The SSC is charged with the responsibility of overseeing all aspects of ZTF science operations under the policies and guidelines established by the ZTF Board. The spirit of ZTF is to conduct large surveys, which will have synergetic impact on a wide range of research topics. ZTF strategies will be limited by several facts including commitments to parties external to the Consortium (e.g. NSF, DESI) and limitations of the telescope, camera, and software pipelines. The exact strategy, taking into account all these limitations as well as science needs, will be the responsibility of the SSC and shall be approved by the ZTF Board.

The ZTF SSC will convene at least semi-annually to conduct/assess ZTF science operations in the following areas:

1. Assess the status of existing ZTF projects, and make recommendations to ZTF Project teams on the assessment/status of their project.
2. Define the ZTF time allocations and priorities for the next semester, and report those to the ZTF Operations Scientist.
3. Assess requests to add Collaborators to ZTF-related projects and forward to the Board Chair for approval.
4. Maintain the list of approved ZTF Collaborators.
5. May review and comment on all ZTF publications before submission.
6. Report on overall ZTF status to the ZTF Board.
7. Oversee standing Science Working Groups.

F. ZTF Projects and Working Groups

ZTF projects are specific science investigations undertaken using the ZTF data. (Appendix B provides a non-exclusive list of high-level topics.) ZTF Projects may be led by individual Members or Associates (the Project Leaders) affiliated with one or more ZTF Partners. Eligibility for individuals or groups to participate in ZTF is determined by the Partner which employs them, or with whom they are affiliated, but is subject to the final authority of the ZTF Board. Projects sharing common science (e.g., supernovae) or methods (e.g., variable stars) may be undertaken within larger science working groups. The SSC may organize and will oversee standing science working groups.

New projects and working groups should be proposed to the SSC, which will evaluate the scientific merit and feasibility of the investigation, the past performance of the leaders, and the potential for any conflict with existing projects or working groups. If approved by the SSC, leaders shall publicize the project or working group to the Partners and include it among the list of active investigations on an appropriate internal website.

ZTF projects are expected to make steady progress against project objectives. As such, all projects will be required to submit progress reports to the SSC at intervals determined by the SSC. These reports will be the basis for the SSC's ongoing assessment of the project. The SSC may at its discretion make future observing time allocation or priority adjustments based on its assessment of the project.

Project and working group leaders are expected to be inclusive and to take advantage of requests of eligible consortium members to join the established projects. Prospective new members should naturally have a sound reason (interest, knowledge, track record, skills) to join an established project. However, teams reserve the right to decline participation of additional members.

If a project has science goals requiring specialized sky coverage, cadences, or other specialized requirements, project leaders will convey any such requests to the SSC, which will determine appropriate survey strategies to maximize the overall scientific return of the survey.

An important part of any project is the plan for follow-up observations (e.g. spectroscopy) to support project objectives. The project team should assume they have the flexibility to pursue follow-up activities (and financial support for same) as appropriate, and independent of ZTF Board or SSC.

G. ZTF Science Operations Group

The ZTF Consortium will maintain an *ad hoc* ZTF Science Operations Group (SOG) to monitor the ongoing functioning of ZTF elements. Such operational elements will include telescope/instrument function and data quality, data processing pipelines, data archiving and availability/extraction. The ZTF SOG shall be chaired by the ZTF Operations Scientist, and the group will serve to advise the Consortium and Palomar Observatory on the ongoing operations and data quality of ZTF elements.

IV. Categories of Individuals Involved in ZTF

A. Members

Faculty (or equivalent), postdoctoral scholars, and students at Partner institutions are eligible to be ZTF Members unless excluded by action of the lead Partner representative. Non-resident adjunct faculty or equivalents are not eligible to be ZTF Members.

B. Associates

Associates are individuals who are invited to join the ZTF Consortium as individuals participating in ZTF based on their scientific or technical contributions to the project. Associate invitations are the exclusive purview of the ZTF Board. Associates have the same privileges as ZTF Members but have been invited by the ZTF Consortium for their expertise and anticipated valuable contribution to the Consortium. The students and postdocs of the Associate are also members of ZTF. However, this privilege does not extend to other faculty, staff or other individuals in their institution.

