Comparative h- and m-indices for Fifteen Ground- and Space-Based Observatories

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Introduction & Methodology

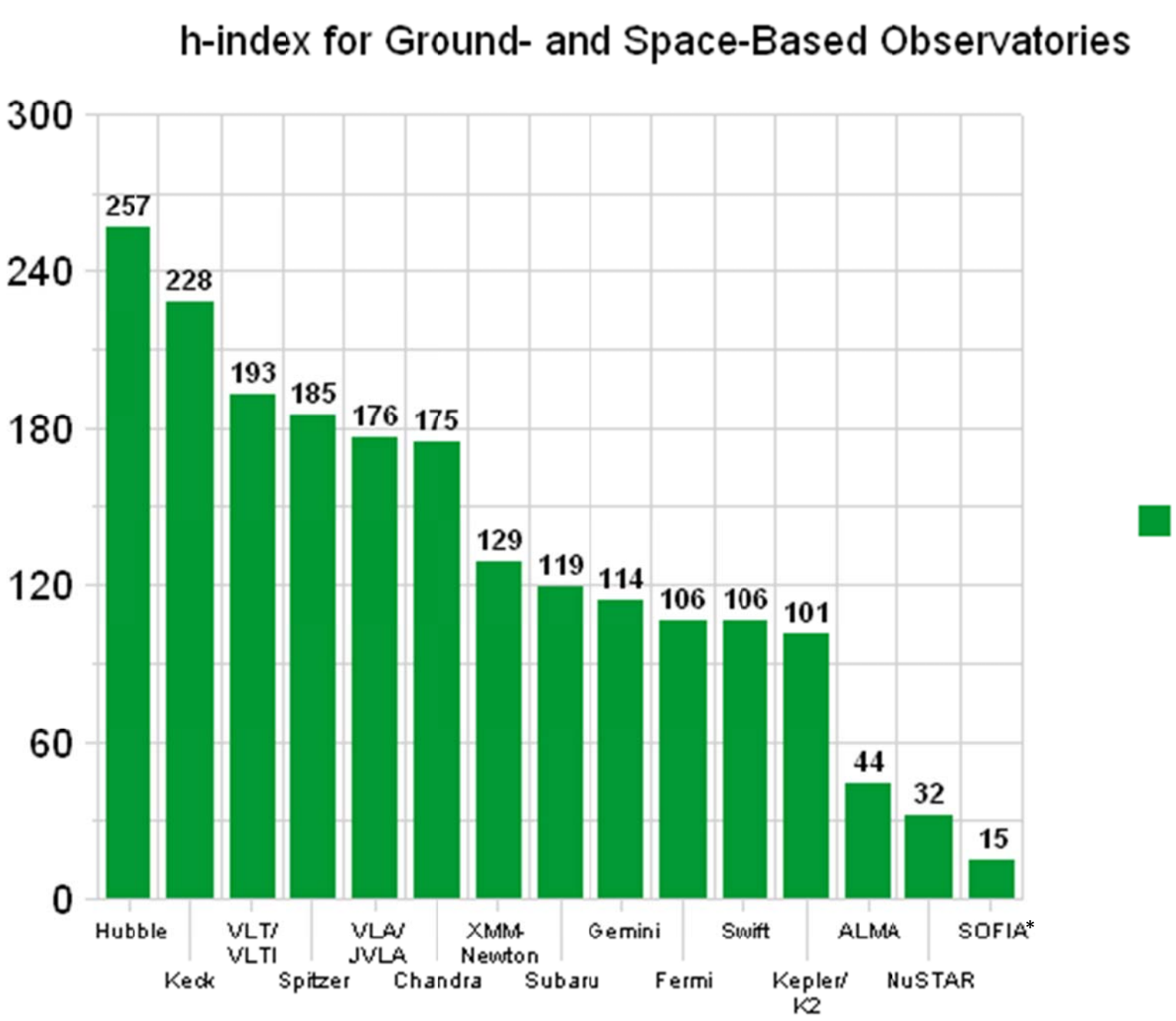
This report provides a comparison of fifteen ground-based and space-based observatories. As an accepted standard measure, the h-index was used to provide a comparison of scientific productivity. For further information on how the h-index is calculated, refer to the original Hirsch publication (2005). To normalize the results for telescopes that have been in operation for varying lengths of time, the m-index was also determined (Grothkopf & Stevens-Rayburn 2007). For the purposes of this paper, the m-index was calculated by dividing the h-index by the number of years since the first scientific paper was published using observational data. For consistency, m-index values where based on calculations through 2016.

