



LABORATÓRIO NACIONAL DE ASTROFÍSICA

OBSERVATÓRIO DO PICO DOS DIAS

Pedido de Tempo de Telescópio

1. **Titulo do Projeto:** Characterization of Gaia Transients

2. **Telescópio:** Perkin-Elmer

3. **Semestre:** Set - Fev

4. **Resumo da Justificativa do Projeto** (máximo 10 linhas, o excedente será desconsiderado):

The currently available large photometric surveys are discovering a vast amount of transients, ranging from supernovae to dwarf nova outbursts. In particular, the Gaia satellite is discovering such phenomena at a rate of about three per day. A complete follow-up of these objects is barely feasible and a preliminary characterisation is crucial to isolate the targets which deserve a detailed study. The Cassegrain Spectrograph is ideally suited for this task, sitting on a 1.6m telescope and providing sufficient resolution to provide a useful spectrum in a reasonable amount of time. The present proposal is aimed at observing Gaia transients for characterisation and trigger a more complete follow-up observations with larger facilities.

5. **Nome do responsável:** Alessandro Ederoclite

6. **Instituição de origem:** Instituto de Astronomia, Geofísica e Ciências At

7. **Endereço eletrônico:** aederocl@iag.usp.br

8. **Celular:** +55 (11) 3091-2723

É solicitação de renovação de projeto de Longo Prazo?: Não

Em caso positivo, informe a identificação original do projeto:

8. **Co-autores e Instituição** (missões anteriores dos co-autores são levadas em conta na avaliação da produção científica):

| | | |
|----------------------------------|---------|--------------------------------|
| Antonio Amadeu | IAG/USP | antoniolamadeu@gmail.com |
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9. **Existe tese dependendo deste projeto?** Não

11. **Os itens abaixo devem ser justificados em 13, 14, 15 e 16:**

11a. **Tempo de Telescópio (Número de noites solicitadas no período):** 12

11b. **Tempo mínimo de telescópio (Número mínimo de noites necessárias):** 4

11c. **Projeto Longo Prazo?** Não

11d. **Período(s) desejados(s):**

11e. **Datas impossíveis:**

11f. **Lua:** [x] Quarto Crescente - [] Cheia - [x] Quarto Minguante - [x] Nova

11g. **Tempo de retenção dos dados (default=24 meses):** (6) meses

12. **Solicita a opção de Observação Remota:** Não

13. **Especificação detalhada dos instrumentos e materiais a serem utilizados:**

Instrumento: Espectrógrafo CASSEGRAIN Detector (preferencial): WI105

Gaveta Polarimétrica: Não

Rede(s) difração: 300-500

Ordem: 1i Lambda #1: Lambda #2: Lambda #3:

CCD de guiagem: Sim Redutor focal: Não

Filtros:

Observações:

For follow-up, the ideal is to have 2 nights per month spread over the semester.

14. Justificativa científica. Discuta as bases científicas, os objetivos do seu programa de observação e o impacto dos resultados na área de pesquisa.

(máximo de uma página de texto e mais uma de figuras, o que exceder estes limites será desconsiderado. Fonte do texto mínima 10):

Nowadays, a large amount of wide field telescopes is patrolling the sky in search for transients with main science drivers as diverse as supernovae or near earth asteroids. Projects like the Intermediate Palomar Transient Factory (iPTF, [1]) or Catalina Real-Time Transient Survey (CRTS, [2]) are providing a vast amount of variable candidates. This situation will become even more complex when LSST will come online, triggering millions of alerts per night. Given the limited telescope time for both photometric and spectroscopic follow-up, most of the transient candidates are left behind. The Gaia mission is a cornerstone ESA astrometry space mission and a successor to the Hipparcos mission. During its operation (which is supposed to last until 2022), Gaia is expected to scan repeatedly the sky, then having a great potential for variability studies. In particular, since the beginning of its operations, Gaia has been providing a large amount (almost 10,000, at the moment of writing this proposal) of photometric alerts. Nonetheless, most of these alerts (about 86%) are classified as "unknown" (for details on the Gaia Photometric Alerts system, see [3]). Given the depth of Gaia, it is not surprising that the peak of the histogram is at $G \sim 19$ (where G is in the Gaia photometric system). It is striking that many of the sources are classified as "unknown", regardless of their magnitude.

