ESA Announcement of Opportunity (EAO-9)

Suzaku
Guest Investigator Programme
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European Space Agency
Agence spatiale européenne

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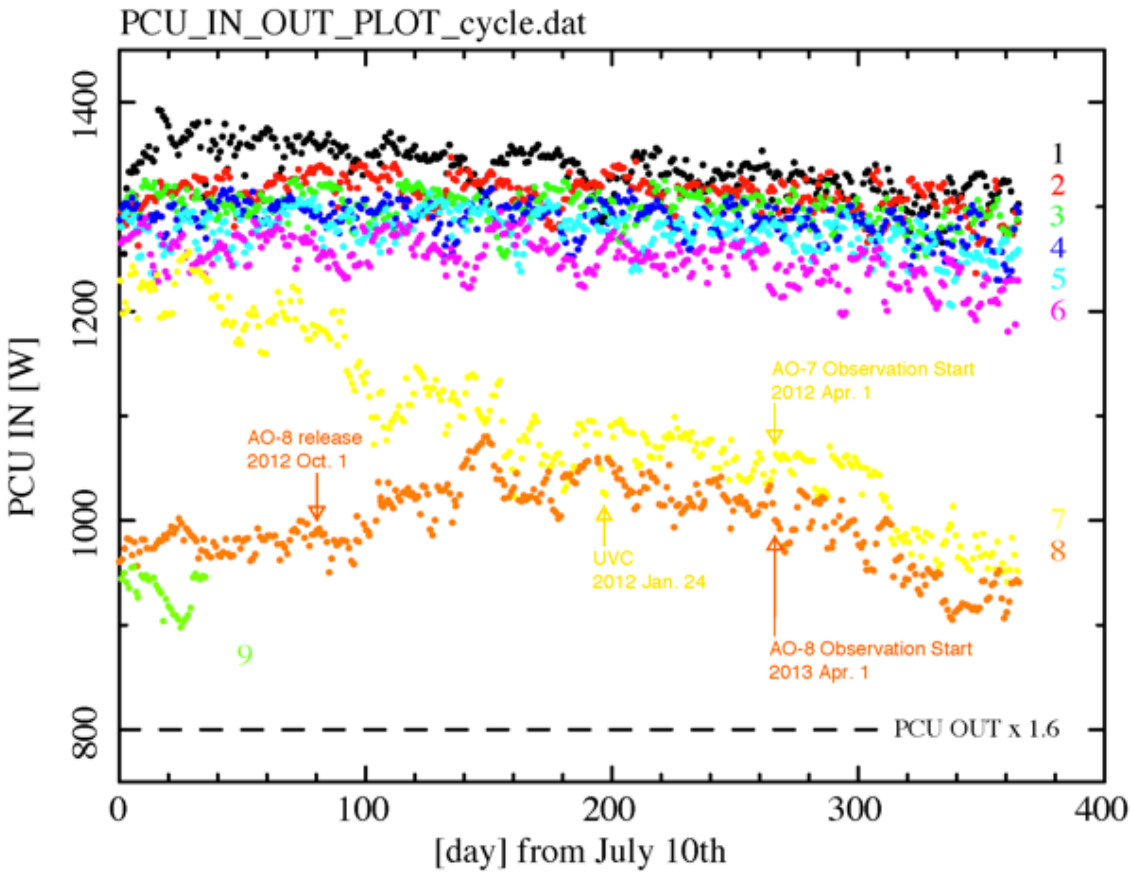
1. Overview

This announcement solicits proposals for observations using the Japanese-US X-ray astronomy satellite *Suzaku*.

The X-ray Astronomy satellite *Suzaku* was developed under collaboration by Japan and the United States and was launched by ISAS/JAXA on 10 July 2005. *Suzaku* is successfully carrying out astronomical observations using the X-ray Imaging Spectrometer (XIS) and the Hard X-ray Detector (HXD). After the initial operation for instrument calibration and performance verification, which confirmed the wide-bandpass, high-sensitivity and moderate spectral resolution capabilities of *Suzaku*, the international AO phase of the mission started in April 2006, performing observations based on proposals received from the world-wide astronomical community. In the meantime however, the amount of electrical power from the Solar Array Paddle (SAP) has degraded. The figure below shows the history of the electric power supply from the SAP.