Being invited to be an Associate is a great privilege and as such appointments will be made only if the case is extremely strong. Before an Associate is proposed by a member of the ZTF Board there should be extensive discussion with the PI. An Associate is elected by the Board by at least a 2/3 vote of the entire Board. Upon Board approval, the PI will send letters to Associates clearly specifying the duration of the appointment, and outlining the expectations in each case.

Associates are required to comply with all ZTF rules applicable to them under this Agreement, including but not limited to the intellectual property, data products, and confidentiality clauses. Upon receiving an invitation letter from the PI, new Associates will be asked to sign a letter accepting the invitation and acknowledging their agreement to abide by these rules.

C. Collaborators

Collaborators are individuals who are not ZTF Members or Associates, but who are approved to engage in long-term collaboration with ZTF members on specific, prescribed ZTF science analyses. Collaborators are so-designated by the ZTF SSC.

Each Collaborator will be identified by their explicit contribution to a specific Project. The contribution should be identified in advance with specificity (including duration). The Collaborator should list all personnel (including student or students, postdoc or postdocs and other researchers). Other than students all personnel should be named. In return for their specific contribution the Collaborator and the named group will be included in papers that specifically rest on their contribution. Given the large size of the ZTF Consortium, well-defined and specific collaborations are strongly desirable.

ZTF benefits by having access to follow up resources beyond that available to the ZTF group. To this end it is advantageous for ZTF to have Collaborators who can bring such resources.

Project leaders should first discuss offers of collaboration within their own project and with other project leaders. After having developed a strong case for collaboration they should formally propose to the Chair of the Board. Under normal circumstances the Board Chair will make the decision in no less than a week, and promptly will notify the remainder of the Board. Should any member of the Board raise concerns, the Chair will consult with the full Board. The time to take a decision is generally no more than six weeks. Upon Board approval, the PI will send letters to Collaborators clearly specifying the duration of the appointment, and outlining the expectations in each case.

The ZTF Board will maintain a list of current Collaborators and the Project Leaders associated with them. Collaborators will be so designated for a fixed period of time, with the possibility of extension.

Collaborators are required to comply with all ZTF rules applicable to them under this Agreement, including but not limited to the intellectual property, data products and confidentiality clauses. Upon receiving an invitation letter from the PI, new Collaborators will be asked to sign a letter accepting the invitation and acknowledging their agreement to abide by these rules.

D. Builders

Builders are individuals who participated in the development, construction, commissioning, and/or maintenance of important ZTF assets (e.g., the P48 ZTF Camera, the SED machine IFU, and the ZTF data center) as determined by the ZTF Board. The ZTF Builder's list recognizes the efforts of those who devote significant time to the cause of ZTF. The list will be nominated by the ZTF PI and ratified by majority vote of the Board. Researchers on the Builders list will have the option to participate in any ZTF paper. The ZTF Builder's list will be reviewed and updated every year by the ZTF PI, and approved by the ZTF Board.

V. PARTNER CONTRIBUTIONS

A. COO Contributions

COO is contributing the use of the Samuel Oschin Telescope (P48), the 60-inch Telescope (P60) and associated instrumentation. COO shall endeavor, within its available resources, to continue to make available the P48 and P60 during the ZTF performance period.

B. Unavailability of P48 and P60

In the event COO is unable to continue to make the P48 and/or the P60 available, the COO

Director shall designate an emergency situation, and convene an executive session of the ZTF Board to consider available options, which may include terminating and/or restructuring the ZTF Project and/or pooling additional resources needed to effect the continuation of the Project, subject to the terms of this Collaborative Agreement regarding termination. In no circumstances shall any ZTF Partner be liable for any costs or resources beyond that specified below, unless agreed to in writing by the Partner. In such emergency situation Partners may terminate their ZTF participation with a six-month (6) close-out period.