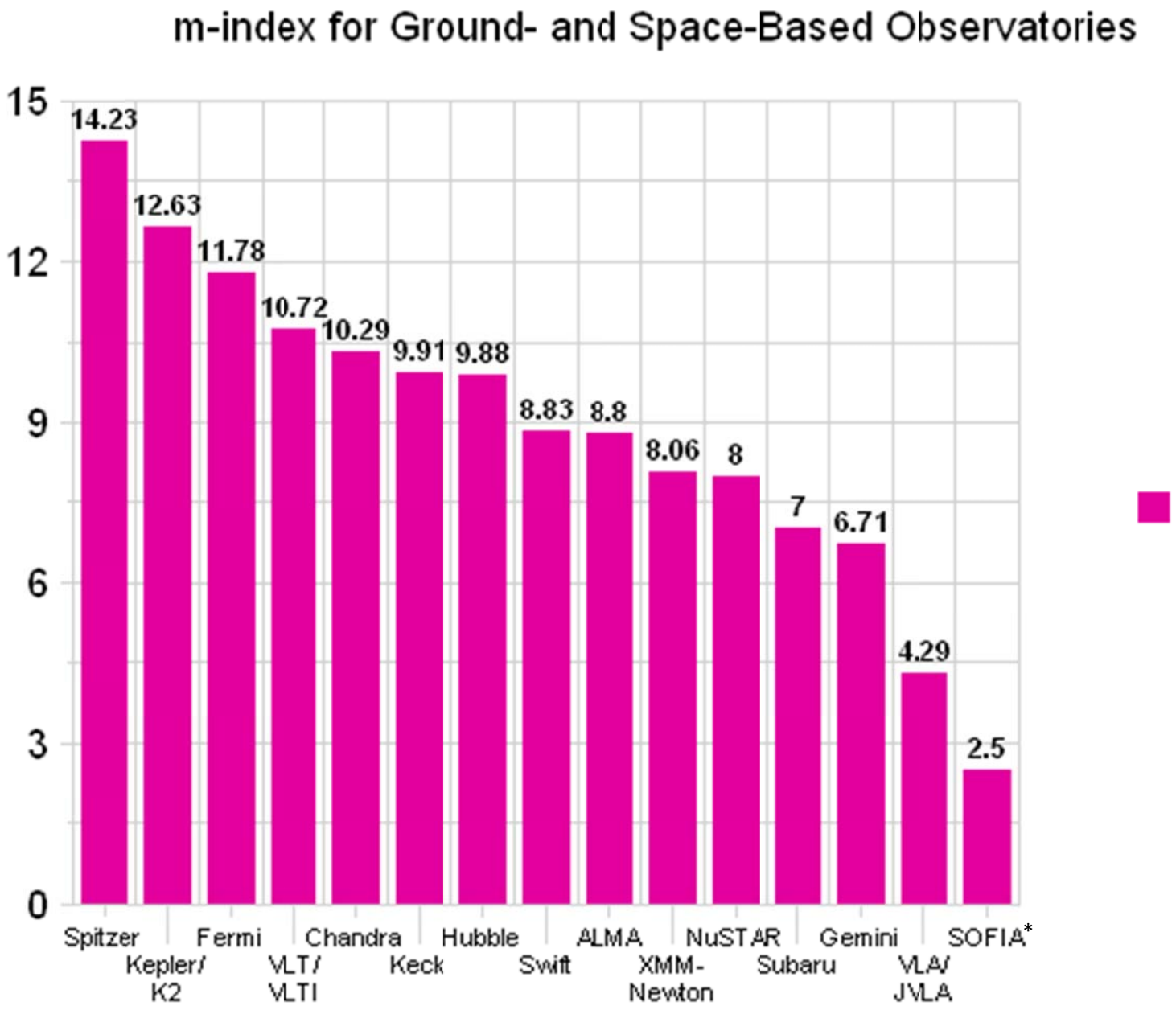
Every effort was made to provide a normalized comparison. The h-index and m-index are just two of many measures available for benchmarking scientific productivity. Other methodologies include the g-index (Egghe 2006) and the hg-index (Alonso et al. 2010).