This figure indicates the yearly profile of the amount of electric power supply with the origin of the ordinate being set at the launch date of *Suzaku*, (10 July 2005). The numbers at the right of the panel, arranged vertically, are the number of years since launch. The power output started to decrease immediately after the beginning of the 7th year (yellow dots). On 24 January 2012 there was insufficient power to maintain full functionality of the spacecraft and *Suzaku* entered into its automatic power reduction mode (so called "Under Voltage Control" mode). After this, for half a year, the power amount reduction seemed to continue, and the ISAS/JAXA project team suspected even the fulfillment of the AO-7 observations might be impossible at the end of the 7th year. However, early in the 8th year (orange dots), the power reduction seemed to stop. Accordingly, the project team decided to issue AO-8 whose announcement was made on 1 October 2012.

As the data for the 8th year were being accumulated, it was found that the reduction of the SAP electric output stopped at around the 140th day and after that the power reduction from the previous year is around 50 W. The minimal electric power necessary for *Suzaku* to retain current performance is 800 W, which is indicated by the horizontal dashed line around the bottom of the figure. Simple extrapolation from the current power supply, on the other hand, suggests that the minimal electric power during the AO-9 period is expected to be in the range 850 – 900 W, and thus it seems, at this moment, it is possible for *Suzaku* to operate until the end of the AO-9 period. Accordingly, ISAS/JAXA, NASA and ESA are soliciting the submission of observation proposals for AO-9 starting in 1 April 2014. However, the ISAS/JAXA project team would like proposers to note the following:

- Although the project team will make their best effort to continue the normal observing programme, part of the payload may have to be switched-off before the end of AO-9 (31 March 2015). Further problems with the electrical power supply could lead to an early termination of AO-9.
- Due to the reasons discussed above, ESA solicits proposals for which the science goals can be fulfilled within this AO (AO-10 may not be released). Proposals, the observations based on which were already carried out in past AOs, are welcome if they meet certain conditions. Please refer to Sect. 4 (1) for more details.
- As in AO-8, the project team has decided to limit the observable sky area to a range of 70-110 degrees from the Sun. This may lead to a reduction in the number of ToO and Time Critical proposals that can be accepted (see below for more detail).
- ISAS/JAXA is resuming the solicitation of new Key Project proposals, which was suspended in AO-8. Note that, although proposals continuing beyond a single AO period had been accepted until AO-7, this is prohibited in AO-9. The Key Project proposals solicited this time should achieve their scientific purpose within the AO-9 period. Proposals whose total exposure time exceeds 400 ksec should be submitted to the Key Project programme, which is solicited separately.

The Key Project programme was initiated in AO-4, in order to fully utilize the unique capabilities of *Suzaku*. The *Suzaku* project team expects to carry out observations that challenge important astrophysical issues and will be utilised for a long time after the observations as legacy of *Suzaku*. Key Project proposals are **not** being solicited here and observers from ESA Member States who wish to submit Key Project proposals should send them directly to ISAS/JAXA. Please refer to:

http://www.astro.isas.jaxa.jp/suzaku/proposal/ao9/announce/Keyp_AO-9E2.html

for more information.

During the AO-9 period, observations on the basis of *Suzaku*-Fermi joint program initiated in AO-6, and those of Joint Chandra/*Suzaku* proposals initiated in AO-4 will be carried out. We refer those who are interested in these programmes to the home pages of Chandra and Fermi, respectively.

This is one of three parallel announcements, and solicits proposals from researchers affiliated with institutes or universities located in the 20 ESA Member States (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland and the United Kingdom). Details of the Announcement and links to mission descriptions etc. can be found at:

http://cosmos.esa.int/Suzaku/

Researchers in the US should consult the version at:

http://astroe.gsfc.nasa.gov/

Researchers based in Japan, and all other countries, should consult the version at:

http://www.astro.isas.jaxa.jp/suzaku/

2. The Suzaku X-ray observatory

The *Suzaku* satellite carries four modules of the X-Ray Telescope (XRTs) that focus X-rays up to ~10 keV with a high efficiency. In the focal plane of each XRT there is an X-ray CCD camera (XIS) module. The XIS has a high sensitivity and a moderate spatial resolution, and is particularly suitable for the studies of extended sources. The XIS also has a good spectral resolution for soft X-rays below 0.8 keV, which is superior to those of Chandra and XMM-Newton. Moreover, ISAS/JAXA have applied the so-called "Spaced-row Charge Injection" technique for the XIS since AO-2 to suppress the degradation of energy resolution. The HXD has unprecedented sensitivity in the wide energy range up to 600 keV, although it has no imaging capability. The wide bandpass coverage of 0.2 keV through 600 keV with the XIS and the HXD is an important characteristic of the *Suzaku* mission.