C. Contributions from Partners

The Partners will make the following contributions to develop the ZTFC and toward operating and maintaining the ZTF observing assets and associated data center during the survey as follows:

	To date	Forthcoming	Total
Oskar Klein Centre	$30K	$1.47M	$1.5M
Weizmann Institute of Science	$411K	$1.089M	$1.5M
University of Maryland, Joint Space-Sciences Institute	$0	$1.5M	$1.5M
DESY	$246K	$129K, plus $375K in-kind shutter contribution	$750K
UWM	$50K	$450K, plus $250K in-kind support for software development	$750K

The Founding Partners agree to provide their cash contributions according to the schedule in Appendix E. The contribution schedule for all future partners shall be determined by the ZTF Board and appended to Appendix E.

The Partners acknowledge that individual Partners may not yet have secured funds for their full contributions, but such Partners herewith commit to develop the resources necessary to meet their obligations.

Valuation of any non-COO in-kind Partner contributions will be determined by the Board. Contingency on in-kind development is held by the Consortium as a whole.

D. ZTF Camera

The ZTF Consortium has purchased the sixteen CCDs needed to complete the ZTF Camera (the ZTFC). The expectation is that delivery of the funds listed above from the Founding Partners, in addition to the funds awarded by the National Science Foundation, will be

sufficient to complete the full camera by 2017.

VI. Observing Time

A. COO will assign ZTF 80% of the science observing time on the P48 and 65% of the science observing time on the P60 at Palomar Observatory. Allocated time will be equitably distributed with respect to season and lunar phase.

B. Of the P48 time available to the ZTF Consortium, up to 10% may be allocated for Target of Opportunity observations interrupting regular survey operations. Additionally, 5% of the telescope time will be reserved as discretionary for the ZTF SSC to leverage unanticipated opportunities. Approximately 50% of the consortium time will be used to conduct public surveys as part of the NSF MSIP award (Appendix D).

C. Scheduling of Palomar telescopes is the responsibility of the COO Director or his/her designated alternate, although detailed (daily) queue scheduling at the P48 and P60 telescopes may be delegated as appropriate.

D. Independent, Caltech-affiliated investigations assigned time on P48 and/or P60 outside the ZTF allocation will have access to the ZTFC and basic ZTF data reduction pipelines for the purposes of deriving standard data products. Such independent data products shall be protected as proprietary for a period of no more than 18 months

VII. Instrumentation and Other Operations Assets

A. The ZTFC is being developed as part of the ZTF Project. The ZTFC will be the property of COO, and the maintenance of ZTFC is and shall remain the responsibility of COO.

B. The SED Machine integral field spectrograph for P60 is being developed by COO (with contributions from the University System of Taiwan). The SED Machine is and shall remain the property of COO, and the maintenance of SED Machine is and shall remain the responsibility of COO.

C. Title to any hardware contributed by one or more Partners shall be transferred to Caltech upon the completion of thirty (30) months of ZTF operations, as determined by the COO Director, or 1 Nov 2019, whichever is later. Any software contributed by any of the Partners for use in the Project shall be deemed as permanently useable by COO under a nonexclusive paid-up license from that Partner. A paid-up license means that the licensee is free to use the software without payment of any additional money.

VIII. Intellectual Property

A. Intellectual Property (inventions or computer software) that is created by the Parties or their contractors for use in the ZTF Project during the period of this Collaborative Agreement and any extensions thereof shall each be owned as set forth in the following

paragraphs.

B. Title in such intellectual property that is created solely by one Partner, in the performance of activities under this Agreement, shall be vested in that Partner, who shall grant a paid-up, non-exclusive license to that intellectual property to the other Partners for the exclusive purpose of its use, by the other Partners, only under this Agreement. The right to use that intellectual property for research unrelated to the ZTF Project is subject to the prior written consent of the providing Partner.

C. Title in such intellectual property that is created by more than one Partner shall be jointly owned Intellectual Property, and the Partners who are joint owners agree to enter into an inter-institutional agreement setting forth their respective rights and obligations with regard to the protection and possible commercialization of the jointly-owned Intellectual Property. These Partners shall grant a paid-up, non-exclusive license to that intellectual property to the other Partners for the exclusive purpose of its use, by the other Partners, only under this agreement. The right to use that intellectual property for research unrelated to the ZTF Project is subject to the prior written consent of the providing Partners.