The automatic classification of transients is a great challenge which is being faced by many projects (see [4]) and, in most cases, it requires a large amount of additional data (either long duration light curves or high signal-to-noise spectra). Projects like Gaia, which produce many detections per day (and will have produced hundreds of thousands of alerts by the end of its operations), can provide, on one hand, statistics on very numerous phenomena (e.g. supernovae) but can also be a unique tool to identify unusual objects. A great example, in this sense, is the discovery of the AM CVn star Gaia14aae [5], a member of a rare family of interacting white dwarfs. This is the famous search for a needle in a haystack.

Astrophysical transients are at the forefront of current research. It is highly disturbing that almost 90% of the transients observed by Gaia remain unclassified. Possibly the leading group in the business of characterising and following-up transients is PESSTO ([6]), being carried out with EFOSC2 and SofI on the 4m New Technology Telescope (NTT). Soon, the NTT will receive a new instrument (SoX, Son of X-Shooter, [7]) which will transform the telescope in a machine dedicated to the follow-up of transients. This shows that spectroscopy is still the most reliable method to classify an object. Even more critically, 4m class telescopes with low-resolution spectroscopy can have a critical impact on the field. Whereas it is true that, in many cases, a complete follow-up of a transient may be required, every follow-up must start with a first spectrum. In particular, we are interested in transients which are not associated with a host galaxy (in other words, not supernovae).

This proposal aims at improving the sample of transients with a classification and, ultimately, improve the understanding of the various transient astrophysical phenomena. Since the Gaia "G" band covers most of the optical range and a significant part of our knowledge of transients is based on optical spectra, it seems natural to ask to use the Cassegrain Spectrograph with low-resolution (in order to increase the observing efficiency).

Finally, this proposal has a large didactic potential as the co-authors of the proposal are undergraduate students who will learn a great deal from the observation of these "unknown" targets.

15. Detalhes do programa. Descreva sumariamente os procedimentos de observação e redução. Indique as propriedades medidas nos dados e discuta os métodos de análise utilizados na obtenção dos resultados. Se existirem problemas técnicos particulares associados com esta proposta, forneça informações suficientes para que a CP possa avaliar sua factibilidade.

We will select the most recent targets available in the Gaia Alerts Index <http://gsaweb.ast.cam.ac.uk/alerts/alertsindex> with type "unknown" and that are observable from OPD during the semester.

Standard stars will be observed during the night because, in principle, we would attempt a flux calibration of our data.

Bias removal, flat-fielding, wavelength calibration and flux calibration will be done with IRAF by the PI, who has extensive experience on similar instrumentation (NTT/EFOSC2 or GTC/OSIRIS, just to name two).

The idea is to be able to access the region of spectrum where most of the Balmer lines are located (rest-frame), hence between 4000 and 7000 Angstrom.

The obtained spectra will be reported as Astronomers' Telegrams <http://www.astronomerstelegram.org/> and shared through the Transient Name Server <http://gsaweb.ast.cam.ac.uk/alerts/alertsindex>

16. Justificativa de solicitação de projeto de Longo Prazo. Se for o caso, forneça aqui a justificativa e informações pertinentes para que a CP avalie se a proposta pode ser enquadrada na política de projetos de Longo Prazo do OPD.

This is not a long program (yet).

17. Justificativa da solicitação de Observação Remota, descreva de forma resumida a plataforma e infraestrutura para o bom sucesso da sua conexão remota.

None of the proposers has familiarity with the 1.6m telescope. Hence we do not ask for remote observation.

18. Justificativa da solicitação do tipo de telescópio, número de noites, datas e lua necessária, incluindo os cálculos para chegar-se ao tempo de exposição. Forneça a relação sinal/ruído necessária e outras informações que possam ser úteis para a CP. Quantifique os resultados de sua estimativa de tempo de exposição. Indique se as observações estão sendo dimensionadas em função da cobertura temporal de fenômenos variáveis.