The h-index and m-index values provided must be taken in context. H-index citation counts do not factor in the total number of observing hours for each telescope/observatory, the share of data used in papers that analyze data sets from two or more observatories (Grothkopf et al. 2015), or the size of the community with access to observation time. Other bibliographers may calculate the indices in a different manner using the same data. Both the h-index and m-index are subject to change. Whereas an h-index can only increase over time as citations accrue, the m-index can increase or decrease depending on the continued productivity of the observatory/telescope.

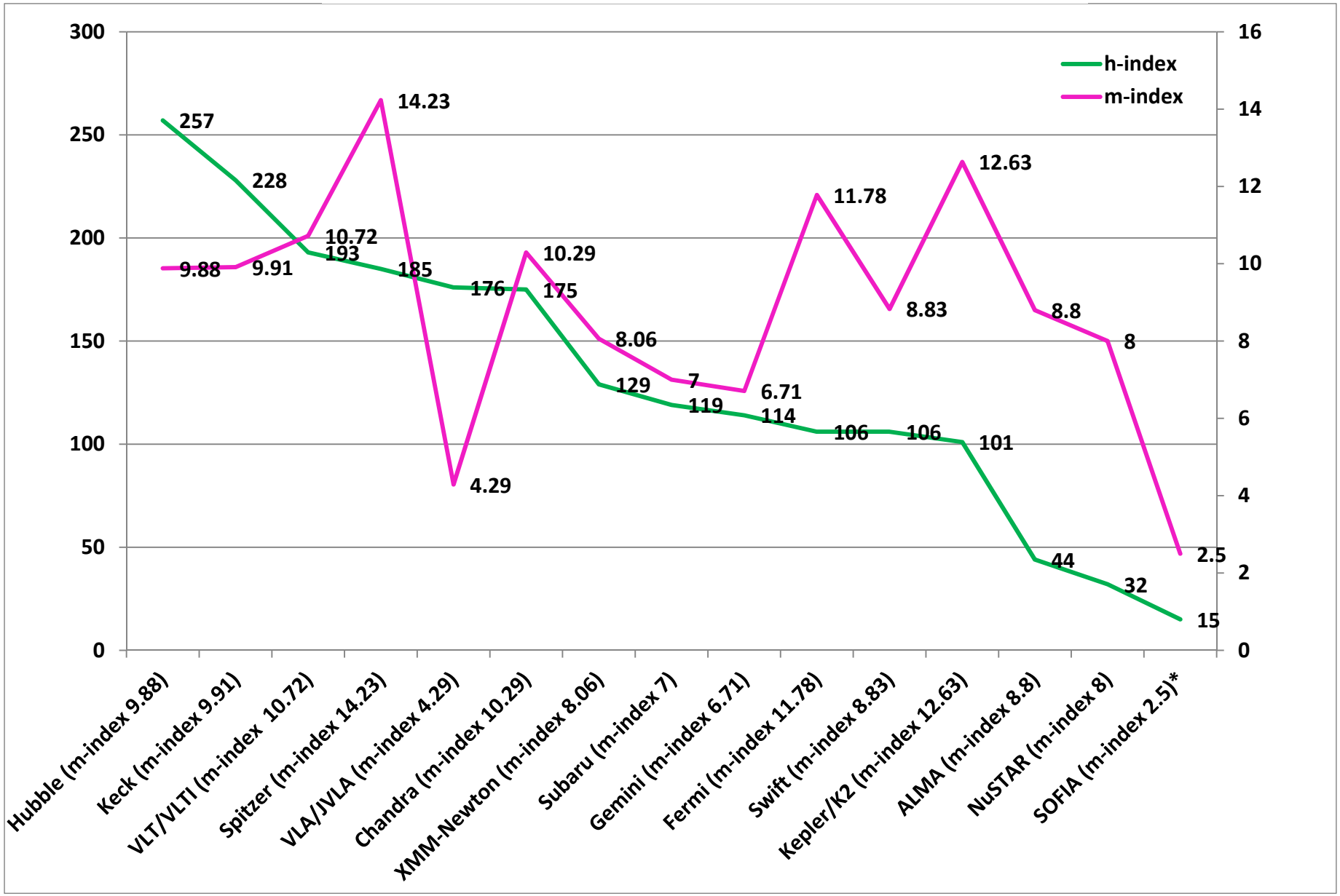
Although ADS Beta now simplifies h-index calculations for nearly any results list, this process was rejected unless no other data were available for the following reasons:

