D.7 K2 GUEST OBSERVER – CYCLE 1

NOTICE: Amended on June 25, 2014. This amendment presents final text and a new name for D.7, now called K2 Guest Observer – Cycle 1. Step-1 proposals are due August 8, 2014, and proposals are due September 23, 2014.

Proposals to this program will be taken by a two-step process in which the Notice of Intent is replaced by a mandatory Step-1 proposal submitted by an Authorized Organizational Representative. Only proposers who submit a Step-1 proposal will be eligible to submit a Step-2 (full) proposal. Potential proposers are strongly encouraged to carefully read the information about the two-step proposal process provided in Section IV(b)(vii) of the 2014 ROSES Summary of Solicitation and in Section 4 of this appendix.

1. Scope of Program

This program element solicits proposals for the acquisition and analysis of new scientific data from the K2 mission (http://keplerscience.arc.nasa.gov/K2). K2 repurposes the space-borne hardware and ground-based operations of the Kepler mission (http://keplerscience.arc.nasa.gov) for a pointed survey of predetermined locations along the ecliptic plane. The single, visible-wavelength instrument onboard K2 provides high-precision photometry capability, with short cadence and long cadence modes (1 minute and 30 minute exposures), and provides a powerful tool for broadband variability analyses of planetary, stellar, extragalactic, and solar system sources.

Overview

The loss of a second of the four reaction wheels onboard the Kepler spacecraft in May 2013 brought an end to its 4+ year primary science mission to continuously monitor more than 150,000 stars in the 116 square degree Kepler field for transiting exoplanet candidates. Developed over the months following this failure, the K2 mission represents a new concept for spacecraft operations that enables continued scientific observations with the Kepler space telescope. The K2 mission entails a series of sequential observing "campaigns" of fields distributed around the ecliptic plane and offers a photometric precision approaching that of the original Kepler mission to within a factor of ~2 (http://keplerscience.arc.nasa.gov/K2/Performance.shtml). Operating in the ecliptic plane minimizes the torque exerted on the spacecraft by solar wind pressure, reducing pointing drift to the point where spacecraft attitude can effectively be controlled through a combination of thrusters and the two remaining reaction wheels. Each ecliptic campaign is limited by sun angle constraints to a duration of ~75 days. Therefore, four to five K2 campaigns can be performed during each future 372-day orbit of the spacecraft. A description of campaign field distribution across the sky and the full mission concept is provided at http://keplerscience.arc.nasa.gov/K2/MissionConcept.shtml.

1.1 Scope of this Solicitation

This solicitation is specifically for science targets falling within the K2 campaign 4 and 5 observing fields, which are currently planned for execution over the periods for February 7 -

April 24, 2015, and April 26 – July 11, 2015. The Campaign 4 field features substantial portions of both the Pleiades and the Hyades clusters, while the Campaign 5 field includes the cluster M67 and a substantial portion of the Beehive cluster (http://keplerscience.arc.nasa.gov/K2/Fields.shtml - 4). Supporting technical and scientific material is available at the Kepler Science Center website for the K2 mission (http://keplerscience.arc.nasa.gov/K2). A separate solicitation will be released in approximately six months for campaign 6 and 7 observations, allowing the community to gain experience with data from early K2 campaigns before competing for those future resources.

Since they were necessarily planned in advance of NASA approval of the K2 mission (and its associated GO program), observations conducted during K2 campaigns 0 – 3 are not eligible for funding under the K2 GO program. However, investigators with GO observations conducted during those early campaigns may propose for funding under the Astrophysics Data Analysis Program (ADAP). The next ADAP solicitation will be issued as Appendix D.2 of the ROSES-2015 NRA (estimated release, February 2015) with an anticipated proposal deadline in mid-May 2015.

1.2 Changes Since Kepler GO Cycle 5 in ROSES 2012

- The K2 GO Program will employ a two-step proposal process wherein the traditional Notice of Intent to Propose is replaced by a mandatory Step-1 proposal submitted by an Authorized Organizational Representative. Only proposers who submit a Step-1 proposal will be eligible to submit a Step-2 (full) proposal. See Section IV(b)(vii) of the 2014 ROSES Summary of Solicitation and Section 4 of this appendix for details.
- Neither Step-1 nor Step-2 proposals will require a detailed budget/budget justification. Funding levels for proposals selected under the K2 GO program are cost capped and NASA will seek detailed budget information after Merit review, see Sections 3.2 and 4.1.2.
- There are no guaranteed or predetermined targets. All campaign 4 and 5 targets observed by K2 will be selected through this solicitation.
- Each campaign is expected to yield of order 10,000 long cadence targets and of order 50 short cadence targets.
- Similar to the fault developed by module 3, detector module 7 is no longer in operation.
- In the past, the observational resources available to Guest Observers have exceeded the funding available to support the analysis of those observations. Consequently, the NSPIRES proposal cover page now requires all Principal Investigators (PIs) to identify whether or not they would like some or all of their targets to be observed even if their proposal must be declined due to lack of funding. In the event that the PI fails to provide this information, it will be assumed that they decline this opportunity, and the proposed targets will not be considered for observation.

1.3 The K2 Mission

1.3.1 K2 Mission Science.

Unlike the Kepler mission, there are no primary science objectives for the K2 mission. K2 can indeed continue and enhance the key project science goals of the Kepler mission – identifying planet candidates and providing data for the calculation of planet occurrence rates – however, the spacecraft is now a general-user facility (http://keplerscience.arc.nasa.gov/K2).

All science proposals will be treated equally, programs touching all viable scientific topics are encouraged and targets will be allocated based upon effective scientific and technical justifications.

A detailed discussion of the Kepler mission and its scientific objectives can be found at http://keplerscience.arc.nasa.gov. Background information on NASA's Discovery Program is available at http://discovery.nasa.gov. As well as at http://keplerscience.arc.nasa.gov/K2, the K2 mission is summarized within Howell, Sobeck, Haas, et al., 2014, PASP, 126, 398 (http://arxiv.org/abs/1402.5163).

1.3.2 Instrumentation and Technical Capabilities.

Kepler is in a heliocentric orbit, which insures a thermally stable environment and provides the ability to remain on a single pointing for the duration of each campaign. Pointing is maintained by a combination of two reaction wheels and thrusters, reacting to motion data provided by fine guidance sensors (fine-point observing) or star trackers (coarse-point observing). With only two remaining reaction wheels, these operations are only possible while pointing within the orbital plane of the spacecraft, which approximates to the ecliptic. Only this specific family of pointings yield operational configurations where solar pressure is largely mitigated by spacecraft geometry, thereby making viable precision pointing and photometry approaching the quality of the Kepler mission.

K2 will achieve a benchmark photometric precision on an m_v = 12 G2V star of 170 parts-per-million (ppm) in 30 minutes of integration, i.e. 1 long cadence exposure. This corresponds to ~50 ppm over a 6.5-hour transit of an Earth-sized body around that star.

While stars brighter than m_v = 11.5 will saturate some pixels, K2 performs well on stars as bright as m_v = 4, provided the scientific benefit justifies the large number of pixels needed to capture saturated flux bleeding along CCD columns. Kepler also has many faint-target scientific applications where m_v = 20 objects yield a photometric precision of 10% over 30 minutes.

The broad photometric bandpass has a half-maximum transmission range of 430 to 840 nm. The instrument has neither changeable filters, dispersing elements, or shutter. The detector has a pixel scale of 3.98 arcseconds. Image quality varies with position in the focal plane, with the 95% encircled energy diameter ranging from 3.1 to 7.5 pixels, with a median of 4.2 pixels. The percentage of point-source flux concentrated in the center pixel is between 20% and 62%, with a median value of 45%.

1.3.3 Observing Modes and Data Products.

Constraints imposed by onboard storage and communications dictate that 94% of the data from the full focal plane are not saved. Instead, data for specific, pre-determined targets are saved and transmitted as subimages with a typical area of 200+ pixels, depending on source brightness. The brighter a target, the more pixels are required to capture it. Image size can be tailored further to accommodate extended or very bright, saturated objects. This current Announcement of Opportunity requests target proposals for campaigns 4 and 5. Highlights of these fields include substantial portions of the Pleiades and the Hyades clusters (Campaign 4), as well as M67 and a substantial portion of the Beehive cluster (Campaign 5). The Kepler

Science Center will derive pixel masks for those targets successfully justified by proposers and upload these targets to the spacecraft before each campaign.

All observations are taken at one of two temporal resolution settings: long (30-minute) or short (1-minute) cadence. It is expected that of order 10,000 long cadence targets will be available per campaign, and of order 50 short cadence targets. Extended or bright objects requiring larger aperture sizes decrease the total number of targets available to the GO program and must be justified carefully.

Data distribution and archival services will be performed by the Space Telescope Science Institute's MAST archive (https://archive.stsci.edu). Final data products available to observers will include original and calibrated pixel values and, after a cycle of pipeline development, light curves for each target. The calibration will correct for bias level, smear, galactic cosmic rays, flat fielding, dark current, background, and instrument noise. Aperture photometry will be used to generate light curves.

Data will be delivered to the observer in FITS format. A thorough understanding of the noise sources and systematic errors of K2 will be needed by observers in order to generate their own light curves from the original (uncalibrated or calibrated) pixel data or interpret structure found in archived light curves. There is no exclusive use period associated with any K2 GO data.

2. Guest Observer Targets

2.1 Permitted GO Science Areas

There are no guaranteed, or predetermined, targets for K2 campaigns. All K2 targets are proposed by the community through the GO program.

The K2 GO Program welcomes proposals addressing compelling scientific questions in any area of astrophysics and planetary science providing the required observations are amenable to the operational characteristics and constraints of the mission. These may include, but are not limited to, exoplanet detection, stellar astrophysics, galactic and extragalatic astrophysics, and Solar System science. All science proposals must be compelling and carefully justified scientifically and technically. Proposers should particularly note that short cadence resources and bright targets are expensive in pixels and onboard storage and have historically been in high demand. Short cadence proposals must justify scientifically and technically the need for higher cadence monitoring relative to long cadence observations.

Proposers must take into account the difference between science that can be achieved exclusively using archived Kepler data and science that requires new observations by K2. The K2 GO program is specific to the case of science requiring new observations. Funding for archival science is provided through the Astrophysics Data Analysis Program (ADAP; Appendix D.2 of ROSES-2014). This includes all Kepler data and K2 campaigns 0-3. All proposals to this call must justify the need for new observational data within their program.

2.2 On-source Monitoring Times

Each K2 campaign has a duration of ~75 days and remains fixed upon a single boresight position. The target list remains fixed throughout the full duration of a campaign; targets

cannot be swapped during a campaign. The fixed locations and observing windows of campaigns 4 and 5 are provided at http://keplerscience.arc.nasa.gov/K2/Fields.shtml.

2.3 Target Selection Tools

Pointed observations away from the single stare position of any given field cannot be accommodated by K2; campaign targets are limited to the objects available in the fixed field of view. Small gaps between the 42 detector CCDs result in additional loss of available objects that would otherwise be within the Kepler field of view. A documented target search tool, http://archive.stsci.edu/k2/epic/search.php, determines if an object of a particular coordinate lies close to the observable field of view. The target search tool accesses the Ecliptic Plane Input Catalog (EPIC), which provides physical data, coordinates, magnitudes, and colors, for sources close to K2 silicon. The EPIC is complete to only $m_v \sim 17$; specifications of the catalog are documented at http://archive.stsci.edu/k2/epic.pdf. It is the proposer's responsibility to identify targets that are faint or missing from the EPIC. K2 collection of valid data relies on the delivery of accurate celestial positions and magnitudes of each target. Proposals must state the origin for this information, especially if it does not come from the EPIC. Determining whether or not desired targets fall on active regions of the focal plane is also the responsibility of the proposer. The Kepler Science Center at http://keplerscience.arc.nasa.gov/K2/ToolsK2FOV.shtml provides a tool to identify which targets fall upon active silicon. Only those targets within the active field of view should be proposed.

2.4 Target Table

All proposals are required to include a target table with the format shown in Table 1 to specify desired observing modes and other needed parameters. A definition of each column and a template for insertion into the proposal may be downloaded from the Kepler Science Center website at http://keplerscience.arc.nasa.gov/K2/ProposalPreparationTargetTable.shtml. In addition to appearing as text within the proposal, this table must also be submitted electronically (see Section 3.4) to the Kepler Science Center. Table 1 below includes example entries.

Table 1: Required format of target table. See the URL above for instructions to complete the table.

Object	J2000 Right Ascension (deg)	J2000 Declination (deg)	Kp (mag)	Cadence (min)	Proper motion ("/yr)		extent (arcsec)	Comments
					δRA	δDec		
204436324			12.6	30				
203457483			13.9	1				
J113853.2+010514.6	174.72172	1.08748	18.3	30				Not in EPIC. Kp estimated from SDSS
201744789			11.4	30			11.0	Extended object with semi-major axis radius 11.0 arcsec
207942582	172.57983	-2.96567	14.5	30	0.13	0.35		High proper motion star

3. Programmatic Information

3.1 Proposal Submission and Evaluation

Proposals submitted to NASA in response to this solicitation will be evaluated with respect to the criteria specified in Section C.2 of the *NASA Guidebook for Proposers*, which are intrinsic merit, relevance, and cost realism/reasonableness. In addition to the factors for intrinsic merit given in the *NASA Guidebook for Proposers*, intrinsic merit includes the following factors:

- The suitability of using the K2 observatory and data products for the proposed investigation;
- The degree to which the investigation uses K2's unique capabilities;
- The feasibility of accomplishing the objectives of the proposed investigation with the requested observations, including the degree to which the proposal satisfies K2's observational constraints; and
- The feasibility and suitability of the proposed analysis techniques.

3.2 Period of Performance, Award Sizes, and Availability of Funds

K2 Cycle 1 Guest Observer (GO) observing programs will be made up of sources found in the campaign 4 and/or campaign 5 fields, and will begin on or about February 7, 2015. Funding for selected programs will start upon availability of campaign 4 data to the PI in July 2015. All data will be made available through the public archive at MAST. There is no exclusive use period associated with any K2 GO data. The duration of awards will be one year, not including no-cost extensions.

Awards are cost capped at $30,000 for small proposals (<1,000 targets) and $100,000 for large proposals (>1,000 targets). These cost caps are for the total cost of the award, including NASA Civil Servant Salary and overhead. Proposers should not include detailed budget information with either Step-1 or Step-2 proposals, NASA will seek detailed budgets from selectable proposals after peer review.

3.3 Eligibility

Application to the K2 GO program is open to all investigators, including those from outside the U.S. under NASA's no-exchange-of-funds policy. Investigators who are not affiliated with a U.S. institution are not eligible for funding through this program. Co-Investigators (Co-Is) affiliated with a U.S. institution are eligible to receive funding under a proposal led by a foreign PI.

4. Submission of Proposals to the K2 Cycle 1 GO Program

4.1 The Two-Step Proposal Submission Process

To facilitate the early recruitment of conflict-free reviewers, and to ensure that proposal concepts are responsive to and compliant with the solicitation, the K2 GO program will use a two-step proposal submission process (see Section IV(b)(vii) of the 2014 ROSES Summary of Solicitation.)

A Step-1 proposal is required and must be submitted electronically by the Authorized Organizational Representative (AOR). Step-1 proposals will not be submitted to a formal, binding peer-review. The purpose of the Step-1 proposal is simply to avoid conflicts in the assembly of the review panel, and no response will be provided to proposers unless concerns regarding the responsiveness/compliance of their proposal concept are identified. However, only proposers who submit a Step-1 proposal are eligible to submit a Step-2 proposal. Full (Step-2) proposals must address the same scientific goals proposed in the Step-1 proposal. The Step-1 proposal title and PI cannot be adjusted. To add funded investigators between the Step-1 and Step-2 proposals, proposers must notify the NASA point of contact listed in

Section 5 in writing (email with cc to sara@nasa.gov) at least two weeks in advance of the Step-2 proposal due date. Submission of the Step-1 proposal does not obligate the proposer to submit a Step-2 (full) proposal later. No budget is required for either the Step-1 or Step-2 proposals. The funding level for selected proposals are cost capped, see Section 3.2.

4.1.1 Step-1 Proposals.

Proposers should refer to the "Instructions for Submitting a Step-1 Proposal" under "Other Documents" on the NSPIRES page for this program. The Step-1 proposal should identify the PI and all funded Co-Is on the proposal. The Scientific/Technical/Management section of the Step-1 proposal is restricted to one page in length and should include a description of the science goals and objectives of the proposal, an estimate of the number of targets to be observed (a target table is not required), a brief description of the methodology to be used, and a description of the relevance of the proposed research to this solicitation. The relevance section will be used to confirm that the proposal is responsive to the requirements of this call. No evaluation of intrinsic merit will be done on Step-1 proposals.

The NSPIRES system for proposal submission requires that Step-1 proposals include both a summary (i.e. abstract) describing the proposed work, and the one page overview of the Scientific/Technical/Management section described above. The proposal summary is entered directly into a text field in NSPIRES, while the brief Scientific/Technical/Management section must be uploaded as the PDF "Proposal Attachment." Proposers will be notified by email when they are able to submit their Step-2 proposals. If NASA determines that the proposed investigation is likely to be either non-responsive or non-compliant with the solicitation, proposers will be notified in advance of the submission of their Step-2 proposal. In such cases, proposers are not precluded from submitting their Step-2 proposal, but should be aware that, without addressing the issues identified in the notification, there is a risk that their proposal may be declined without review.

4.1.2 Step-2 Proposals.

Proposers should refer to the pdf entitled "How to submit a Step-2 proposal" under "Other Documents" on the NSPIRES page for this program. The process for preparation and submission of the Step-2 (full) proposals is essentially identical to that associated with any other ROSES proposal, subject to the following program-specific constraints:

- K2 proposals will be divided as large and small proposals. Small proposals will consist of all those that have 1000 or fewer approved targets. Large proposals will consist of all those that have > 1000 approved targets.
- Large proposals must include a section of no more than one half page in length describing a value-added community resource product that the large proposal will provide and deliver to the NASA Archives at the end of the period of performance of the grant. This product should be greater than simply a published paper. Example products might be delivery of a uniform set of well-produced open cluster star light curves, follow-up ground-based observations of exoplanet host stars, or a catalogue of sources with additional astrophysical information. This information will be used in large proposal evaluation. The target list of any large proposal may be reduced if the need for a large number of targets is not adequately justified in the proposal.
- The Scientific/Technical/Management section of the Step-2 proposal, which consists of text, tables (excluding the target table), and figures must not exceed six pages. References do not count against the six-page limit.

- A complete table of proposed targets (see Section 2.4) must also be included at the end of the Scientific/Technical/Management section of the proposal, but does not count against the page limit of that section. However, the target table should be truncated in instances where its incorporation will cause the Scientific/Technical/Management section to exceed a length of 15-pages.
- For the purpose of submitting proposals through NSPIRES, proposers from non-U.S. institutions must affiliate in NSPIRES with the Kepler Guest Observer Office, which will submit the proposal on their behalf. For details, see http://keplerscience.arc.nasa.gov/ProposalPreparationSubmit.shtml.
- Complete and submit electronically the proposal through NSPIRES (http://nspires.nasaprs.com). Hard-copy submissions are not permitted.
- A separate electronic version of the target table must be submitted to the Kepler Science Center by the proposal deadline. An Excel template for the target table, which is suitable for direct insertion into the proposal, instructions about the required file format for submission to the Kepler Science Center, and information regarding the file-naming convention for the target table file are available at http://keplerscience.arc.nasa.gov/K2/ProposalPreparationContent.shtml.
- All electronic proposal materials (proposal and separate electronic target file submitted to NSPIRES and the Kepler Science Center, respectively) must arrive at the designated destinations by 11:59 p.m. Eastern time on the due date given in Section 5 in order to be included in the proposal review for this cycle of the K2 GO Program.

4.2 Proposal Formatting

This is a reminder that all proposals submitted to ROSES must strictly conform to the formatting rules in Section IV of the Summary of Solicitation and Chapter 2 of the NASA Guidebook for Proposers. Any proposal found to violate these formatting rules may be rejected without review. In previous years, problems with the following aspects of formatting proposals have been noted. Proposers should pay particular attention to:

- Margins: 1 inch on all sides, with a standard page size of 8.5 × 11 inches.
- Font: The NASA Guidebook for Proposers requires easily read fonts having, on average, no more than 15 characters per inch (e.g., 12-point Times New Roman and Arial). Proposers may not adjust the character spacing or otherwise condense a font from its default appearance.
- Line spacing: Font and line-spacing settings should produce text that contains no more than 5.5 lines per inch. Proposers may not adjust line-spacing settings for a selected font below single-spaced.
- Figure captions: Must follow the same font and spacing rules as the main text.
- Figures and tables: For text in figures and tables, font and spacing rules listed above do not apply, but all text must be judged to be legible to reviewers without magnification above 100%. Proposers may not place expository text in tables or figures in order to gain space.

4.3 Sources of Additional Information

The Kepler Science Center (http://keplerscience.arc.nasa.gov/K2), located at NASA Ames Research Center, provides support to Guest Observers and to proposers of this solicitation, such as technical information about the K2 mission and instrument, and other information supporting proposal preparation, including a FAQ link and template files for proposal preparation. Contact information may be found in Section 5.

5. Summary of Key Information

Expected program budget for Campaigns 4-5 awards	~$1.0M
Estimated number of funded investigations selected for observations	~ 5 large investigations containing >1,000 observed targets over campaigns 4 and 5 combined, and ~15 small investigations containing <1,000 observed targets over campaigns 4 and 5 combined.
Maximum duration of awards	1 year
Due Date for electronic submission of MANDATORY Step-1 proposals.	August 8, 2014
Due Date for electronic submission of Step-2 proposals	September 23, 2014
Planning date for start of investigation	Funds will be awarded when the data are made available to the PI. Proposers should use July 1, 2015 as the probable date for receiving data from campaign 4
Page limit for the central Science-Technical-Management section	No more than six pages for the Scientific/Technical/ Management section, including text, tables, and figures. References and the required target table do not count against this page limit, but the target table should be truncated in cases where it would cause this section to exceed 15 pages.
Relevance	This program is relevant to the astrophysics strategic goals and subgoals in NASA's *Strategic Plan;* see Table 1 and the references therein. Proposals that are relevant to this program are, by definition, relevant to NASA
General information and overview of this solicitation	See *ROSES Summary of Solicitation*
Detailed instructions for the preparation and submission of proposals	See the *NASA Guidebook for Proposers* at http://www.hq.nasa.gov/office/procurement/nraguidebook/
Submission medium and number of copies	Electronic proposal submission is required; no hard copy is required or permitted. See also Section IV of the *ROSES Summary of Solicitation* and Chapter 3 of the *NASA Guidebook for Proposers*
Web site for submission of proposals via NSPIRES	http://nspires.nasaprs.com (help desk available at mailto:nspires-help@nasaprs.com or (202) 479-9376)
Web site for submission of proposals via Grants.gov	http://grants.gov (help desk available at support@grants.gov or (800) 518-4726)
Funding opportunity number for downloading an application package from Grants.gov	NNH14ZDA001N-K2GO1
Mandatory submission of electronic version of target table	http://keplerscience.arc.nasa.gov/K2/ProposalPreparationTargetTable.shtml
Kepler Science Center	Webpage: http://keplerscience.arc.nasa.gov/K2 Email: keplergo@mail.arc.nasa.gov
Technical questions concerning	Dr. Thomas Barclay

this program element may be directed to the Kepler Science Center	Kepler Guest Observer Office NASA Ames Research Center, MS 244-30 Moffett Field, CA 94035-1000 Telephone: (650) 604-3560 Email: keplergo@mail.arc.nasa.gov
NASA point of contact for programmatic information	Dr. Douglas Hudgins Astrophysics Division Science Mission Directorate NASA Headquarters Washington, DC 20546-0001 Telephone: (202) 358-0988 Email: douglas.m.hudgins@nasa.gov