IAU WORKING GROUP ON ECLIPSES TRIENNIAL REPORT FOR SEPTEMBER 2018-SEPTEMBER 2021
Division C-E WG Solar Eclipses — Functional
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(https://www.iau.org/science/scientific_bodies/working_groups/93/)

I report on the educational and outreach aspects of the activities of the IAU Working Group on Solar Eclipses of Divisions C (Education, Outreach, and Heritage) and E (Sun and Heliosphere) over the last triennium and with plans for the next triennium.

CHAIR
Jay Pasachoff (USA Chair)

MEMBERS
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 (US)
Jay Anderson (Canada)
Glenn Schneider (US)
Michael Gill (UK)
Michael Zeiler (USA)
Bill Kramer (USA);
associates: Michael Kentrianakis (USA)
Ralph Chou (Canada)

THE TRIENNIAL REPORT (2019-2021)

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

The triennium between the September 2018 General Assembly (Vienna, to which I went following viewing a partial solar eclipse from Sweden) and the September 2021 General Assembly (delayed from Busan, South Korea with business meetings remaining on the original schedule) had total solar eclipses in Chile/Argentina on 2 July 2019 and on 14 December 2020; and annular eclipses on 26 December 2019, 21 June 2020, and 10 June 2021. It also included a partial eclipse visible from China, Russian Siberia, Korea, and Japan on 6 January 2019.
Our Working Group includes members from Russia, Japan, India, Slovakia, China, USA, UK, France, and Canada as well as newly Chile and Argentina, with additions proposed from Australia and Germany.

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. Anderson at http://eclipspophile.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.

2. MEMBERSHIP

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. (http://eclipses.info). For the next triennium, September 2021-September 2024, given visibility of totality from Learmonth, Western Australia in 2023, we propose adding Terry Cuttle (public outreach, Australia) and Michael Wheatland (U. Sydney; an editor of the journal Solar Physics). We also propose adding Andreas Möller (Germany; who will collaborate with Bill Kramer on an archive of eclipse publications and maintain the eclipse-chaser.com website). Prof. Wheatland is an IAU member; Mr. Cuttle and Mr. Möller would be associates. Also we add Costantino Sigismondi (Italy) and Kevin Reardon (US National Solar Observatory, USA). For outreach, we are adding Robert Walsh (UK) For the three eclipses in Spain in 2025-2026-2027 (two totals and an annular), we add Mohamad Soltanolkotabi (Spain), who would be an associate.

3. REPORT OF ACTIVITIES

Schneider is an expert on aerial eclipse flights, and has planned a flight to the sunrise point for the 4 December 2021 totality that otherwise passes only over Antarctica and nearby ocean with low cloudiness-success probability. Kramer at http://eclipse-chasers-com keeps a log of statistics of individual eclipse observers, and is newly partnering with Andreas Möller for 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. 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. The task force is headed by Claire Raftery of the U.S. National Solar Observatory, with Angela Speck, now at U. Texas, and Rick Fienberg of the American Astronomical Society.

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 them 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 14 December 2020 total solar eclipse.

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 annularity or the totality because of COVID-19 travel restrictions, Pasachoff summarized the observations of others in articles in Astronomy Magazine:


Soon after the eclipse, NASA released the following:

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


4. RESOURCES

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

The following new eclipse-related items appeared:
The following softbound books are particularly useful for the next triennium:


Especially useful websites:

- IAU website linking much eclipse reference material: [http://eclipses.info](http://eclipses.info)
- NASA Eclipse Website (formerly from Fred Espenak, now retired)
- EclipseWise.com from Fred Espenak, with current and past maps
- GreatAmericanEclipse.com from Michael Zeiler, with maps and materials
- Eclipse-chasers.com from Bill Kramer, with individuals' logged eclipses

Earlier eclipse-related material

- Fred Espenak, *Five Millennium Canon of Solar Eclipses: -1999 to +3000*, 2006 (NASA/TP-2006-214141);
- Peticolas, Laura, Hugh Hudson, Calvin Johnson, Dan Zevin, Vivian White, Juan Carlos Martínez Oliveros, Igor Ruderman, Justin Koh, David Konerding, Mark Bender, Christopher Cable, Brian Kruse, Darlene Yan, Larisza Krista, Braxton Collier, Andrew Fraknoi, Jay M. Pasachoff, Bryan Mendez, Alex Filippenko,


- Publications by Shadia Habbal's Solar Wind Sherpas

Note that sometimes ESA's Solar and Heliospheric Observatory (SoHO) sees some additional partial solar eclipses, such as on Jan 13, 2021: