Implications of CAHA in GAIA

CSIC
JUNTA DE ANDALUCIA
RIA
RED DE INFRAESTRUCTURAS DE ASTRONOMIA
GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

The talk in nutshell

- Current status of Calar Alto observatory
- Highlights in 2019. Current legacy programs and instrumental developments.
- GAIA-CAHA interaction.
- Public survey and new instrumentation for Calar Alto observatory in 2020.

Calar Alto in 2019

- 10-12-18, the CAHA member assembly met in Madrid to agree:
  - The withdrawal of the MPG as CAHA partner
  - The consent for the inclusion of Junta de Andalucia

- 20-05-19, MPG transferred the CAHA participation to Junta at the notary

- 20-12-19, the new member assembly of CAHA met again to:
  - Formalize the new member assembly
  - Formalize the incorporation of the new partnership.

Calar Alto in 2019

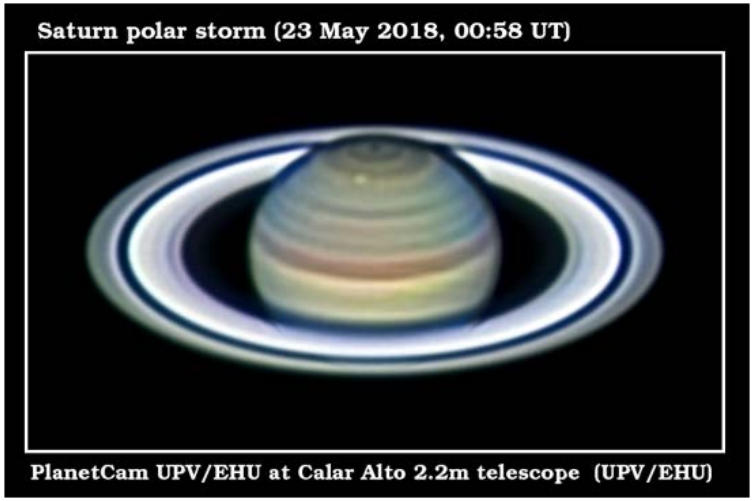
- During all this time, new legal statutes were being negotiated:
  - CAHA will continue with a similar structure
  - CAHA will be considered as General Administration

- Lack of executive committee, which is absolutely necessary to take high level decisions.

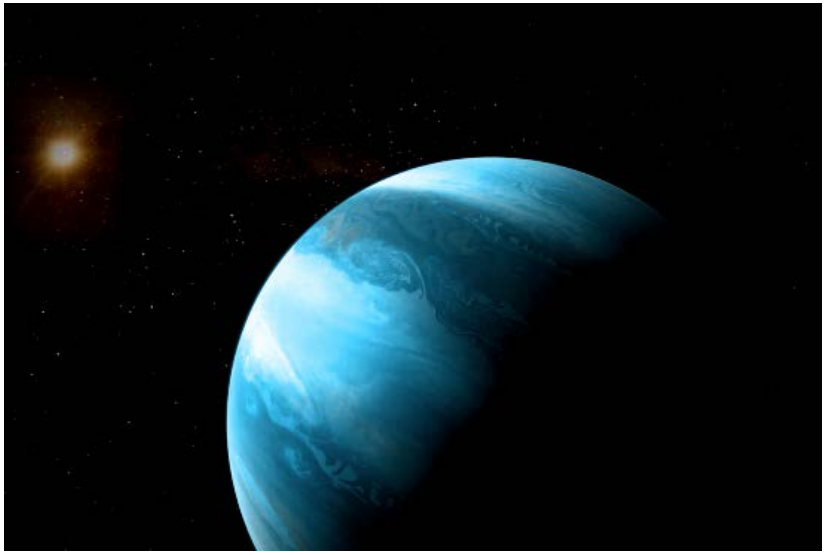
- Fortunately, the management positions are already identified and will be named shortly.