The details of the instruments (Technical Description document), and a list of targets that have been observed, or accepted, can be found at the following *Suzaku* homepage:

http://www.astro.isas.jaxa.jp/suzaku/

3. Mission phases and time allocation

The *Suzaku* mission has been developed and maintained as a collaboration between Japan and the US. The Science Working Group (SWG), that consists of researchers involved in the development and operations, oversees the project overall. Since the end of the SWG phase of the mission (2006 March), all observation time except:

(a) Observatory Time (3%) for satellite maintenance and related purposes
(b) Calibration time (5%) for calibration of instruments
(c) Director's Discretionary Time (DDT; 5%) for gamma-ray bursts or any genuinely unpredictable events and other important observations granted at the discretion of the mission director,

has exclusively been dedicated for AO observations. The AO-9 programme (1 year period starting in April 2014) will be run under the same policy. Target of Opportunity (ToO) observations based on proposals from the MAXI team have been carried out within (c) – the DDT since AO-5.

The remaining 87% of the total time, which amounts to 360 d x 38 ksec/day x 0.87 = 11,902 ksec per year, is open to the AO-9 ordinary observation programme, and is distributed among Japan, US, ESA and other countries as follows:

Category	Description	Observing Time (ksec)
1	Japanese time	5451 of which 909 is for ESA and 4542 is for Japan and other countries
2	US time	3963
3	Joint Japan-US time	488
4	Key project time	2000

Here the Japan time includes joint Japan-ESA time, which amounts to 909 ksec. Accordingly, the remaining 4541 ksec is the time for Japanese scientists in AO-9. All proposals from scientists located in institutes that are **not** in Japan, US and the ESA Member States should be submitted to the Japanese time. Note, that the total approved exposure time of proposals whose PIs are not Japanese, nor researchers from ESA Member States, should not exceed the joint Japan-ESA time. The joint Japan-US time will be used if proposals for the same targets are accepted both in Japan and US, and if both PIs accept such merging (the proposal form has a check box for the PI to indicate whether he/she accepts the merging). Observation time from the *Suzaku*-Fermi joint program and joint Chandra/*Suzaku* proposals are included in either one category of (1) to (3) depending on the PI's affiliation. The time (4) is dedicated to Key Project observations, which is the same as in AO-7.

4. Proposal policies

(1) The complete list of the targets accepted until AO-8 can be found at the following URL:

http://www.astro.isas.jaxa.jp/suzaku/accept/

Observations of priority A and B targets are guaranteed. New proposals for these targets will not be approved without a strong justification for an additional observation, such as a much longer exposure, different pointing position on the same extended object, or a different phase of a variable object. As mentioned earlier, it is possible that AO-9 is the final one for the *Suzaku* mission. Accordingly, proposals which are similar to those submitted and accepted in previous AOs are welcome if the observations based on them are expected to strengthen or finally establish excellent results from previous AOs. They include, for example, enhancement of statistics of a certain object by simply adding exposure time, completing a mapping observation to entirely cover a diffuse object, increasing the number of samples from a certain source category, and so on. In addition, the next generation X-ray observatory ASTRO-H will be launched in the Japanese fiscal year 2015. Proposals whose scientific purpose can be extended with ASTRO-H are also welcome.

On the other hand, some of the priority C targets and ToO targets will not be observed. This can be checked at the following URL:

http://www.astro.isas.jaxa.jp/suzaku/log/

Anyone can submit proposals for the C or ToO targets that are unobserved. It must be noted, however, that these unobserved C targets and ToO targets may be observed until the end of the AO-8 period (March 2014). In this case, the observations of the C targets are regarded as being completed if the exposure time exceeds 70% of the proposed time and no further observations will be carried out in AO-9. If the exposure time is less than 70 %, on the other hand, a complementary observation will be carried out to complete the requested time, if a proposal for the same target and the same PI is accepted at a higher priority (A or B) in AO-9. Otherwise the observation carried out in AO-8 (less than 70% filled) is ignored, and the target is open for competition in AO-9.