We intend to take spectra of the Gaia transients with classification "unknown" which are observable from OPD During the "A" semester of 2019, Gaia detected 781 transients (with classification "unknown") which would have been observable from OPD. Most importantly, half of these objects had Gaia G magnitude smaller than 18, hence comfortably observable with the Cassegrain Spectrograph. These targets are added as target list to the present proposal. The Cassegrain Spectrograph is the ideal instrument for this project, as a single spectrum even with the lowest resolution can provide a good classification in a short time.

In absence of an exposure time calculator, we used a similar instrument (EFOSC2 on the New Technology Telescope at La Silla Observatory) and rescaled the exposure time from a 3.5m telescope to a 1.6m telescope.

For our purpose, SNR~20 is more than enough and this is achievable in about 5minutes. Considering overheads, we ask for a grand-total of 12 nights which is enough to observe about half of the targets without classification, thus improving by a factor of 2 the number of known transients. In order to demonstrate the feasibility of the project, 4nights is the minimum amount of time which we can use to produce results, considering the chance of losing time due to weather.

19. Os dados obtidos serão adicionados ao banco de dados do OPD. O observador tem direitos exclusivos sobre os seus dados durante um período de 24 meses. No caso de um tempo maior de exclusividade ser solicitado, justificar neste campo:

In fact, we believe that, given the transient nature of our targets, a long proprietary period is counter-productive. Six months are more than enough.

20. Projeto de backup. Se o tempo de observação está sendo solicitado para um projeto cuja amostra não ocupa a noite inteira e/ou muito exigente em termos das condições observacionais (por exemplo, só podendo ser executado em noites fotométricas) é adequado, mas não obrigatório, propor um projeto de backup. Descreva-o sumariamente nesse campo.

Our project, by nature, has objects spread all across the sky. Hence, we do not ask for a backup project.