Highlights in 2019

Highlights 2019



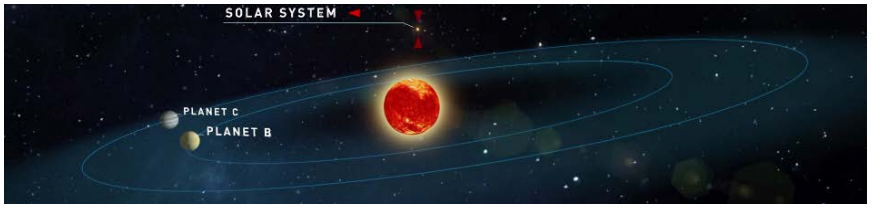
Saturn in 2018: a stormy year. Lavega et al. 2019. Nature Astronomy 2019.



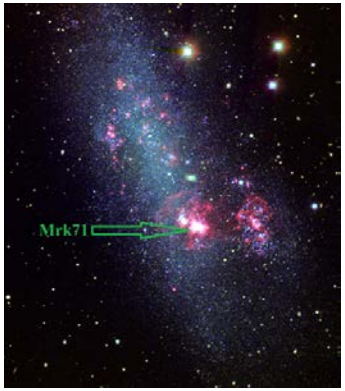
CARMENES finds an anomalous planetary system that challenges our understanding of how planets form J. C. Morales et al 2019 Science.

Highlights 2019

Space- and ground-based observations reveal a planetary trio around a nearby star. R. Luque et al. 2019 A&A.



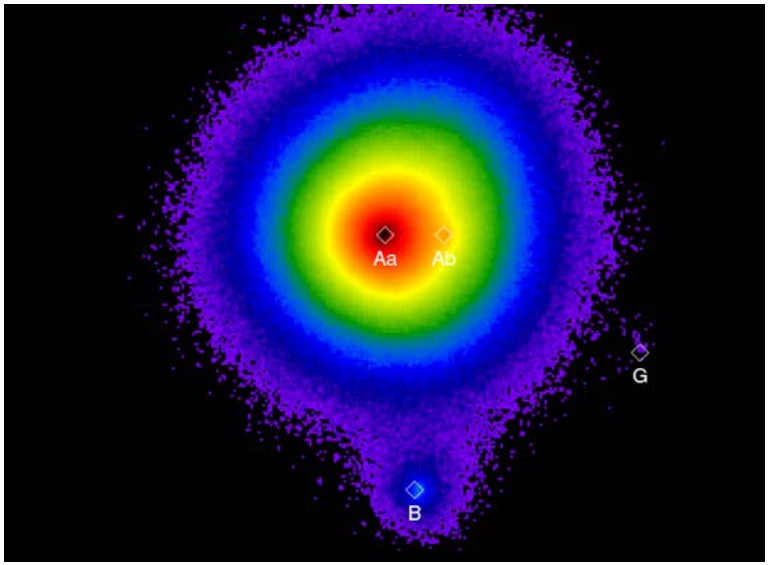
CARMENES finds two temperate terrestrial planets around Teegarden´s star, a small nearby star. Zechmeister et al. 2019 A&A.



A nearby green pea galaxy, analog to the first galaxies, shows how the young Universe became illuminated. Micheva et al. 2019 A&A.