IX. Data and Data Products

A. Data and data products acquired from the P48 in the course of the public MSIP surveys are subject to the data release policies described in Appendix D. Such data and data products will be available solely to the ZTF Partners and (under the terms of Appendix C) to the DESI Consortium in the period prior to their scheduled public release, if any such period exists.

B. All data and data products acquired in the course of the ZTF Project that are not subject to the MSIP provisions will be available solely to the ZTF Partners and (under the terms of Appendix C) to the DESI Consortium for a period not to exceed eighteen (18) months from the date the data are obtained, after which time the data will be released to the public. The ZTF Board may decrease, but not increase, this period of protection.

C. Members may not share ZTF data and data products with any other collaborators at non-Partner institutions except as approved by the ZTF Science Steering Committee.

D. COO shall permanently retain the exclusive right to distribute the complete set of standard data products (bulk P48 and P60 single-epoch and coded images, photometric catalogs, and lightcurves; bulk P60 SEDM spectra) derived from ZTF. Partners may distribute higher-level products produced by specific scientific projects in the course of published studies (e.g., libraries of supernova spectra obtained by the ZTF Collaboration) with consent of the ZTF Board.

E. Upon expiry of this agreement, Partners shall retain non-exclusive rights to access and use the data obtained in the course of the ZTF Project. The eighteen (18) month period referenced in paragraph A shall remain in force even if it extends beyond the

termination date of this agreement.

X. Early Termination by a Party

A. The Partners have entered into this Collaborative Agreement in good faith, with the intention of collaborating scientifically and technically under its terms and conditions. Any Partner may terminate its participation upon twelve (12) months written notice to the Board. If a Partner terminates its participation, the Partner's cash and in-kind contributions provided prior to the termination date remain with the Consortium, excepting any hardware obtained under prior bilateral agreements, which is subject to the dissolution clauses contained under applicable agreements. Any ongoing operations costs associated with such contributions shall be the responsibility of the Consortium, except as explicitly agreed to by the terminating Partner. Partners retain intellectual property rights to any technology pre-existing and/or developed at their institution.

B. A Partner terminating their participation in ZTF shall retain access to the data and data products acquired while that Partner was in good standing within the consortium.

C. This Collaborative Agreement shall remain in force for the remaining Partners unless the terminating Partner is COO, in which case the termination notice by COO shall constitute an immediate termination on behalf of all Partners.

XI. DESI/ZTF Arrangement

As codified in a separate agreement, the ZTF PI has arranged with the DESI Consortium (http://bigboss.lbl.gov/index.html) to provide derived ZTF data products to DESI. These data products are described in Appendix C.

XII. NSF MSIP Arrangement

As part of the ZTF formulation, the ZTF PI has proposed to the U.S. National Science Foundation Mid-Scale Innovations Program (MSIP). The approved MSIP program provides approximately $9M to the project in exchange for public surveys and release of a variety of ZTF data products. These surveys and data products are described in Appendix D. Delivery of these products may place constraints on acceptable survey strategies for ZTF.

XIII. Export and Import Laws & Regulations

The Parties agree to comply with U.S. export and import control laws in engaging in activities under this Collaborative Agreement. Partners will alert the other Partners' administrative contacts in writing and receive permission before providing them with any export-controlled information or items, and Partners are not obligated to accept such information or items.

XIV. Publications, Citations, & Press Releases

A. The Parties expect publications coming from this collaboration. Publications based wholly or in part on data obtained at the Samuel Oschin Telescope and/or the Palomar 60-inch Telescope as a consequence of this collaboration shall include the following acknowledgment:

> Based on observations obtained with the Samuel Oschin Telescope 48-inch and the 60-inch Telescope at the Palomar Observatory as part of the *Zwicky Transient Facility* project, a scientific collaboration among the California Institute of Technology, the Oskar Klein Centre, the Weizmann Institute of Science, the University of Maryland, Deutsches Elektronen-Synchrotron, and the University of Wisconsin-Milwaukee. Further support is provided by the U.S. National Science Foundation under Grant No. AST-1440341.

B. Future Partners signing in Appendix F shall be appended to the list of collaborating institutions in the above-stated paragraph.