21. Lista dos objetos:

| Objeto | A.R.(h,m) | Dec.(g) | Magnitude | Banda | Comentários |
|-----------|-----------|-----------|-----------|-------|-------------|
| Gaia19ajv | 16:22:44 | +23:57:13 | 18.78 | G | |
| Gaia19ake | 13:00:07 | -06:13:31 | 15.78 | G | |
| Gaia19akk | 14:29:24 | +10:38:59 | 18.81 | G | |
| Gaia19akm | 23:58:00 | +12:44:19 | 18.45 | G | |
| Gaia19ako | 12:32:16 | -10:15:25 | 16.3 | G | |
| Gaia19akp | 12:39:15 | -08:06:37 | 18.92 | G | |
| Gaia19aks | 12:52:07 | -09:19:44 | 18.03 | G | |
| Gaia19akt | 17:36:49 | +27:36:10 | 18.85 | G | |
| Gaia19aku | 23:24:29 | +18:02:51 | 18.64 | G | |
| Gaia19alf | 19:55:18 | +29:59:00 | 19.33 | G | |
| Gaia19alg | 19:48:32 | +29:04:52 | 18.16 | G | |
| Gaia19alh | 23:47:49 | +18:08:22 | 18.76 | G | |
| Gaia19alk | 23:00:06 | +23:07:34 | 19.19 | G | |
| Gaia19als | 19:20:31 | +27:43:33 | 16.93 | G | |
| Gaia19aly | 22:31:30 | +28:48:10 | 18.92 | G | |
| Gaia19amd | 14:16:02 | -13:00:02 | 18.69 | G | |
| Gaia19amh | 20:04:43 | +27:20:23 | 18.24 | G | |
| Gaia19ana | 18:56:46 | +19:05:38 | 17.82 | G | |
| Gaia19anc | 19:19:36 | +21:55:47 | 16.91 | G | |
| Gaia19and | 19:44:50 | +23:34:33 | 18.2 | G | |
| Gaia19ane | 18:06:09 | +11:51:02 | 18.31 | G | |
| Gaia19anl | 13:32:45 | -27:33:39 | 18.69 | G | |
| Gaia19ano | 18:42:14 | +13:30:13 | 17.73 | G | |
| Gaia19aoa | 18:45:02 | +11:03:23 | 18.36 | G | |
| Gaia19aoc | 18:01:46 | -00:19:26 | 18.07 | G | |
| Gaia19aof | 18:30:09 | +07:18:15 | 20.2 | G | |
| Gaia19aoi | 13:58:21 | -40:31:32 | 18.72 | G | |
| Gaia19aoj | 18:10:32 | +01:33:11 | 18.65 | G | |
| Gaia19aom | 18:39:42 | +07:48:57 | 18.82 | G | |
| Gaia19aoq | 18:10:21 | +00:39:24 | 16.25 | G | |
| Gaia19aor | 19:17:52 | +14:44:59 | 18.84 | G | |
| Gaia19aow | 19:13:45 | +13:22:10 | 18.72 | G | |
| Gaia19apb | 14:57:13 | -42:48:37 | 16.25 | G | |
| Gaia19apc | 19:23:57 | +14:05:17 | 15.63 | G | |
| Gaia19ape | 18:29:52 | -03:56:54 | 16.91 | G | |
| Gaia19apf | 12:04:11 | -49:49:48 | 17.91 | G | |
| Gaia19apg | 17:27:28 | -21:40:44 | 18.49 | G | |
| Gaia19aph | 14:39:15 | -47:52:38 | 18.4 | G | |
| Gaia19apk | 13:53:07 | -52:59:00 | 16.91 | G | |
| Gaia19apm | 17:39:22 | -21:51:49 | 16.56 | G | |
| Gaia19apn | 18:45:03 | +00:37:42 | 18.35 | G | |
| Gaia19apo | 12:40:10 | -55:42:07 | 17.53 | G | |
| Gaia19app | 18:14:39 | -14:59:22 | 16.79 | G | |
| Gaia19apq | 17:46:01 | -24:45:33 | 18.1 | G | |
| Gaia19apr | 17:29:31 | -30:32:29 | 18.79 | G | |
| Gaia19apt | 18:26:30 | -07:18:15 | 17.46 | G | |
| Gaia19apw | 18:20:48 | -11:34:35 | 18.87 | G | |
| Gaia19apx | 18:02:08 | -18:29:06 | 18.03 | G | |
| Gaia19apz | 18:16:58 | -19:53:31 | 16.64 | G | |
| Gaia19aqa | 16:17:48 | -49:26:48 | 17.38 | G | |