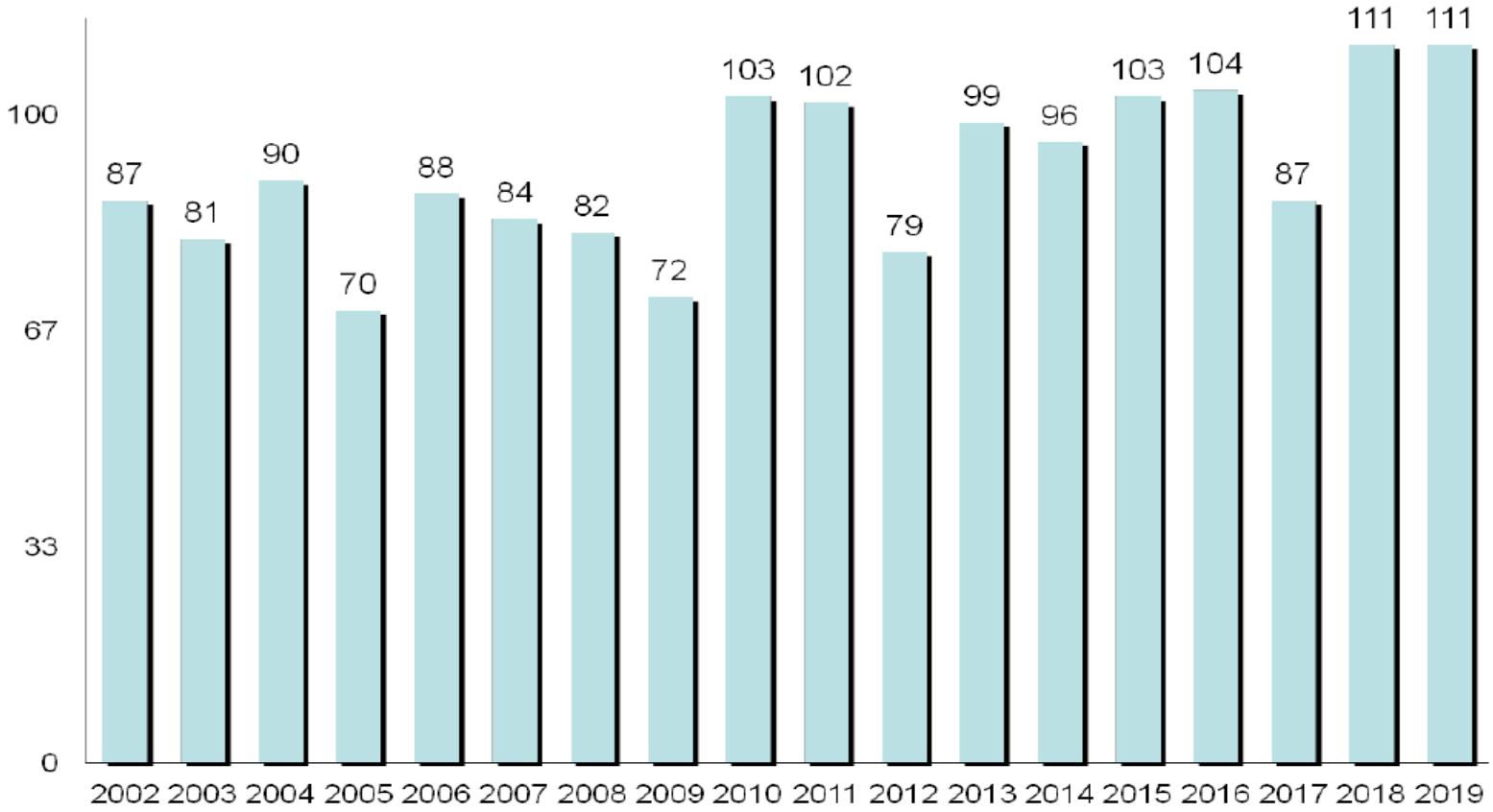
Highlights 2019

Galaxies co-rotate with their moving neighbors. J. H. Lee et al. *"Galaxy Rotation Coherent with the Motions of Neighbors: Discovery of Observational Evidence". AP. J. 2019*

