

IAU Working Group on Eclipses Annual Report for the Calendar Year 2021
Inter-Division C-E WG Solar Eclipses — **Functional**

Jay M. Pasachoff, Chair

eclipse@williams.edu

https://www.iau.org/science/scientific_bodies/working_groups/93/

- Members: Jay Pasachoff (USA, Chair), Iraida Kim (Russia), Jagdev Singh (India), Vojtech Rusin (Slovakia), Yoichiro Hanaoka (Japan), Zhongquan Qu (China), Beatriz Garcia (Argentina), Patricio Rojo (Chile), Xavier Jubier (France), Fred Espenak (USA), Jay Anderson (Canada), Glenn Schneider (US), Michael Gill (UK), Michael Zeiler (USA); associates: Michael Kentrianakis (USA), and Ralph Chou (Canada). For the 2019 and 2020 total eclipses in Chile and Argentina, Patricio Rojo (U. Chile) and Beatriz Garcia (Pierre Auger Observatory, Argentina) were added to the Working Group. In 2021, additions included Shadia Habbal (USA; U. Hawaii) as an addition to the science members; Michael Wheatland (Australia) and Terry Cuttle (Australia), especially in anticipation to the 2023 total solar eclipse that clips Learmonth, Australia; and Andreas Möller, who has taken over the website administration with the list of eclipses at eclipsechasers.com maintained by Bill Kramer.
- For the coming triennium (with the 2021 Busan General Assembly postponed to August 2022), we have also added: Costantino Sigismondi (Italy); Robert Walsh (U.K.; STFC Leadership Fellow in Public Engagement, IAU UK National Outreach Coordinator); Mohamad Soltanolkotabi (msoltanolkotabi@gmail.com) from the tourist point of view for the 2025-2026-2027 solar eclipses visible from Spain; and Kevin Reardon (U.S. National Solar Observatory).
- <http://eclipses.info>

Web sites: www.eclipses.info, and for specific expeditions: www.totalsolareclipse.net.

The Working Group on Solar Eclipses has as its task the coordination of solar eclipse efforts, particularly making liaisons with customs and other officials of countries through which the path of totality passes and providing educational information about the safe observation of eclipses for the wide areas of the Earth in which total or partial eclipses are visible. Two of our members, Espenak and Anderson, produce widely used Technical Publications with eclipse paths and detailed information, available as hard copies or online, linked through www.eclipses.info or via <http://EclipseWise.com>, a successor to the "NASA Eclipse Site." Gill runs the Solar Eclipse Mailing List, now at SEML@groups.io; daily summaries are available: <https://groups.io/g/SEML>. High-quality mapping is now available from Michael Zeiler, GreatAmericanEclipse.com and eclipse-maps.com. Anderson at <http://eclipseophile.com> has cloudiness statistics and other weather-related information. Chou, a professor of optometry, is the world's expert on eye safety at eclipses. Jubier produces zoomable, clickable maps customizable for each eclipse; the forthcoming few are linked at our website at <http://eclipses.info>. We thank Prof. Vojtech Rušin of Slovakia for his past service on our Working Group.

Schneider is an expert on aerial eclipse flights, and planned a successful pair of chartered flights to near the sunrise point for the 4 December 2021 totality that otherwise passed only over Antarctica and nearby ocean. Kramer at <http://eclipse-chasers-com> kept a log of statistics of individual eclipse observers, which Andreas Möller has taken over and has added an archive of historical eclipse papers. Kentrianakis was the project manager for the American Astronomical Society's 2017 eclipse efforts, <http://eclipse.aas.org>; the site now has advance notice of the 2023 and 2024 eclipse visibility across the United States, now headed by Claire Raftery (U.S. National Solar Observatory), Angela Speck (U. Texas at San Antonio), and Rick Fienberg (American Astronomical Society). Pasachoff is a member of the newly reconstituted American Astronomical Society Task Group on Eclipses for the 2023 annular eclipse, with partial phases across all of North America, and the 2024 total solar eclipse, with totality from Mazatlán, Mexico across the US from Texas to Maine and onto the Canadian Maritimes.

Among our successes is the distribution of material for tens of thousands of eye-protection filters. The organization Astronomers Without Borders collected millions of slightly used "eclipse glasses" (really "partial eclipse glasses") from users at the 2017 American eclipse. As an example. jmp brought 5000 of the used filters to Mumbai and Madurai, India, for use at the 26 December 2019 annular eclipse, with further use at the 21 June 2020 annular eclipse. Some were sent to Chile for the 2020 and 2021 total solar eclipses. Andrew Fraknoi (USA) worked to get donated filters from the Moore Foundation for distribution through libraries.

Because of the pandemic access was limited for international travelers for the June 21, 2020, annular eclipse, with path from Africa across the Middle East, through China, and for the December 14, 2020, total solar eclipse whose path was centered on Chile and Argentina, extending from the Pacific to the Atlantic. Though he was unable to get to either the 2020 annularity or the totality because of COVID-19 travel restrictions, Pasachoff summarized the observations of others in articles in *Astronomy Magazine*:

Pasachoff, Jay M., 2021, "Corona Light," 2020 annular eclipse images, *Astronomy Magazine*, February issue, pp. 40-45.