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|-----------|----------|-----------|-------|---|--|
| Gaia19aqb | 18:20:21 | -10:38:26 | 17.59 | G | |
| Gaia19aqc | 18:15:30 | -20:48:41 | 17.45 | G | |
| Gaia19aqf | 19:11:53 | +03:56:58 | 18.3 | G | |
| Gaia19aqh | 13:38:06 | -64:21:23 | 18.05 | G | |
| Gaia19aql | 12:18:46 | -60:19:00 | 18.13 | G | |
| Gaia19aqm | 15:06:53 | -67:12:14 | 16.29 | G | |
| Gaia19aqn | 17:39:08 | -34:41:25 | 18.9 | G | |
| Gaia19aqq | 16:23:29 | -50:37:37 | 18.7 | G | |
| Gaia19aqs | 12:17:58 | -60:40:10 | 15.9 | G | |
| Gaia19aqt | 15:18:28 | -61:32:53 | 16.08 | G | |
| Gaia19aqw | 12:09:01 | -68:02:13 | 15.56 | G | |
| Gaia19aqx | 15:51:30 | -61:34:56 | 16.97 | G | |
| Gaia19aqy | 18:51:09 | -09:01:49 | 18.25 | G | |
| Gaia19ard | 18:15:48 | -37:54:39 | 18.05 | G | |
| Gaia19ark | 18:22:58 | -31:03:40 | 18.71 | G | |
| Gaia19arl | 18:26:52 | -29:55:57 | 18.91 | G | |
| Gaia19arn | 18:46:35 | -18:31:20 | 18.88 | G | |
| Gaia19arp | 19:06:58 | -09:40:56 | 17.6 | G | |
| Gaia19arv | 18:23:24 | -37:26:08 | 18.15 | G | |
| Gaia19ary | 18:35:23 | -31:09:04 | 18.83 | G | |
| Gaia19asa | 19:03:10 | -32:31:41 | 17.46 | G | |
| Gaia19asb | 19:10:55 | -02:41:10 | 18.77 | G | |
| Gaia19asd | 19:10:30 | -30:53:39 | 18.96 | G | |
| Gaia19ase | 14:44:02 | -84:06:49 | 17.75 | G | |
| Gaia19asg | 19:08:40 | -50:46:38 | 18.49 | G | |
| Gaia19asi | 19:03:31 | -34:14:44 | 17.27 | G | |
| Gaia19asp | 19:00:54 | -53:44:24 | 19.04 | G | |
| Gaia19asq | 19:15:03 | -58:34:26 | 17.97 | G | |
| Gaia19asu | 19:29:40 | -34:09:17 | 18.34 | G | |
| Gaia19asv | 19:16:35 | +26:21:53 | 16.84 | G | |
| Gaia19asx | 19:16:27 | +26:39:13 | 18.61 | G | |
| Gaia19atf | 20:00:46 | -52:54:51 | 17.65 | G | |
| Gaia19ati | 19:10:59 | -26:45:55 | 15.87 | G | |
| Gaia19atm | 22:06:00 | -70:38:59 | 17.94 | G | |
| Gaia19atn | 20:52:45 | -67:48:15 | 17.31 | G | |
| Gaia19atr | 20:27:33 | -48:08:18 | 17.58 | G | |
| Gaia19ats | 18:44:31 | +23:22:34 | 15.57 | G | |
| Gaia19aua | 18:46:59 | +12:04:24 | 17.45 | G | |
| Gaia19aud | 21:09:45 | -50:18:45 | 18.81 | G | |
| Gaia19auf | 21:27:22 | -54:13:10 | 18.51 | G | |
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| Gaia19aux | 22:27:06 | -53:55:14 | 17.85 | G | |
| Gaia19avd | 18:28:18 | -03:03:21 | 18.45 | G | |
| Gaia19avi | 17:41:35 | +16:33:14 | 19.87 | G | |
| Gaia19avj | 17:56:05 | +13:09:10 | 17.18 | G | |
| Gaia19avl | 20:19:06 | -35:57:56 | 15.97 | G | |
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| Gaia19avs | 23:23:06 | -55:32:48 | 18.1 | G | |

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|-----------|----------|-----------|-------|---|--|
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| Gaia19awq | 16:20:11 | +10:42:33 | 18.97 | G | |
| Gaia19awr | 18:43:45 | -19:19:07 | 18.2 | G | |
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| Gaia19awx | 18:16:59 | -19:49:53 | 17.34 | G | |
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| Gaia19axg | 17:57:20 | -20:34:20 | 18.63 | G | |
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| Gaia19axi | 19:02:12 | -33:48:15 | 17.04 | G | |
| Gaia19axm | 18:22:21 | -15:48:11 | 20.27 | G | |
| Gaia19axn | 18:19:16 | -21:04:48 | 17.82 | G | |
| Gaia19axo | 18:54:25 | -37:09:13 | 17.12 | G | |
| Gaia19axs | 18:36:13 | -31:15:26 | 17.88 | G | |
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| Gaia19aye | 17:14:09 | -22:54:53 | 18.9 | G | |
| Gaia19ayf | 18:03:37 | -35:44:21 | 17.29 | G | |
| Gaia19ayh | 17:30:34 | -27:29:31 | 17.75 | G | |
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| Gaia19ayj | 14:22:58 | +26:55:15 | 18.98 | G | |
| Gaia19aym | 17:05:58 | -24:06:49 | 19.42 | G | |
| Gaia19ayo | 17:40:52 | -36:02:22 | 17.55 | G | |
| Gaia19ayp | 17:43:25 | -34:54:13 | 18.1 | G | |
| Gaia19ayr | 17:18:07 | -32:25:13 | 18.68 | G | |
| Gaia19ays | 16:57:54 | -27:08:47 | 18.93 | G | |
| Gaia19ayt | 19:41:24 | -55:06:07 | 18.49 | G | |
| Gaia19ayu | 20:41:14 | -57:36:47 | 19.2 | G | |
| Gaia19ayx | 15:08:47 | +10:41:50 | 18.46 | G | |
| Gaia19aza | 17:03:19 | -29:52:23 | 15.07 | G | |
| Gaia19azb | 18:42:35 | -48:47:35 | 14.93 | G | |
| Gaia19azi | 20:00:37 | -64:43:28 | 16.66 | G | |
| Gaia19azj | 22:31:16 | -62:57:23 | 19.27 | G | |
| Gaia19azk | 16:09:16 | -26:24:45 | 18.71 | G | |
| Gaia19azl | 16:56:35 | -40:14:21 | 19.02 | G | |
| Gaia19azm | 16:54:17 | -40:08:06 | 17.28 | G | |
| Gaia19azo | 17:17:28 | -49:56:56 | 17.57 | G | |