- Dedicated telescope bibliographic groups (coded as *bibgroup*) exist in ADS, but not for all telescopes or observatories for which an index was requested. Some telescopes which do not exist as dedicated bibgroups include SOFIA, Fermi, NuSTAR, and Kepler/K2. Additionally, ESO Telescopes exist as their own bibgroup without VLT/VLTI and ALMA separated.
- The process for updating each ADS bibgroup varies according to each observatory. Some are updated only a few times a year, others monthly. The full picture was not guaranteed without asking each observatory for a current, curated list.
- The decision to include scientific vs. non-scientific papers in the ADS bibgroup depends on each observatory. A curated list, whenever possible, guaranteed a more consistent comparison. Engineering, instrument, and theoretical papers may be included in an ADS search whereas the curated lists more closely align with the HST definition of a scientific paper.


h-index for Ground- and Space-Based Observatories
300
240
180
120
60
0
257
228
193
185
176
175
129
119
114
106
106
101
44
32
15
Hubble
Keck
VLT/ VLTI
Spitzer
VLA/ JVLA
Chandra
XMM-Newton
Subaru
Gemini
Fermi
Swift
Kepler/ K2
ALMA
NuSTAR
SOFIA*


m-index for Ground- and Space-Based Observatories
15
12
9
6
3
0
14.23
12.63
11.78
10.72
10.29
9.91
9.88
8.83
8.8
8.06
8
7
6.71
4.29
2.5
Spitzer
Kepler/ K2
Fermi
VLT/ VLTI
Chandra
Keck
Hubble
Swift
ALMA
XMM-Newton
NuSTAR
Subaru
Gemini
VLA/ JVLA
SOFIA*

Comparison of h- and m- indices



Telescope/Observatory Comparison through 2016					
Telescope/observatory	h-index	m-index	# yrs since first publication	First scientific paper published	Date of launch/first light
Hubble	257	9.88	26	1991	April 24, 1990
Keck	228	9.91	23	1994	Keck I May 1993/Keck II Oct 1996
VLT/VLTI	193	10.72	18	1999	1998 (Fully operational w/ fourth telescope in 2000)
Spitzer	185	14.23	13	2004	Aug 25, 2003
VLA/JVLA	176	4.29	41	1976	Sept 1975 (Officially dedicated in 1980)
Chandra	175	10.29	17	2000	July 23, 1999
XMM-Newton	129	8.06	16	2001	Dec 1999
Subaru	119	7	17	2000	Jan 1999
Gemini	114	6.71	17	2000	1999 Mauna Kea/2000 Chile
Fermi	106	11.78	9	2008	June 2008
Swift	106	8.83	12	2005	Nov 20, 2004
Kepler/K2	101	12.63	8	2009	March 2009/June 2014
ALMA	44	8.8	5	2012	Oct 2011
NuSTAR	32	8	4	2013	June 2012
SOFIA*	15	2.5	6	2011	Nov 30, 2010 (Full operational capabilities reached May 29, 2014)

* Addendum, 3/15/17: The SOFIA data in this study represents the starting point at first light, Nov 30, 2010. The SOFIA program declared full operations on May 29, 2014. Indices for this relatively young observatory should be measured at a later date for a fuller and more accurate picture of productivity. As a unique airborne observatory, future assessments should measure SOFIA against other observatories while taking into account the available hours for data collection for this unique non-space, non-ground observatory.

Conclusions

The above charts suggest observatory h-indices behave in similar ways to individual researcher h-indices. The number of years a telescope/observatory has been available to the community is linked, in general, to a greater h-index since there has been more opportunity to publish results from observational and archival data as well as added time to accrue citations for influential published works.

The m-index can be factored in when comparing scientific impact across a group of telescopes or observatories to provide a more neutral account of productivity.

Data Sources

Data sources are provided for each telescope or observatory. Individuals listed in the contact field are acknowledged for their assistance providing curated bibliographies or identifying the best source for a bibliography.