C. Researchers publishing papers based on ZTF data shall acknowledge use of the ZTFC, the Samuel Oschin Telescope, and/or the Palomar 60-inch Telescope by referring to the appropriate instrument paper(s) specified by the Board. Authorship of the instrument papers will be designated by the ZTF PI according to standard scientific practices.

D. Researchers publishing papers based wholly or in part on data obtained under the ZTF framework shall invite individuals on the ZTF Builders List to participate in the paper and be included in the author list.

E. Researchers publishing papers based wholly or in part on data obtained under the ZTF framework shall provide draft copies of their papers to the ZTF SSC prior to publication through a mechanism to be specified by the ZTF Board. The SSC should routinely provide any input within two weeks, and within no more than one week for papers designated as urgent by the SSC. If the SSC does not comment or request additional time for consideration (not to exceed four weeks) within this interval, researchers may submit said paper for publication.

F. Press releases based wholly or in part on data obtained under the ZTF framework as a consequence of this collaboration shall be coordinated, in advance, with the ZTF Board, through the offices of the COO Director.

XV. Material Breach

In the event there is a material breach of this Collaborative Agreement by a Party which is not cured within sixty (60) days following written notice thereof from the ZTF PI, then the ZTF Board, by two-thirds vote of the Partners who have not received notice of a material breach, may remove the Partner from ZTF or adjust its responsibilities and privileges, or take such other or additional action as it deems appropriate to science and the goals of the ZTF project.

XVI. No Warranties

The Partners enter into this Agreement in good faith, however, the development of the ZTFC and execution of a ZTF program is a risky endeavor and may not, for reasons both foreseeable and unforeseeable, ultimately meet the science objectives of the Partners. The Partners acknowledge ultimate responsibility for their use of the Palomar Observatory and the data and data products and understand no Partner in any way warrants or assures project success. THE CALTECH FACILITIES PROVIDED HEREUNDER BY CALTECH, AS WELL AS ANY DATA, PROTOTYPE, PRODUCTS OR OTHER RESOURCES GENERATED IN CONNECTION WITH THIS AGREEMENT OR OTHERWISE MADE AVAILABLE BY CALTECH ARE PROVIDED ON AN 'AS IS' BASIS, WITHOUT WARRANTY OF ANY KIND, AND CALTECH HEREBY DISCLAIMS ANY AND ALL WARRANTIES WITH RESPECT TO THE FOREGOING, INCLUDING, WITHOUT LIMITATION, ALL EXPRESS OR IMPLIED WARRANTIES AS TO THE CONDITIONS OF ANY SUCH RESROUCES OR THE MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF ANY SUCH RESOURCES.

XVII. Liability

No Party shall be responsible to any other Party for consequential, special, incidental, punitive damages, indirect loss or similar damage such as, but not limited to, loss of profit, loss of revenue or loss of contracts to each other, regardless of the basis of the claim. Nothing in the preceding sentence shall operate to exclude or restrict any Party's liability for personal injury and/or property damage in connection with, resulting from, or arising from its sole willful act or gross negligence or the negligent acts or omissions of its employees.

XVIII. Independent Parties

The Parties agree that they are independent, and that the Parties' Personnel are not employees or agents of the other Parties, and that no Party has responsibility to provide Workers' Compensation or other liability coverage, insurance, benefits or compensation for the other Parties' Personnel.

XIX. Force Majeure

A Party shall not be deemed in default of this Collaborative Agreement for any failure of or delay in its performance for the period that such failure or delay is due to causes beyond its reasonable control, including but not limited to acts of God, natural disasters, war, terrorism, armed conflict, strikes or labor disputes, embargoes, government order or similar events, but not including lack of funding, provided that the Party relying on this provision gives prompt written notice to the ZTF Board thereof, and takes all steps reasonably necessary to mitigate the effects of the force majeure event.

XX. Counterparts

This Collaborative Agreement may be signed in counterparts and such counterparts shall be treated as though signed as one document. Scanned or facsimile signatures on this Collaborative Agreement shall be treated as original signatures.