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|-----------|----------|-----------|-------|---|--|
| Gaia19azp | 21:15:43 | -66:04:30 | 19.42 | G | |
| Gaia19azt | 22:27:16 | -67:10:36 | 18.58 | G | |
| Gaia19azw | 17:05:57 | -49:19:52 | 18.08 | G | |
| Gaia19azx | 18:23:14 | -60:41:06 | 16.8 | G | |
| Gaia19baa | 16:16:49 | -39:20:47 | 19.26 | G | |
| Gaia19bac | 23:58:35 | -65:13:24 | 18.77 | G | |
| Gaia19bad | 15:37:08 | -32:29:35 | 18.82 | G | |
| Gaia19bae | 15:31:08 | -32:28:59 | 18.87 | G | |
| Gaia19baf | 16:41:13 | -56:23:07 | 18.25 | G | |
| Gaia19bag | 19:50:56 | -73:22:32 | 17.78 | G | |
| Gaia19bah | 16:39:47 | -61:46:01 | 16.13 | G | |
| Gaia19bai | 16:40:56 | -56:32:12 | 17.87 | G | |
| Gaia19baj | 15:11:29 | -24:37:43 | 17.9 | G | |
| Gaia19bak | 15:19:49 | -34:28:11 | 17.02 | G | |
| Gaia19baq | 16:34:46 | -70:01:12 | 17.72 | G | |
| Gaia19bar | 15:37:05 | -42:19:20 | 17.11 | G | |
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| Gaia19bfk | 14:17:57 | -45:16:02 | 16.08 | G | |
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| Gaia19bfw | 12:44:58 | -51:10:52 | 16.81 | G | |
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| Gaia19bkh | 21:53:22 | +03:04:44 | 18.23 | G | |

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| Gaia19bkm | 15:08:36 | -68:47:48 | 16.29 | G | |
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| Gaia19bmz | 19:25:14 | -52:11:38 | 16.85 | G | |
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| Gaia19bow | 23:49:22 | -17:40:29 | 17.55 | G | |
| Gaia19bqb | 12:23:18 | +19:43:23 | 18.81 | G | |
| Gaia19bqn | 12:22:56 | +15:49:34 | 15.81 | G | |
| Gaia19bqx | 22:05:36 | +26:32:28 | 18.96 | G | |
| Gaia19brl | 22:25:50 | +11:40:04 | 20.48 | G | |
| Gaia19brm | 23:31:05 | -02:25:30 | 20.21 | G | |
| Gaia19brs | 20:53:26 | +27:17:43 | 17.72 | G | |
| Gaia19bry | 19:45:54 | +29:43:40 | 18.22 | G | |
| Gaia19bsa | 20:35:16 | +22:18:55 | 17.36 | G | |
| Gaia19bsb | 22:33:26 | +04:39:15 | 17.27 | G | |

