

IAU Division C Working Group on Star Names 2020 Annual Report

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The IAU Division C Working Group on Star Names (WGSN) consists of an international group of astronomers with expertise in stellar astronomy, astronomical history, and cultural astronomy who research and catalog proper names for stars for use by the international astronomical community, and also to aid the recognition and preservation of intangible astronomical heritage. The Terms of Reference and membership for WG Star Names (WGSN) are provided at the IAU website: https://www.iau.org/science/scientific_bodies/working_groups/280/. This annual report covers activities over 2020 and early 2021.

1. Etymologies

One of the tasks agreed upon at the 2018 WGSN business meeting in Vienna and in our triennial Terms of Reference was “*to add etymological information to the IAU Catalog of Star Names in the interests of further preserving astronomical heritage.*” We provide an update on these efforts here. The etymologies of star names are sometimes controversial, sometimes unknown, and sometimes in error or unstated in popular references (e.g. Allen 1899, 1963). Doris Vickers (classical philologist) is leading the effort to trace etymologies, and checked the information in Allen (1899) and Kunitzsch (1959) against original sources, where available and researched and added missing etymologies. The result is a statistical survey on the current distribution of origins of the 449 star names adopted by WGSN for the IAU (https://www.iau.org/public/themes/naming_stars/). Note that this list includes the names adopted from the two IAU NameExoWorlds public naming campaigns (2015, 2019). The etymological information, which will eventually be published on the IAU website, includes: language, period of first use and its source text, information on whether it's a translation of a previous name in a different language (e.g. Latin from Greek), and references for further reading or information.

For this preliminary report, we use period labels that roughly follow Kunitzsch & Smart (2006) and extend the range towards earlier and later epochs. This results in the following categories:

ancient = before 500 CE
medieval = 500 CE to 1500 CE

Renaissance = 1500 CE to 1800 CE
 recent = 1800 CE to 2000 CE
 modern = since 2000 CE

For the 199 Arabic star names, we follow Kunitzsch & Smart (2006) and mark star names as "ind-A" (indigenous Arabic) for those from the period between 500-700CE. For those from after the foundation of Baghdad (762 CE), the Arabic-Islamic culture superseded the previous culture and stars named from this period onwards are marked "sci-A" (scientific-Arabic; because it was in this period that the sciences developed). Note that "Renaissance" is generously defined as "encompassing the Renaissance period and the subsequent centuries, from approximately 1500 A.D. to 1800 A.D.", i.e. covering most of the "Early modern period."

Among the assigned Chinese names, there are names of lunar mansions that are attested since the -2nd millennium: Preserving the knowledge of obsolete or currently not official indigenous constellation/asterism names is one of the goals of the WGSN. Other Chinese star names can be traced back to the ancient epoch (which doesn't exclude the possibility that they are even older) and labeled "ancient". This equals the Chinese Han dynasties (roughly -200 to +200, contemporary with the time slot from Hipparchus to Ptolemy), cf. Sun and Kistemaker (1997). At least three of the Chinese names do not have a commonly known origin. The history of the Chinese star names has to be studied in more detail in order to find their real origin: translation of the Suzhou map by Rufus & Tien (1945), study on star and constellations names in the Han by Sun & Kistemaker (1997), a very detailed study of the development from early roots on with archaeological as well as philological studies in the 3rd/2nd millennium by Pankenier (2013), and the overview tables in the appendices of the books on astronomical texts in chronicles by Xu, Pankenier and Jiang (2002) and Pankenier, Xu and Jiang (2008). On this basis, Susanne M Hoffmann added some time stamps to Doris Vicker's etymological study and made a statistical survey of the historical epoch of the names' origins.

The preliminary result of the statistics (as far as could be determined by March 2021) is summarized in this table: Not all 449 stars could be counted here as some are undetermined. Furthermore, some are out of the scale for the reasons explained below.

		Arabic	Chinese	Unknown	All other	Total	%
<i>-2nd millennium</i>			3		4	7	2.1
<i>early -1st millennium</i>					1	1	0.3
<i>ancient</i>	-500 to +500	11	5		34	50	14.8
<i>medieval</i>	+500 to 1500	37				37	11.0
<i>Renaissance</i>	1500 to 1800	113		1	4	118	35.0
<i>recent</i>	later than 1800	13		5	6	24	7.1

<i>Out of time scale: Indigenous</i>				11	11	3.3
<i>Out of time scale: NameExoWorlds</i>				127	127	37.7

There are some star names that could not be dated, e.g. for many of the indigenous names it is not clear for how long the name has been in use. These cultural names are considered out of the time scale and labeled “Indigenous”. In contrast, there are some star names that have been applied later in the NameExoWorlds campaigns. Both categories did not systematically evolve as star names and are, therefore, beyond the scope of the timescale study. For studying the languages, the names of the “NameExoWorlds” campaigns do not count towards the respective languages but are excluded from the statistic and their own category.