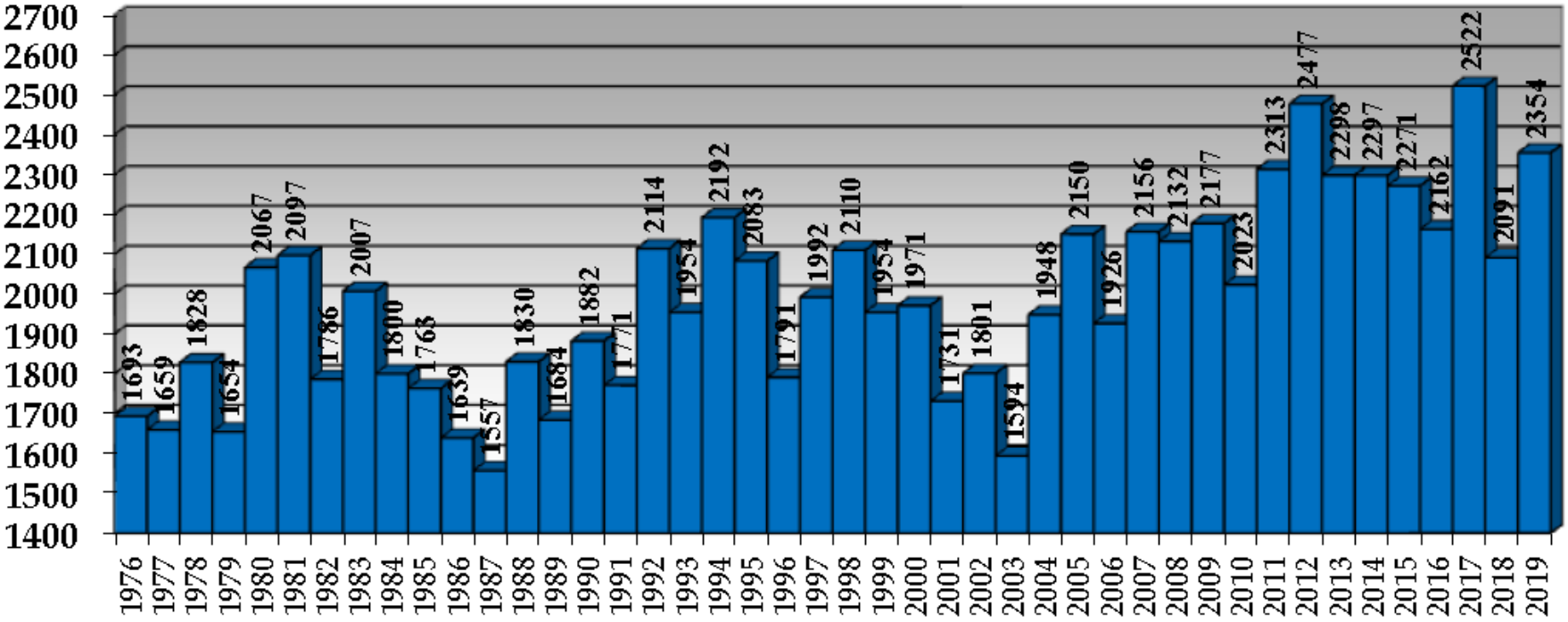


Massive stars prefer high-order multiplicity over binarity. Maíz-Apellániz et al. *Astronomy & Astrophysics,* 626, June 2019.