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| Gaia19bsg | 20:09:20 | +21:33:36 | 18.52 | G | |
| Gaia19bsh | 19:10:35 | +25:58:20 | 17.27 | G | |
| Gaia19bsi | 19:48:00 | +24:59:46 | 15.22 | G | |
| Gaia19bsm | 17:06:42 | +28:38:20 | 18.95 | G | |
| Gaia19bso | 12:42:07 | +18:10:25 | 18.78 | G | |
| Gaia19bsp | 22:00:49 | +02:34:30 | 18.44 | G | |
| Gaia19bsq | 19:59:03 | +18:18:07 | 18.57 | G | |
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| Gaia19bsw | 19:51:58 | +16:40:25 | 18.75 | G | |
| Gaia19bsy | 19:47:38 | +14:17:36 | 14.69 | G | |
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| Gaia19buj | 19:43:31 | +00:57:35 | 19.64 | G | |
| Gaia19buo | 23:01:15 | -26:57:42 | 17.05 | G | |
| Gaia19bus | 23:31:58 | -32:07:59 | 17.73 | G | |
| Gaia19buv | 23:57:04 | -35:07:26 | 18.54 | G | |
| Gaia19bux | 19:34:11 | -02:59:44 | 18.83 | G | |
| Gaia19buy | 19:03:15 | +01:20:28 | 16.23 | G | |
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| Gaia19bvt | 19:00:59 | -04:08:02 | 19.28 | G | |
| Gaia19bwd | 19:00:50 | -09:06:35 | 18.94 | G | |
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| Gaia19bwg | 18:45:05 | -04:02:17 | 18.09 | G | |
| Gaia19bwi | 18:42:53 | -03:27:35 | 18.61 | G | |
| Gaia19bwj | 21:59:59 | -47:51:59 | 18.56 | G | |
| Gaia19bwm | 18:57:06 | -08:00:18 | 19.9 | G | |
| Gaia19bwo | 23:18:49 | -54:13:19 | 19.5 | G | |
| Gaia19bws | 22:02:27 | -53:22:08 | 18.88 | G | |
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| Gaia19bxb | 19:01:51 | -10:50:54 | 16.84 | G | |
| Gaia19bxc | 17:31:58 | +27:09:36 | 19.28 | G | |
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| Gaia19bxu | 20:51:03 | -53:00:12 | 18.83 | G | |
| Gaia19bxv | 20:44:24 | -53:07:47 | 18.48 | G | |
| Gaia19bxy | 18:29:42 | +26:28:42 | 16.45 | G | |
| Gaia19bya | 18:31:19 | +19:49:30 | 18.24 | G | |

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| Gaia19byc | 18:41:01 | +16:09:29 | 17.03 | G | |
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| Gaia19ccs | 21:16:57 | +17:30:34 | 18.92 | G | |
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| Gaia19chq | 21:45:36 | -47:11:04 | 18.86 | G | |
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| Gaia19cih | 22:16:52 | -30:50:22 | 20.15 | G | |
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| Gaia19cim | 23:50:21 | +18:37:23 | 18.19 | G | |
| Gaia19cio | 22:24:16 | -29:24:22 | 15.95 | G | |
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| Gaia19czq | 19:30:55 | +29:59:53 | 18.94 | G | |

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| Gaia19dar | 23:54:24 | +26:36:38 | 18.1 | G | |
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| Gaia19dch | 19:04:24 | -78:50:37 | 18.91 | G | |
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| Gaia19dfy | 23:45:54 | -09:28:15 | 17.83 | G | |
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| Gaia19dgg | 12:39:55 | +19:40:20 | 18.42 | G | |
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| Gaia19dij | 15:14:39 | +22:39:35 | 18.6 | G | |
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| Gaia19djt | 12:32:25 | -10:27:59 | 18.19 | G | |

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| Gaia19dsd | 17:59:40 | -26:01:44 | 18.86 | G | |
| Gaia19dse | 18:04:52 | -24:25:27 | 20.5 | G | |
| Gaia19dsi | 16:15:29 | -53:10:09 | 18.83 | G | |
| Gaia19dsk | 18:54:23 | -08:37:47 | 17.01 | G | |
| Gaia19dsl | 17:54:22 | -29:17:18 | 17.56 | G | |
| Gaia19dsn | 17:43:17 | -33:49:44 | 18.03 | G | |
| Gaia19dso | 18:45:35 | -08:11:51 | 18.85 | G | |
| Gaia19dsp | 17:49:27 | -34:13:05 | 17.46 | G | |
| Gaia19dsr | 16:51:20 | -47:28:42 | 18.47 | G | |
| Gaia19dss | 19:04:08 | +02:08:33 | 20.02 | G | |
| Gaia19dst | 12:14:59 | -65:44:03 | 17.6 | G | |
| Gaia19dsu | 18:24:41 | -30:13:59 | 14.72 | G | |
| Gaia19dsx | 18:00:17 | -32:22:17 | 16.41 | G | |
| Gaia19dsy | 16:04:28 | -60:03:21 | 18.99 | G | |
| Gaia19dsz | 18:31:50 | -21:00:14 | 16.87 | G | |

| | | | | | |
|-----------|----------|-----------|-------|---|--|
| Gaia19dta | 19:42:25 | +18:18:39 | 19.88 | G | |
| Gaia19dtb | 13:28:35 | -69:18:03 | 16.53 | G | |
| Gaia19dtd | 18:11:58 | -29:55:23 | 15.83 | G | |
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| Gaia19dtg | 18:37:32 | -17:27:28 | 18.6 | G | |
| Gaia19dth | 18:30:18 | -22:21:39 | 18.22 | G | |
| Gaia19dtj | 18:46:23 | -22:26:41 | 17.98 | G | |
| Gaia19dtk | 18:41:43 | -28:29:01 | 18.45 | G | |
| Gaia19dtn | 19:19:07 | -01:10:54 | 18.63 | G | |
| Gaia19dts | 19:00:54 | -11:03:59 | 18.33 | G | |
| Gaia19dtx | 19:05:23 | -15:25:07 | 16.01 | G | |
| Gaia19dty | 18:43:22 | -23:41:11 | 18.69 | G | |
| Gaia19dub | 16:45:18 | -57:48:49 | 18.94 | G | |
| Gaia19dud | 17:26:30 | -49:21:52 | 18.26 | G | |
| Gaia19due | 15:43:48 | -67:43:36 | 18.87 | G | |
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| Gaia19duq | 13:01:32 | -67:21:56 | 19.16 | G | |
| Gaia19dur | 18:55:29 | -10:45:07 | 18.37 | G | |
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| Gaia19duv | 19:03:58 | -11:21:17 | 16.25 | G | |
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| Gaia19dvh | 19:17:26 | -48:28:58 | 17.73 | G | |
| Gaia19dvj | 19:18:43 | -65:30:45 | 18.33 | G | |
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| Gaia19dvr | 19:42:57 | -64:32:21 | 18.68 | G | |
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| Gaia19dvu | 19:22:34 | +27:32:01 | 16.69 | G | |
| Gaia19dvx | 19:29:59 | -52:42:57 | 19.0 | G | |
| Gaia19dvz | 22:01:53 | -78:48:07 | 18.73 | G | |
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| Gaia19dwg | 19:12:53 | -41:25:30 | 15.07 | G | |
| Gaia19dwp | 19:24:39 | -06:06:48 | 18.88 | G | |
| Gaia19dwq | 19:21:07 | -02:26:04 | 18.71 | G | |
| Gaia19dws | 21:56:15 | -70:28:09 | 18.98 | G | |
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| Gaia19dwx | 19:26:22 | -13:30:26 | 18.01 | G | |
| Gaia19dwz | 19:12:35 | +11:54:48 | 15.62 | G | |

22. Descreva o andamento do(s) projeto(s) fornecendo resultados preliminares de missões anteriores ainda não publicados (este item é particularmente importante para projetos de longa duração). A sua descrição deverá dar subsídios para que a CP possa avaliar o desempenho do(s) projeto(s) tendo em vista o número de noites obtidas até agora. As publicações serão utilizadas na avaliação e para tanto devem ser comunicadas (www.lna.br/infoPublicacao.php). Não é necessário incluir aqui os artigos publicados.

This is the second time that this group requests for observing time at OPD. The first time was for a training night on the IAG 60cm which was lost due to clouds.

23. Referências Bibliográficas. Espaço destinado a colocação das citações utilizadas para elaboração da proposta (itens 14 a 22).

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