Using Allen (1899), Kunitzsch (1959), and further sources available, Doris Vickers also tracked the original languages:

Language	No.	% of 449
Aboriginal	6	1.3
Arabic	199	44.3
Babylonian	1	0.2
Chinese	11	2.4
Coptic	3	0.7
Corrupted Names	7	1.6
English	2	0.4
Graeco-Latin (Latin translated from Greek)	4	0.9
Greek	22	4.9
Greek with Arabic prefix	1	0.2
Hawaiian	1	0.2
IAU WGSN	4	0.9
Italian	1	0.2
Khoikhoi	1	0.2
Latin	29	6.5
Latin + unknown	1	0.2

Constructed	5	1.1
Mursi	1	0.2
IAU NameExoWorlds *	127	28.3
Persian	5	1.1
Polynesian	1	0.2
Sanskrit	3	0.7
Sumerian	1	0.2
Tahitian	1	0.2
Turkish	1	0.2
unknown	10	2.2
Yucatec Maya	1	0.2
Total	449	

*) The “Name ExoWorlds” campaign of the IAU 2015 and 2019/20 will be explained below.

The whole study will be made available in an Excel spreadsheet that shall be published on the IAU website later (https://www.iau.org/public/themes/naming_stars/).

These statistics show clearly that Arabic star names (44%) outnumber all other cultural names. Latin (7%), Greek (5%), and Chinese (2.4%) are the next highest numbers. In the interests of diversifying the pool of star names adopted by the IAU WGSN (outside of the NameExoWorlds campaigns, i.e. drawing from literature), we should therefore focus more attention outside of the Arabic and Greco-Latin sky culture. Indigenous and pre-ancient roots of the ancient names for stars and constellations are clearly underrepresented.

2 Exploring further sky cultures

Besides research etymologies, the WGSN also agreed in its Terms of Reference “*to continue an exhaustive search of star names from the cultural astronomy literature*” and “*to construct a new supporting list or name bank of names for stars and associated asterisms which is culturally and geographically diverse.*” Here we summarize WGSN activities over the past year. While the WGSN has slowly grown since being first formulated in 2016, it is obvious that more expertise is needed in order to further diversify the pool of astronomical traditions surveyed for the WGSN’s activities on behalf of the IAU. We encourage experts to reach out to the WGSN (IAUWGSN@gmail.com) and contact the WG’s members.

Clive Ruggles has been working with John Mahelona on a third edition of *Nā Inoa Hōkū: Hawaiian and Pacific Star Names* by Johnson, Mahelona and Ruggles, due for publication in

2022. As well as including updates to the existing Hawaiian and Polynesian star name catalogues following new source material research, this edition will include a catalogue of wider Austronesian star names, many of which were included in the original 1975 publication but were omitted from the second edition. This new edition also benefits from the work of additional contributing authors from within the relevant regions. Courtesy of Duane Hamacher, who is also involved in the project, the new edition will feature on-line materials that link to a developing digital catalogue of Australian Aboriginal star names.

Danielle Adams (arabist) studied the etymology of Arabic star names, and wrote a book chapter entitled "Early Islamic Encounters with the Rains Stars of pre-Islamic Arabian Astronomy" in Routledge's 2021 *Intersections of Religion and Astronomy*¹. She recently began writing her first monograph on Arabian astronomy, and she gave several virtual presentations on Arabian astronomy, including one for the Grand Canyon Star Party².

B.S. Shylaja (cultural astronomer) is continuing her research on Indian star names (see also: WGSN 2019 annual report). In 2020, she co-authored a paper with R. Veneketeswara Pai ("*From Nadyantaka to Pauṣṇa: Compilation of stars catalogued in Sarvasiddhāntarāja*") that proposes new star name identifications in the remarkable 17th century Indian astronomical treatise *Sarvasiddhāntarāja* by Nityānanda. The study shows star names of Indian origin hitherto unknown.

Susanne M Hoffmann (historian of science) pursues the investigation of transfer and transformation of Babylonian names for all types of asterisms (stars, constellations, alignments) to the Greco-Roman ones. Her interdisciplinary studies resulted in several publications on Babylonian constellations and a strong paper on the earliest Babylonian compendium MUL.APIN together with the assyriologist: Hoffmann S. and Krebernik M, *What Do Deities Tell us about the Celestial Positioning System?* (2020). In 2021 she joined the interdisciplinary research group of Wayne Horowitz (assyriology, archaeology and Greek language) and finalized a book on these transfers and transformations resulting in the insight that many names have never been canonical. They always changed from time to time and varied between geographical regions - in some cases from one city to another.