(2) The exposure time of the observation should be justified based on the specific scientific objectives, preferably using simulations. However, there is a minimum exposure time of a single pointed observation of 10 ksec, considering the efficiency of satellite operation. On the other hand, the upper limit of the total exposure time per proposal is 400 ksec in AO-9. Note that observations based on a proposal whose exposure time is equal to, or longer than, 300 ksec will be opened to the public immediately after the initial processing of the data has been performed. No proprietary period is awarded to the PI.

(3) An uninterrupted continuous observation is guaranteed for up to 100 ksec. This limitation originates from moonlight constraints to the star trackers' field of view, conflicts with other time critical (see item (5) below) and other operational and planning difficulties. The *Suzaku* operations team will accept requests for uninterrupted observations longer than 100 ksec, but will conduct them on a best-effort basis.

(4) ToO proposals are allowed for short-lived events on known objects whose timing is uncertain. This category is referred to as "Reserved ToO observation". In this case, the conditions to trigger the observation, estimated probability of the event taking place during the AO-9 period and the expected duration of the event should be specified in the proposal as well as other information required for the ordinary observation proposals (see Sect. 5.2 of "Call for Proposals of the *Suzaku* AO-9 Period", below). Any proposal without specifying a target name, such as "Observation of a forthcoming nearby supernova", or "Next nova explosion in M31", will not be accepted. The number of targets that is allowed in the target list is limited at most to 5 per proposal. It is requested to specify in the scientific justification how many targets should be observed to fulfil the scientific goals of the proposal. Note however, that the maximum total exposure time per proposal is limited to 400 ksec (see (2), above). If for example, five targets with 100 ksec for each are proposed, the trigger number is limited to four (= 400 ksec exposure = the exposure limit). In addition, note that, if the trigger number is 1 or 2, the PI will be awarded a proprietary period of 1 year, whereas if it is 3 or 4, the data will be immediately opened to the public (total exposure time is equal to, or more than, 300 ksec).

(5) It is possible to submit proposals specifying the type of observations as TC (Time Critical). These include all the observations that require, by the operation team, consideration of operational/planning constraints other than the solar angle limitation. They, for example, include roll-angle-constraint observations, multi-pointing observations of a variable target (even with a lax constraint of once per half a year, for example), a background observation planned closely in time with the main target observation, an observation at a certain binary phase, coordinated observations with other wavebands, and so on. The *Suzaku* operation team will do their best to perform the observations as requested. In all these cases, the PI has to raise the TC flag in the application form. Even if the coordination with other instruments is not planned in detail at the time of the proposal submission, the PIs are requested to check the TC box if they would like to do so after the approval of the proposal. The *Suzaku* long- and short-term schedules can be revised even just before observation start, due to interruption by a ToO observation. The operation team cannot guarantee the coordination if the TC flag is off, even in the case that the other instruments follow the *Suzaku* schedule.

(6) Any genuinely unpredictable events such as, gamma-ray bursts and supernovae and so on, can be observed as part of the DDT. This category is referred to as a "real-time ToO observation". The observation proposals of this category can be received at any time and are refereed out of the ordinary proposal selection process. Any proposer who would like to propose a real-time ToO observation is requested to fill the form:

http://www.astro.isas.jaxa.jp/suzaku/planning/gtoo/

and send it to the *Suzaku* managers by e-mail

suzaku_managers@astro.isas.jaxa.jp

The proposer has no proprietary rights to real-time ToO observation data. Note that real-time ToO observations of gamma-ray bursts will be accepted from any investigators worldwide in AO-9, which had been planned by the *Suzaku* Science Working Group in AO-6, by referring to information from various other observation networks.

(7) The *Suzaku* project team will accept proposals using P-sum/timing mode for the XIS, as well as the normal imaging mode. In the P-sum/timing mode, photon pile-up scarcely occurs, and a time resolution as fast as 7.8 msec can be achieved, although only 1-dimentional images can be obtained. Note, that the P-sum/timing mode can be used only for XIS3, and neither Spaced-row Charge Injection, nor CTI correction can be applied. Hence the energy resolution is significantly worse than in the normal imaging mode. The calibration accuracy of the energy response is not as good as that in the normal imaging mode, either. Refer to the technical description document for the P-sum/timing mode for more details.

(8) The project team has supported the two default pointing positions since AO-1 - the XIS nominal and HXD nominal positions. Of these, the team ceased to support the HXD nominal position from AO-7. As a result, the standard HXD response matrices will not be supplied, and XIS observations with a non-standard readout clock (P-sum/timing mode and window/burst options) have not been available since AO-7. Note, however, that the operation team does not prohibit the proposers to carry out their observations at the HXD nominal position. In this case, they should make the response matrices by themselves by utilizing the response builder tools for the XIS and the HXD.