IN WITNESS WHEREOF, the duly-authorized representatives of the Parties have executed this Collaborative Agreement as of the Effective Date:

17 Dec 2014

Shrinivas Kulkarni – California Institute of Technology Date
Director, Caltech Optical Observatories
Principal Investigator, Zwicky Transient Facility

B.T.S. 12/17/14

B.T. Soifer – California Institute of Technology Date
Kent and Joyce Kresa Leadership Chair, Division of Physics,
Mathematics and Astronomy, Director Spitzer Science Center, and Professor of Physics
California Institute of Technology
Pasadena, CA 91125

Astrid Soderbergh Widding – Oskar Klein Centre Date
Vice Chancellor
Stockholm University, SE-106 91
Stockholm, Sweden

Haim Garty– Weizmann Institute of Science Date
Vice President

Antoinette Lawson – University of Maryland Date
Director, Office of Research Administration
University of Maryland, College Park, MD 20742 USA

Jayanth R. Banavar – University of Maryland Date
Dean, College of Computer, Mathematical, and Natural Sciences
University of Maryland, College Park, MD 20742 USA

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Director, Caltech Optical Observatories
Principal Investigator, Zwicky Transient Facility

B.T. Soifer – California Institute of Technology Date
Kent and Joyce Kresa Leadership Chair, Division of Physics,
Mathematics and Astronomy, Director Spitzer Science Center, and Professor of Physics
California Institute of Technology
Pasadena, CA 91125

Astrid Söderbergh Widding 08 Dec 2014

Astrid Soderbergh Widding – Oskar Klein Centre, Stockholm University Date
Vice Chancellor
Stockholm University, SE-106 91
Stockholm, Sweden

Haim Garty– Weizmann Institute of Science Date
Vice President

Antoinette Lawson – University of Maryland Date
Director, Office of Research Administration
University of Maryland, College Park, MD 20742 USA

Jayanth R. Banavar – University of Maryland Date
Dean, College of Computer, Mathematical, and Natural Sciences
University of Maryland, College Park, MD 20742 USA

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Shrinivas Kulkarni – California Institute of Technology Date
Director, Caltech Optical Observatories
Principal Investigator, Zwicky Transient Facility

B.T. Soifer – California Institute of Technology Date
Kent and Joyce Kresa Leadership Chair, Division of Physics,
Mathematics and Astronomy, Director Spitzer Science Center, and Professor of Physics
California Institute of Technology
Pasadena, CA 91125

Astrid Soderbergh Widding – Oskar Klein Centre Date
Vice Chancellor
Stockholm University, SE-106 91
Stockholm, Sweden

Michal Neeman
MICHAL NEEMAN

Prof. Mudi Sheves
Vice President
Technology Transfer

December 9, 2014

~~Haim Garty~~– Weizmann Institute of Science Date
Vice President

מכון ויצמן למדע
WEIZMANN INSTITUTE OF SCIENCE

Antoinette Lawson – University of Maryland Date
Director, Office of Research Administration
University of Maryland, College Park, MD 20742 USA

Jayanth R. Banavar – University of Maryland Date
Dean, College of Computer, Mathematical, and Natural Sciences
University of Maryland, College Park, MD 20742 USA

This Collaborative Agreement may be signed in counterparts and such counterparts shall be treated as though signed as one document. Scanned or facsimile signatures on this Collaborative Agreement shall be treated as original signatures.

IN WITNESS WHEREOF, the duly-authorized representatives of the Parties have executed this Collaborative Agreement as of the Effective Date:

Shrinivas Kulkarni – California Institute of Technology Date
Director, Caltech Optical Observatories
Principal Investigator, Zwicky Transient Facility

B.T. Soifer – California Institute of Technology Date
Kent and Joyce Kresa Leadership Chair, Division of Physics,
Mathematics and Astronomy, Director Spitzer Science Center, and Professor of Physics
California Institute of Technology
Pasadena, CA 91125

Astrid Soderbergh Widding – Oskar Klein Centre Date
Vice Chancellor
Stockholm University, SE-106 91
Stockholm, Sweden

Haim Garty– Weizmann Institute of Science Date
Vice President

Antoinette Lawson 12/1/14
Antoinette Lawson – University of Maryland Date
Director, Office of Research Administration
University of Maryland, College Park, MD 20742 USA

Jayanth R. Banavar 12/1/14
Jayanth R. Banavar – University of Maryland Date
Dean, College of Computer, Mathematical, and Natural Sciences
University of Maryland, College Park, MD 20742 USA