Scientific productivity

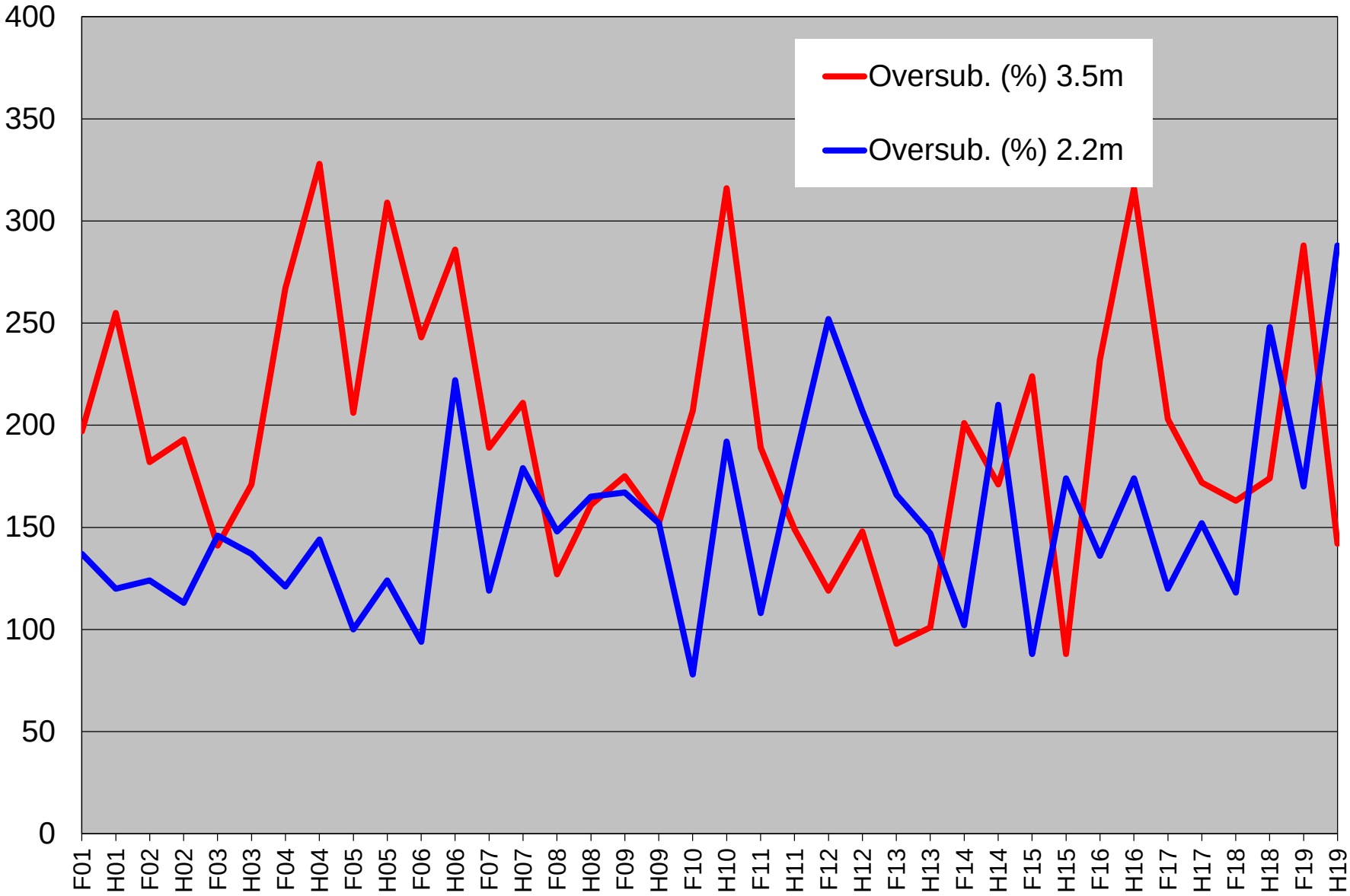


Long term weather statistics

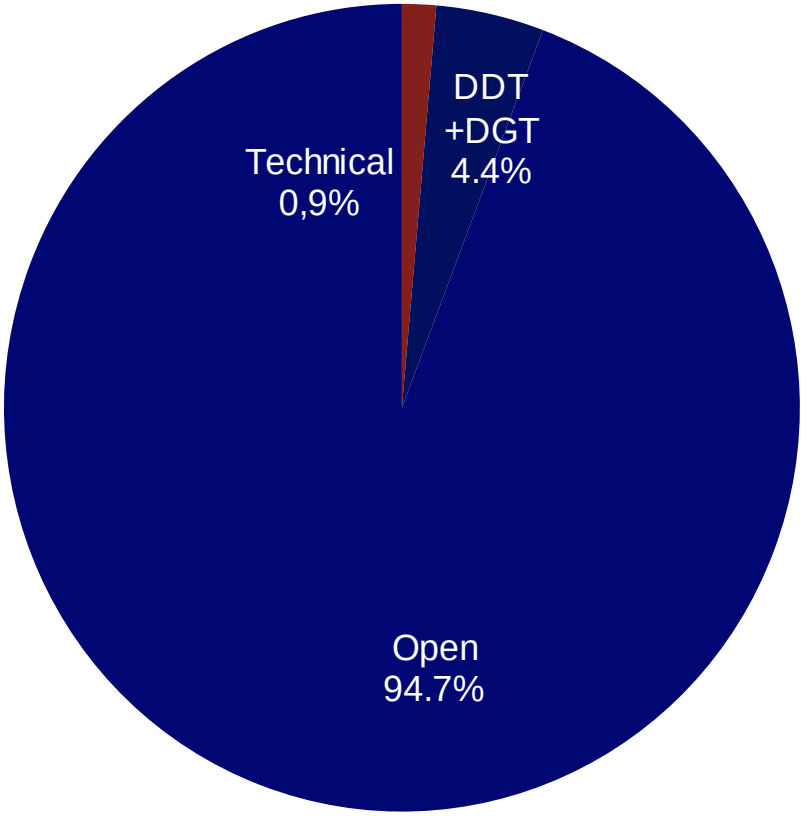


- Total observed hours

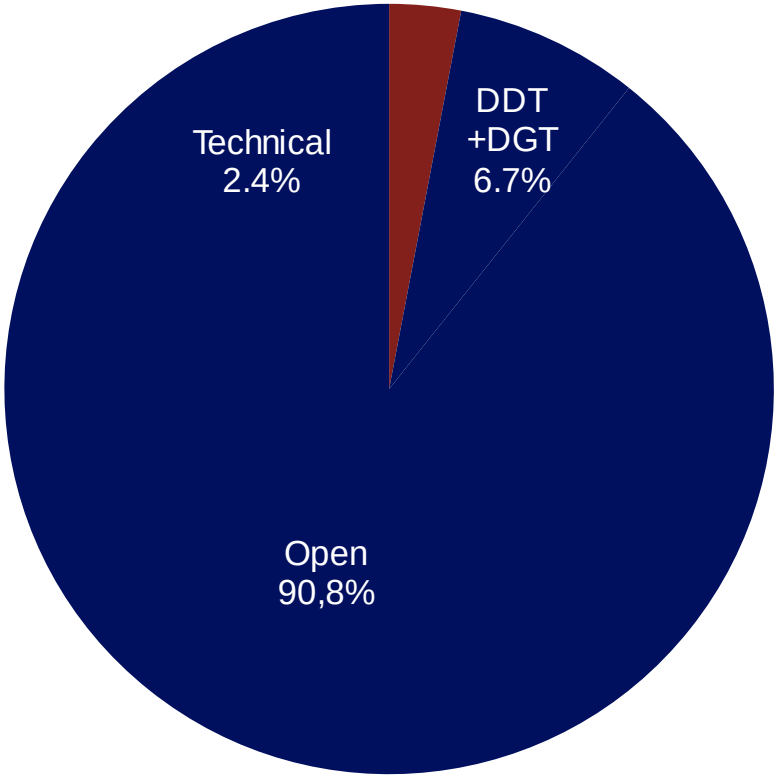
Oversubscription factor



Technical time lost 2019



Science 3.5m : 99.1%



Science 2.2m: 97,5%

Contribution of CAHA to GAIA

GAIA – CAHA interaction

- GAIA, the most exhaustive 3D map of milky way. Recording velocities and distances of about 1 billion of stars

- To become a reality, a lot of previous work needed -> Contribution of CAFOS@2.2m telescope + IAA, grain of sand:
  - Determination of zero point, in collaboration with other facilities, during 5 years. 2009-2013.

- *Paper:* Carrasco, J. M. et al. (2016), 2016A&A...595A...7C, "Gaia Data Release 1. Principles of the photometric calibration of the G band". An example of synergy with the **space mission Gaia**. This paper describes the calibration model of the Gaia photometric passband for Gaia Data Release 1, in which Calar Alto data played a significant role.