(9) ISAS/JAXA resumes solicitation of Key Project proposal submission in this AO-9, which will be refereed separately from the ordinary proposals. The announcement of opportunity of the Key Projects will be issued separately. There is no observing time limitation in the Key Projects. This will provide with a unique opportunity to carry out various projects, such as an extremely long observation of a single object, mapping observation of a certain area of the sky, a long term monitoring observation of an object, and so on, by fully utilizing unique capabilities of *Suzaku*. Note, however, that due to the SAP power supply concern, an observation plan that extends over the AO-9 period is prohibited. The deadline of the Key Project programme is the same as that of the ordinary proposals (solicited by this announcement) of 13 November 2013. Key Project proposals will be sent to the initial refereeing process in Japan and US separately. The PIs of the proposals that survive the initial refereeing process will be requested to make a presentation in a workshop, which is open to all investigators. Immediately after this workshop, the Japan-US merging committee will finally select the Key Project proposals for AO-9. The data taken in the Key Project programme are opened to public immediately after the data are ready for analysis.

(10) If a proposal to this ordinary programme and another proposal to the Key Project programme contain the same investigator(s), and part of the targets overlaps between the two proposals, they are referred to as “duplicated proposals”. A duplicated proposal to the ordinary programme is allowed only if its targets comprise of a subset of those in the counterpart Key Project proposal. The duplicated proposals to the ordinary and to the Key Project programmes are both rejected if the proposal to the ordinary programme contains any targets that are not included in the counterpart Key Project proposal, or if the exposure times of some targets that are included in the ordinary programme proposal exceed those of the same targets in the counterpart Key Project proposal. Only one duplicated proposal to this ordinary programme can be submitted from a parent Key Project proposal.

Except for the case described here, proposing the same targets to both this ordinary programme and to the Key Project programme is strictly prohibited, even if the scientific purpose or observation methodology are different between the two. Any investigator who plans to submit a duplicated proposal to this ordinary programme should declare so in the counterpart Key Project proposal. It is not necessary, in the duplicated proposal to this ordinary programme, to mention that there is the parent Key Project proposal.

5. Review process and schedule

(1) Researchers affiliated with institutes located in the ESA Members States should submit their proposals to ESA according to this AO document. The deadline is 2013 November 13 at 16:00 CET. After the ESA review, a Japan-US merging committee will be convened in mid February 2014 and the final observing programme will be released soon thereafter.

(2) Accepted targets will be classified into three categories (A, B, and C) based on proposal ranking. Priority A targets will be preferentially observed during the AO-9 period (2014 April to 2015 March) and the observations are regarded as completed if the exposure time is more than 90% of the requested time. Priority B targets will be scheduled in this period on a best-effort basis and hence they may be carried over to any future AOs. Observations of priority B targets are regarded as complete if the observation covers more than 70% of the requested time. Priority C targets will be used as fillers when there are gaps in the time line after scheduling the priority A and B targets. Of the total available time, T, (=11902 ksec, 360 d x 38 ksec/day x 0.87) JAXA will accept 0.6T (=7141 ksec) for Key Projects and priority A (the Key Project time is at most 2000 ksec), 0.3T (=3571 ksec) for priority B, and 0.5T (=5951 ksec) for priority C proposals. This implies an over-subscription of 40%. The oversubscribed targets will be scheduled if observing time remains after the observatory time, the calibration time and DDT are assigned.

(3) Reserved ToOs and Time Critical observations pose constraints on scheduling observations. Hence their total fraction is limited to be some 15% of the total available time. Note that this number may be reduced in the discussions of the Japan-US merging committee meeting (in February 2014), based on the rate of the SAP power supply degradation.

6. Data rights

The data taken in the ordinary observation programme are immediately delivered to the proposer. The proposer has proprietary rights to the data for 1 year after the data are ready for scientific analysis. This does not apply to the data based on real-time ToO proposals and proposal whose total exposure time is equal to or more than 300 ksec, which are immediately opened to the public after the initial data processing is completed.

Call for Proposals for the Suzaku AO-9 Period

1. Observations solicited in AO-9

ESA is calling for X-ray observations with the *Suzaku o*bservatory from April 2014 through March 2015.