22.12.2014

Prof. Dr. Helmut Dosch – Deutsches Elektronen-Synchrotron — Date
Chairman of the Board of Directors

22.12.2014

Christian Scherf – Deutsches Elektronen-Synchrotron — Date
Director of Administration

Johannes Britz – University of Wisconsin-Milwaukee — Date
Provost and Vice-Chancellor for Academic Affairs

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671 Prof. Dr. Helmut Dosch – Deutsches Elektronen-Synchrotron Date
672 Chairman of the Board of Directors
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676 Christian Scherf – Deutsches Elektronen-Synchrotron Date
677 Director of Administration
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680 12/12/14
681 Johannes Britz – University of Wisconsin-Milwaukee Date
682 Provost and Vice-Chancellor for Academic Affairs
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Appendix A
Expected Performance

The PTF and iPTF surveys were and are conducted with a survey camera on the P48 providing a 7.26 square degree field of view. The median time between exposures is 45 seconds, and with median 2" FWHM delivered seeing and 60 second exposures the median R-band limiting magnitude is ~20.7.

The current ZTFC design is a camera with 16 6k x 6k CCDs, providing a 47 square degree field of view while maintaining an expected 2.0" FWHM / 2.2" FWHM image quality in R / g' observing bands over the entire field and thus PTF's limiting magnitude. Modern readout electronics will read out the ZTF camera in 10 seconds, providing < 15 seconds of overhead between images. Assuming optimal 30 second exposures, the median R-band limiting magnitude for ZTF is expected to be ~20.4.

With these parameters, ZTF will survey more than 3750 square degrees per hour, an areal survey rate almost 15 times that of PTF. The resulting variability catalog will produce hundreds of epochs per year for each field. The volumetric survey rate, which relates to the number of detected transients, is more than 12 times that of PTF.

At present, the ZTF Consortium has purchased the sixteen CCDs needed to complete the ZTF camera. We expect to complete the full camera by the goal 2017 start date.

Appendix B
Major Areas of Scientific Interest

The following is a PRELIMINARY list of the major topics of scientific interest to the partners within the ZTF Consortium.

Institution	Areas of Interest
COO + IPAC + JPL	Transients in the Local Universe Follow-up of Gravitational Wave Triggers White Dwarfs Pre-Main Sequence Stars Solar System Objects Relativistic Explosions
OKC	Type Ia SNe Core-collapse SNe (I)
WIS	Core-collapse SNe Shock Breakout TNOs Light Echoes
UMD/JSI	Supermassive black holes High Energy and Astroparticle counterparts Relativistic Explosions Follow-up of Gravitational Wave Triggers
DESY/HU	Follow-up of Neutrino Triggers Cosmological Applications of Type Ia SNe
UWM	Neutron stars and white dwarfs in binary systems Follow-up of Gravitational Wave triggers

Appendix C
ZTF-DESI Agreement

As codified in a separate agreement, in exchange for contributions to the ZTFC (cryostat and optical design), the ZTF consortium agrees to provide the DESI Consortium with data products to be used for target selection within the DESI footprint of up to 14,000 square degrees.

These data products are:

- Deep sky image co-adds derived from ZTF data in g and R bands, or the raw images required to produce such coadds.
- A quasar variability catalog derived from ZTF data, or the raw images required to derive such variability.

These data products will be made available to the DESI collaboration without being subject to ZTF collaboration proprietary periods.

The *uncommitted* goal is to obtain at least 5000 square degrees of imaging in the DESI footprint in SDSS g' and Mould R or similar bands, each to a coadded limiting magnitude of 23.8 (five sigma) or greater. However, DESI imposes no constraints on the ZTF observation cadence and sky distribution of observations. The ZTF collaboration thus does not guarantee that the data products will prove suitable for DESI target selection, but agrees to make them available on a best-effort basis.

The DESI collaboration may build from the ZTF archive, and release, target selection catalogs based upon ZTF raw data analyzed in combination with other data sets, mock catalogs generated using the ZTF raw data, and completeness maps. These derived data products will be released in the DESI data releases, but not before July 1, 2020. Rights to all other releases and scientific uses of ZTF data are held by the ZTF collaboration.