Doris Vickers is researching Latin star names and their history until the early modern period, especially in star catalogues and star maps.

Steven Gullberg (cultural astronomer) originally intended to contribute Babylonian star names but left the field to other experts and now aims to contribute Inka star names. Recently, he has been working on Incan cultural astronomy and published a paper with Alejandro Martín Lopez,

¹<https://www.routledge.com/Intersections-of-Religion-and-Astronomy/Corbally-Dinell-Ricker/p/book/9780367369460>

² <https://www.nps.gov/grca/planyourvisit/grand-canyon-star-party.htm>

Javier Mejuto, Duane Hamacher and others (Gullberg et al. 2020)³ on 'dark constellations', i.e. the regions of the sky notably lacking in naked eye stars (usually demarking dark molecular clouds of high interstellar extinction). Now, he intends to investigate further sources. In South America, especially in Argentina, at the University of La Plata and the University of Buenos Aires, extensive research has been carried out on the celestial cultures of the aboriginal groups of the Chaco for several decades. In particular, Alejandro Martín López (cultural astronomer), a member of the WG, during 2020 has published a paper (López 2020)⁴ where he discusses issues regarding dark asterisms and areas of diffuse brightness and the role of contrast.

WGSN chair Eric Mamajek led the effort to incorporate the IAU100 NameExoWorlds stars into the IAU's catalog of star names on the website⁵. The final results of the IAU100 NameExoWorlds campaign was described in the 2019 WGSN annual report⁶. In early 2020 the chair and members of the IAU100 NameExoWorlds campaign wrote a paper for the IAU CAP Journal on the campaign (Mamajek et al. 2020).

There are roughly 40 (a continuously increasing number) historical and ethnographical sky cultures in *Stellarium* (Zotti et al. 2021). This software is open source and everybody can contribute. This opportunity is frequently used by several scholars and the software provides a correctly reconstructed Arabic, Greek (Almagest), Babylonian (MUL.APIN), historical European (Belarussian, Macedonian, Norse, Romanian, Sami, Sardinian), Hawaiian, Polynesian (Tongan, Vanuatu), Indian (Vedic), Mongolian, Siberian, Australian (Boorong, Kamilaroi/ Euahlayi), Chinese (Suzhou, Song, Korean, Japanese, Contemporary Chinese) and American (Inuit, Aztec, Maya, Navajo, Northern Andes, Ojibwe, Tukano, Tupi-Guarani) sky culture.

All these sky cultures with names of stars and constellations have been contributed to the software. It would be better to have an independent database of these sky cultures where all researchers can contribute as soon as they finish a work or publish a paper and to link this database to *Stellarium*. *Stellarium* has parts formerly developed for the ESO, and other parts that are currently developed for purposes in archaeology, and is currently a sparetime project of a few developers. Due to its open character it is a wonderful platform of interdisciplinary and transdisciplinary collaborations. (e.g. Susanne M Hoffmann and Steven and Jessica Gullberg are currently working on the improvement of the Stellarium sky cultures by depictions of

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https://www.academia.edu/44099229/A_CULTURAL_COMPARISON_OF_THE_DARK_CONSTELLATIONS_IN_THE_MILKY_WAY

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https://www.academia.edu/43139526/PROBLEMATIZANDO_EL_CONCEPTO_DE_OBSERVACION_ASTRONOMICICA_Reflexiones_metodologicas_a_partir_de_la_experiencia_etnografica_entre_los_moqoit_del_Chaco

⁵ https://www.iau.org/public/themes/naming_stars/

⁶ https://www.iau.org/static/science/scientific_bodies/working_groups/280/wg-starnames-annual-report-2019.pdf

constellations instead of only stick figures. Susanne M Hoffmann is also a member of the developer team.)

The IAU WGSN should aim to further develop a database of star and asterism names with etymological information, while Stellarium could provide the frontend to display the work of the researchers. These two components shall play with one another: It would be good to have the historically correct sky cultures immediately in the IAU-database to be as soon as they are contributed to Stellarium. Additionally, it would be good to have Stellarium visualizing the star names as soon as they are approved by the IAU.

An online form has been added to the WGSN site (<http://www.pas.rochester.edu/~emamajek/WGSN/index.html>) to allow researchers and the public to submit new information on historical/cultural names of stars and asterisms to the attention of the WG.

Note that besides the IAU100 NameExoWorlds names, no additional names were added to the list of IAU-approved star names posted at https://www.iau.org/public/themes/naming_stars/ during 2020.

WGSN members were saddened to learn of the passing of Prof. Paul Kunitzsch (1930-2020) during this past year, who was a leading historian of medieval astronomy and prolific author of many works relevant to the history of star names and the *Almagest*.

Eric Mamajek, Chair
on behalf of the WG Star Names
Pasadena, CA, USA
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