2. Applicant eligibility for submitting proposals to the ESA time

Principal investigators who submit their proposals to ESA have to be affiliated with institutions or universities located in one of the ESA Member States.

U.S. based proposers should submit their proposals through NASA.

European researchers who spend most of their time during the AO-9 period in Japan can submit their proposals to ISAS/JAXA. PIs in the other countries should submit their proposals to ISAS/JAXA in Japan. Proposals submitted to ISAS/JAXA and NASA can include US/ESA researchers as Co-Is.

It is not permitted to submit identical proposals to any of ESA, ISAS/JAXA or NASA. They will be ignored on all sides.

There are no restrictions on the countries of co-investigators on proposals submitted to ESA.

3. Due date of proposals

The observation proposals should be submitted to ESA by 16:00 CET on 13 November 2013. Only electronic submission through the Remote Proposal-submission System (RPS) is allowed (see below for details).

4. Proposal submission

The forms summarized in the next section should be submitted electronically with the Remote Proposal-submission System (RPS). The RPS will be ready for use shortly.

5. Proposal form

The proposal form consists of:

(1) **Cover Page**: general information including investigators' names, title and abstract of the proposal.

(2) **Target Form**: information on the proposed targets including target name, celestial coordinates, expected counting rate, and preferred observation mode. The target information in this form is automatically registered in the observation database and utilized for making the long-term observation time line of AO-9. Proposers are therefore strongly required to provide accurate information. All information that is indispensable for operation planning should be provided in the electronic form. PIs are advised to utilize the "Remarks" area if they have detailed requests that cannot be expressed with the check boxes/pull-down menus. Special care should be paid to the following points.

   (a) From AO-6, the XIS3 module can be used in the P-sum/timing mode (the other two modules XIS0 and XIS1 can be operated only in their normal imaging mode). In using the P-sum/timing mode for XIS3 the PI is required to select "PSUM" in the XIS mode pull-down window and describe the mode settings of the other XIS

modules such as window or burst options in the "Remarks" area.

(b) Be sure to mark the TC check box if the proposed observation is Time Critical (see Sect. 4, item 5 of the AO). Provide all information necessary to plan and conduct the observation in the "Remarks" area.

(c) Provide in the "Remarks" area the conditions necessary to initiate the ToO observation and the probability of these conditions being met within the AO-9 interval. If there is no description on the trigger probability, the project team will assume a probability of 100% and, accordingly accumulating the exposure time as written in the proposal. This may hamper acceptance of other lower grade ToO proposals which would have been accepted if there was a description on the trigger probability. In order to utilize valuable *Suzaku* time among the community, the project strongly requests proposers of ToO observations to specify the trigger probability.

(d) It will take ~3 days to start a reserved ToO observation in the P-sum/timing mode following the trigger from the PI, during which the operation team prepares the mode setting commands.

(3) **Scientific Justification**: Background of the proposal, scientific issues to be resolved, and technical feasibility of the proposed observation should be summarized within 4 pages including text, figures, charts, tables, and references.

Of these, the forms (1) and (2) should be created electronically by accessing:

http://www.rssd.esa.int/RPS/SUZAKU/RPS.pl

The form (3) can be made off-line. The proposers can use any editors/word processors they like. It should be in either *pdf* or *ps* format at the time of submission. The allowed language for (3) is English. In submitting a proposal, the proposer should submit forms (1) and (2) through the RPS first, then after receiving confirmation of their acceptance (the proposal ID number is provided), form (3) should to be uploaded. If the proposer would like to revise form (3) after submission, it is possible to re-submit it by adding a revision index (a, b, or c) following the proposal ID number, Note that up to three revisions are allowed. For example, if the ID number is 110, the three revised scientific justifications should be tagged as 110a, 110b, and 110c.

6. Supplemental Information

Detailed information on the *Suzaku* instrumentation, such as capabilities of scientific instruments, is summarized in the Technical Description (TD) document, which can be found at:

http://www.astro.isas.jaxa.jp/suzaku/doc/suzaku_td

ISAS/JAXA plan to update the TD document, as well as the proposal planning tools, in the middle of September 2013. Until then, the proposers are advised to use the existing versions. For those who are not familiar with *Suzaku* data, we summarize how to "walk through *Suzaku* analysis" and a few set of test data (of Crab and other typical X-ray objects) at:

http://www.astro.isas.jaxa.jp/suzaku/pub/20051201.html

If you have questions, please contact

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