GAIA – CAHA interaction

- During the mission
  - Alerts (ToO mode):
    - Transients (novae, supernovae)– SN Gaia14aaa May-2015 O2000
    - Variable sources (galactic & extragalactic)
    - Astrometry of Solar System small bodies

GAIA- CAHA interaction

During the mission and later: additional and complementary science:

Observations to complement GAIA data or new targets discovered

Planetary transits

Following the model provided by *Hipparcos*:

- HD209458 Castellano et al. (2000) AJ 532(1) L51-L53
- HD189733 Hébrad & Lecavelier des Etangs (2006) A&A 445 341-346
- HD209458 Robichon & Arenou (2000) A&A 355 295-298

Astron. Astrophys. 355, 295–298 (2000)

ASTRONOMY AND ASTROPHYSICS

HD 209458 planetary transits from Hipparcos photometry⋆

N. Robichon and F. Arenou

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Received 1 December 1999 / Accepted 7 December 1999

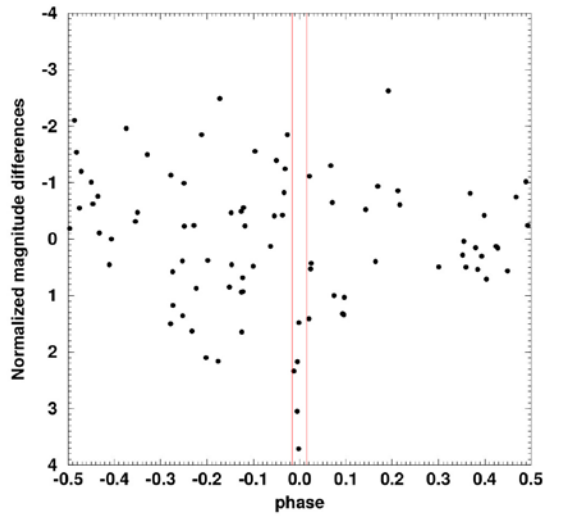


Fig. 3. Normalised magnitude residuals (formal error = 1) versus phase, using T_{c0} from Torres (1999) and the period obtained in Sect. 3. The transit duration is indicated.

Systematic search in photometric series → Defining candidates and their parameters → Photometric and spectroscopic campaigns

Dzigan & Zucker (2013) MNRAS 428 3641-3647

GAIA-CAHA interaction

During the mission and later: additional and complementary science

- Follow-up of variable sources
  - In detail characterization of variable sources discovered by *Gaia* (classification, period, other physical properties) with ground-based observations
- Additional and complementary spectroscopy
  - Radial velocities
  - Other physical parameters
  - With the existing observational resources
- **Calar Alto is open to new ideas and proposals**

Legacy programs and current instrumental developments

CARMENES Status

- Strategic program. To be in operation for the next decade.
- International collaboration with 13 institutions, more than 130 scientific and technical staff.
- 39 referred publications up to now (mostly happened in the last year)
- 24 presentations in SPIE.
- 13 phD Thesis.
- Collaboration with NASA-MIT TESS. 50 nights allocated. First alerts received.
- More than 678 nights invested since 2016 (~72 pending nights,1 more semester).

Agreement with Beijing University

Reverberation mapping survey of AGNs w/ CAFOS@2.2

Measurement of Black Hole Mass

Coevolution of Supermassive Black Hole and Host Galaxy

High-redshift Quasars and Cosmic Reionization

Central Engine of AGN

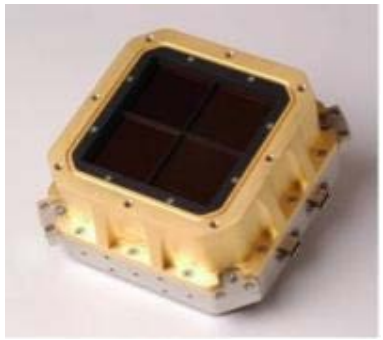
Current developments

- CAFÉ upgrade:
  - ERDF (FEDER funds):