Pasachoff, Jay M., 2021, "The 2020 Total Eclipse," *Astronomy Magazine*, April issue, pp. 47-51.

Soon after the 2020 eclipse, NASA released the following:

Eclipse prediction -- <https://www.nasa.gov/feature/goddard/2020/scientists-use-nasa-data-predict-appearance-corona-dec-14-total-solar-eclipse>

Eclipse comet -- <https://www.nasa.gov/feature/goddard/2020/recently-discovered-comet-seen-during-2020-total-solar-eclipse-SOHO>

and for the 2021 eclipses, with an annular eclipse on 10 June 2021 in southern Canada viewed from a charter flight from *Sky & Telescope Magazine* before it went north over Greenland, the North Pole, and then to Siberia; and with the total solar eclipse in and near Antarctica on 4 December 2021:

Eclipse prediction: <https://www.nasa.gov/feature/goddard/2021/scientists-use-nasa-data-to-predict-corona-of-dec-4-antarctic-eclipse/>

Pasachoff, Jay M., 2021/2022, "Totality From Above the Clouds," *Sky and Telescope*, online.

<https://skyandtelescope.org/astronomy-news/total-solar-eclipse-reports-from-antarctica/>

Theo Boris, Christian A. Lockwood, David Zimmerman ([JM Pasachoff Antarctic Expedition](#)), 2021 (Dec. 9), "A Total Eclipse of the Sun," <https://apod.nasa.gov/apod/ap211209.html>

See also <https://www.forbes.com/sites/jamiecartereurope/2021/12/04/in-photos-and-video-antarcticas-exclusive-eclipse-of-the-sun-attracts-intrepid-travelers-and-humpback-whales/?sh=305334b44730>

and

<https://www.wsj.com/story/a-total-solar-eclipse-as-seen-from-antarctica-e71f1988>

At the time of the 2019 eclipse, Alexander Kosonovich was in charge of IAU Symposium 354 at Copiapo, Chile; the proceedings were published by Cambridge University Press. *Solar and Stellar Magnetic Fields: Origins and Manifestations*, Copiapo, Chile, July 2019. The Proceedings appeared in September 2020:

<https://www.cambridge.org/core/journals/proceedings-of-the-international-astronomical-union/issue/88BDDA474A28E3FE79CB2BE7CE3D8854>

At the time of the 2020 total solar eclipse, Beatriz Garcia ran IAU Symposium 367, <http://sion.frm.utn.edu.ar/iaus367/>, R. M. Ros, B. García, S. Gullberg, J. Moldon & P. Rojo, Proceedings IAU Symposium No. 367, 2020, *Education and Heritage in the Era of Big Data in Astronomy: The first steps on the IAU 2020-2030 Strategic Plan*. Originally scheduled for 9-14 December 2020, San Carlos de Bariloche, Argentina, with a trip to totality at the end of the meeting, it was made virtual. Pasachoff gave an eclipse lecture. The proceedings were published at the end of 2021 by Cambridge University Press:

<https://www.cambridge.org/core/journals/proceedings-of-the-international-astronomical-union/article/iau-volume-15-issue-367-cover-and-back-matter/ED66C850971A5A22F7919165D80973B0>

as part of Network for Astronomy School Education (NASA), the Key Initiatives in Education, Outreach and Development Working Group:

(see https://www.iau.org/science/scientific_bodies/working_groups/334/)

For observations of the 2023 total solar eclipse from Learmonth, Western Australia, see http://xjubier.free.fr/en/site_pages/solar_eclipses/HSE_2023_GoogleMapFull.html?Lat=-22.21921&Lng=114.10302&Zoom=16&LC=1

Anderson's eclipsophile.com shows that the cloudiness statistics are favorable for Australia but unfavorable for observations from East Timor. For a full map, see

http://xjubier.free.fr/en/site_pages/solar_eclipses/xSE_GoogleMap3.php?Ecl=+20230420&Mag=1&Max=1&Map=ROADMAP

For the 2023 annular solar eclipse that crosses northeastern South America and then North America, including Mexico and the United States, on 14 October 2023

http://xjubier.free.fr/en/site_pages/solar_eclipses/xSE_GoogleMap3.php?Ecl=+20231014&Acc=2&Umb=1&Lmt=1&Mag=1&Max=1&Map=ROADMAP

For the 2024 total solar eclipse, see

http://xjubier.free.fr/en/site_pages/solar_eclipses/xSE_GoogleMap3.php?Ecl=+20240408&Mag=1&Max=1&Map=ROADMAP

For maps of eclipses in 2025-2026-2027 visible from Spain, see www.eclipse262728.com

Each year, we provide “Eclipses” for the International Geophysical Calendar (International Space Environmental Service), <http://www.spaceweather.org/ISES/info/geocal/geocal.html>