Appendix D
NSF-MSIP Agreement

A proposal by the ZTF PI to the US National Science Foundation (NSF) Mid-Scale Innovations Program (MSIP) program offers public surveys and data releases in exchange for development and operations support. The NSF has contributed $9M to support ZTF development, fabrication, operations, and data analysis.

In keeping with the approved MSIP proposal, the ZTF Consortium agrees to conduct community surveys in approximately one half of the time available to the collaboration. The baseline public surveys are:

1. A survey of the Galactic Plane, with three hundred visits per year (for each of 3 years) of the Plane ($\delta > -30^\circ$, $|b| < 7^\circ$; $\Delta l = 240^\circ$).
2. A three-night (average) cadence survey of the visible Northern sky in the second and third survey years.

As PI of the MSIP award, the ZTF PI is responsible for directing the execution of the public surveys and ensuring their conformance with MSIP obligations. The ZTF PI may adjust the baseline public surveys in response to new information, to maximize their scientific value, or in response to ZTF CSAC feedback, but the overall proportion of ZTF collaboration survey time used for public surveys shall remain fixed at 50%.

The consortium also agrees to provide the following public data products to the US community:

1. Public release of all data products from PTF in 2015 and from iPTF beginning in 2016.
2. At the end of the first ZTF survey year, release of deep reference images, catalogs, and lightcurves. Subsequent releases of photometric images, catalogs, and lightcurves from the community surveys will occur every six months.
3. In the second and third years, an additional event stream of strong variables, transients, and moving objects found in the community surveys.
4. In the third year, the additional release of near-real-time transient candidates from the image subtraction pipeline for the community surveys.

iPTF and ZTF data from the non-public survey time are subject to collaboration proprietary periods. These data will be made public in the next data release following the expiration of the proprietary period.

A Community Science Advisory Committee (CSAC) advises the ZTF PI according to the following charge:

> The ZTF CSAC is expected to represent the US community during the NSF MSIP project lifecycle, and advise the Principal Investigator on matters of importance to the US community. CSAC advice will be informed by conducting an annual review of ZTF operations; providing an independent assessment of the quality of ZTF observations, observational efficiency, science productivity, and data products and public access to same; assessing progress toward project-wide scientific objectives; and recommending utilization of ZTF resources based on trends developing elsewhere in the transient astrophysics community. As presently envisioned, the CSAC will convene by

teleconference between twice and four times a year, and meet in person annually at either Caltech or Palomar. One of the CSAC members will be appointed (following consultation with the other members) as the Chair. We expect the Chair to work with the committee and issue a formal report that will codify its findings and recommendations.

Members of the CSAC are:

1 Marcel Agueros, Columbia University
2 Todd Boroson, Las Cumbres Observatory Global Observatory
3 Dale Frail, National Radio Astronomy Observatory
4 Neil Gehrels, Goddard Space Flight Center
5 Mario Juric, LSST/University of Arizona
6 Juna Kollmeir, Observatories of the Carnegie Institution
7 Marc Pinsonneault, Ohio State University
8 Allen Shafter, San Diego State University
9 Paula Szkody, U. Washington
10 Steve Ridgway, NOAO

Appendix E
Partner Cash Contribution Schedule

	Contribution Schedule to ZTF Collaboration											
	(all values in thousands of USD, actual year)											
Due Date	31-Dec-14	31-Mar-15	30-Sep-15	31-Mar-16	30-Sep-16	31-Mar-17	30-Sep-17	31-Mar-18	30-Sep-18	31-Mar-19	30-Sep-19	**TOTAL**
	(cumulative to date)	(per semester)										
OKC	750	250	0	250	0	250	0	0	0	0	0	**1500**
WIS	750	250	0	250	0	250	0	0	0	0	0	**1500**
UMD	0	150	150	150	150	150	150	150	150	150	150	**1500**
DESY	246	0	64.5	0	64.5	0	0	0	0	0	0	**375**
UWM	200	0	100	0	100	0	100	0	0	0	0	**500**

Appendix F
Signature Page for New Partners

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Cognizant – TBD (Principal/Minor Partner) Date