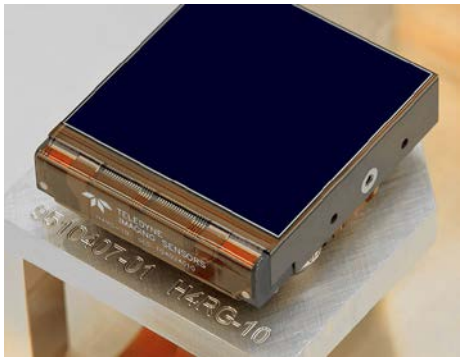
    - CAHA-15-3902, ICTS-2017-07-CAHA-4, CAHA-16-CE-3978
  - Grating substitution. 14th magnitude
  - Thermal room stabilization (±0.01C)
  - New Pipeline (J.L. Box)
  - RV accuracy of about 10m/s.
  - Fabry-Perot calibration unit (under progress)
  - Second phase, a vacuum chamber is foreseen. (Expected RV accuracy of about 2-5m/s).

Current developments

- PANIC Upgrade:
  - ERDF CAHA-15-3902. 1Mill. of euros.
  - Collaboration with MPIA, IAA and AIP.



4x Hawaii-2RG,
Total 4096x4096 pixel
Gap of 167 pixeles
FoV 30x30 arc-minutes



1x Hawaii-4RG-15
Total 4096x4096 pixel
NO gap
FoV 27x27 arc-minutes

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Current developments

- PANIC Upgrade:
  - September 2019 reception of the detector and deliver to Heidelberg.
  - Already integrated into PANIC, connection tests ongoing.
  - Cooling down and tests by end of January in 2020
  - Expected commissioning in June-July 2020.

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Current developments

- Upgrade of the virtualization system of the campus (CAHA-15-3902)
- Implementation of the Energetic island:
  - ICTS-2017-07-CAHA-4
  - CAHA-16-CE-3978
  - Phases:
    - Acquisition of electric cars (completed).
    - Biomass boiler of 750kW (public tender under evaluation, expected conclusion in summer 2020)
    - Photoelectric plant of 350kW (public tender under evaluation, expected conclusion in summer 2020)
  - Expected save of CO2 emission in 157 tons/years
  - Expected energetic optimization in 40%.
  - World-wide reference for other observatories.

Public survey and new instrumentation for Calar Alto observatory in 2020

CAHA strategic plan

- CAHA strategic plan:
  - Renewed 2017-2020 (ICTS nature)
  - Positively evaluated by CAIS (Comité asesor de infraestructuras singulares):
  - Priorities:
    - New instrument for the 3.5/2.2m telescope
    - Upgrade of CARMENES.
  - Possibility to get ERDF to partially fund the new instrument…. Must be committed during 2020 and excuted before June 2023.

Workshop 2020

Goals:

1. Public surveys to be carried out with instrumentation already available at the 3.5m telescope

2. Public surveys to be carried out with new instruments at the 2.2m and 3.5m telescopes.

3. Make an official call for new legacies and instrumental programs

4. To perform a recommendation to EC for execution.

Workshop 2020. Case 1

Requirements Case 1:

- Minimum of 20 nights per semester for completion.
- Minimum of four semesters.
- May use others CAHA telescopes and external ones.
- Non-partners may apply but always in close collaboration with a CSIC-Junta institution. (Co-Pi role).

Workshop 2020. Case 2

Requirements Case 2:

- Impossibility to be done with the current instrumentation.
- Up to two feasibility studies (FS) will be funded by CAHA. (180.000€ for FS)
- Non-partners may apply but always in close collaboration with a CSIC-Junta institution.(Co-Pi role)

Workshop 2020

- Important dates 2020:
  - First announcement Nov-2019
  - Second announcement Jan 9th
  - Deadline for proposals Feb 14th, 23:59:59
  - Scientific program Feb 28th
  - March 12-13, 2020 IAA-CSIC
  - April-2020 evaluation of proposals (tentative)
  - Call for standard proposals March 23- April 22.
  - Immediate EC resolution
  - 6 months for feasibility study (tentative)

WEB links

Register at:

- http://www.caha.es

Straight link:

- http://riastronomia.es/en/public-surveys-and-new-instrumentation-for-calar-alto-observatory/

- Email address: workshop@caha.es