Hubble Space Telescope (HST)
HST Bibliography: http://archive.stsci.edu/hst/bibliography/
HST Publication Statistics: http://archive.stsci.edu/hst/bibliography/pubstat.html
Contact: STScI Library, library@stsci.edu

W.M. Keck Observatory
Keck Observatory Publications: https://www2.keck.hawaii.edu/library/biblio/index.html
Contact: Peggi Kamisato, pkamisato@keck.hawaii.edu

Very Large Telescope/VLT Interferometer (VLT/VLTI)
ESO Telescope Bibliography: http://telbib.eso.org/
Contact: Uta Grothkopf, library@eso.org

Spitzer Space Telescope
Spitzer Bibliographical Database: http://sohelp2.ipac.caltech.edu/bibsearch/
Contact: Elena Scire, escire@ipac.caltech.edu

Karl G. Jansky Very Large Array (VLA/JVLA)
NRAO Papers: https://library.nrao.edu/publications.shtml
Contact: Marsha Bishop and Kristy Davis, library@nrao.edu

Chandra X-ray Observatory
Chandra Bibliography Search: http://cxc.harvard.edu/cgi-gen/cda/bibliography
Contact: Sherry Winkelman, swinkelman@cfa.harvard.edu

X-ray Multi-Mirror Mission (XMM-Newton)
XMM-Newton Bibliographies: http://heasarc.gsfc.nasa.gov/docs/heasarc/biblio/pubs/xmm.html
Contact: Doug van Orsow, Doug.J.vanOrsow@nasa.gov

Subaru Telescope
Publishing Results from Subaru: http://subarutelescope.org/Observing/Proposals/Publish/index.html
Contact: Chie Yoshida, chie.yoshida@nao.ac.jp

Gemini Observatory
Gemini Publications: http://www.gemini.edu/science/publications/
Contact: Xiaoyu Zhang, xzhang@gemini.edu

Fermi Gamma-ray Space Telescope
Fermi Bibliographies https://heasarc.gsfc.nasa.gov/docs/heasarc/biblio/pubs/fermi.html
Contact: Doug van Orsow, Doug.J.vanOrsow@nasa.gov

Swift Gamma-Ray Burst Mission
Swift Bibliographies: http://heasarc.gsfc.nasa.gov/docs/heasarc/biblio/pubs/swift.html
Contact: Doug van Orsow, Doug.J.vanOrsow@nasa.gov

Kepler/K2
Kepler & K2 Publication Database: https://keplerscience.arc.nasa.gov/publications.html#publication-database
Contact: Geert Barentsen, geert.barentsen@nasa.gov

Atacama Large Millimeter Array (ALMA)
ESO Telescope Bibliography: http://telbib.eso.org/
Contact: Uta Grothkopf, library@eso.org

Nuclear Spectroscopic Telescope Array (NuSTAR)
NuSTAR Bibliographies: https://heasarc.gsfc.nasa.gov/docs/heasarc/biblio/pubs/nustar.html
Contact: Doug van Orsow, Doug.J.vanOrsow@nasa.gov

Stratospheric Observatory for Infrared Astronomy (SOFIA)
SOFIA Publications: https://www.sofia.usra.edu/science/publications/sofia-publications
Contact: Ravi Sankrit, sofia_help@sofia.usra.edu

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References

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Grothkopf, U, Stevens-Rayburn, S. 2007. Introducing the h-Index in telescope statistics. In: Ricketts, S, Birdie C, Isaksson, E, editors. LISA V. ASP Conference Series, v. 377. San Francisco (CA): Astronomical Society of the Pacific, p. 86-92. http://www.aspbooks.org/publications/377/086.pdf

Egghe, L. 2006. Theory and practise of the g-index. Scientometrics. 69(1): 131-152. doi:10.1007/s11192-006-0144-7

Alonso, S, Cabrerizo, FJ, Herrera-Viedma, E, Herrera F. 2010. hg-index: a new index to characterize the scientific output of researchers based on the h- and g-indices. Scientometrics. 82(2):391-400. doi:10.1007/s11192-009-0047-5

Grothkopf, U, Meakins, S, Bordelon, D. 2016. Basic ESO Publication Statistics. ESO Library Garching; [Accessed Jan 2017]. http://www.eso.org/sci/libraries/edocs/ESO/ESOstats.pdf

Further Reading

McInerney, J. 2011. H-Index, M-Index and google citations. McInerney Lab. [Accessed Feb 2017]. http://mcinerneylab.com/research/h-index-m-index-and-google-citations/#