PHYSICS OF THE COSMOS PROGRAM ANALYSIS GROUP (PHYSPAG), COSMIC ORIGINS PROGRAM ANALYSIS GROUP (COPAG), and EXOPLANET EXPLORATION PROGRAM ANALYSIS GROUP (EXOPAG) SCIENCE INTEREST GROUP TERMS OF REFERENCE :

"Time Domain and Multi-Messenger Astrophysics (TDAMM)"

Change log*		
Revision	Date	Description of Changes
0	8/14/2023	Recommended for approval by APAC and posted on PhysCOS website.
1	3/3/2025	Updated Membership and Meeting sections in compliance with Executive Orders.

*Additions are in bold and/or italicized text and deletions are struck through in amendments.

The Program Analysis Groups are open community forums for soliciting and coordinating community analysis in support of the objectives of NASA's Astrophysics program. Anyone in the community is welcome to participate and engage in PHYSPAG activities that are carried out at annual (or bi-annual) general body meetings and within various science interest groups (SIGs).

A Science Interest Group (SIG) is a long-term science affinity subgroup consisting of members interested in a specific subfield of Physics of the Cosmos science (e.g. high-energy astrophysics, black holes, cosmology, particle astrophysics, gravitational waves, etc.). SIGs typically meet regularly to discuss and share scientific results, analysis techniques, and science gaps, as well as how the state of the art might be advanced in that subfield. SIGs identify data and technology needs that could enable advances in further scientific discovery.

The Astro2020 Decadal Survey recommended an investment in Time Domain and Multi-Messenger Astrophysics (TDAMM) as the top-priority sustaining activity in space for the coming decade. This relatively new field burst onto the scene with the detection of neutrinos and photons from SN 1987A, and entered a new era in 2017, with the first detection of a binary neutron star merger, GW 170817 / GRB 170817A, in both gravitational waves and across the electromagnetic spectrum, and the second strong association between an astrophysical neutrino, IceCube-170922A, and a known source, the blazar TXS 0506+056. The field's potential continues to grow as searches for electromagnetic counterparts to GW events continue and with the high-significance detection of neutrino emission from the galaxy NGC 1068. TDAMM observations cover a wide range of time varying and multi-messenger phenomena which, expanding on the examples mentioned above, include characterization of exoplanet host stars, variable stars, fast radio bursts, and the regions closely surrounding supermassive black holes to mention just a few. Thus, it is clear that TDAMM observations are of importance to a wide range of science and scientific communities. In order to guide NASA in developing its strategy in response to this Astro2020 recommendation, a TDAMM SIG is being established as a cross-PAG SIG, with an organizational home in PhysPAG. As a cross-PAG SIG, it will draw its membership and leadership from all PAGs: PhysPAG, Cosmic Origins PAG (COPAG), and Exoplanet Exploration PAG (EXOPAG). As many (but not all) of the key science drivers and enabling technologies live in the PhysPAG purview, and as there is a need for a clear line of responsibility, the TDAMM SIG will rely upon the Physics of the Cosmos (PhysCOS) program office for support.

Tasking for the TDAMM SIG may be initiated by NASA via the Physics of the Cosmos Program Scientists or via the PhysPAG Executive Committee (EC), in consultation with the Cosmic Origins and Exoplanet Exploration program scientists and ECs, and may include any of the following tasks:

1. Provide analysis and feedback to NASA on the impact of the Astronomy & Astrophysics Decadal Survey on the subfield.
2. Identify and articulate "science gaps": gaps between the current state of knowledge in the subfield and the goals outlined by the Decadal Survey that require new data in order to fully define new missions (precursor gaps), prepare for approved missions that are in development (preparatory gaps), and maximize the science return from current missions (follow-up gaps).

3. Serve as ambassadors to facilitate communications between NASA and the science community. In particular, act as the interface to relevant TDAMM communities outside NASA's immediate sphere e.g., ground-based observers, physics facilities.
4. Engage in scientific discussions and exchange of ideas through meetings and seminars to make best use of NASA assets for current research and to assist NASA in strategic planning in TDAMM activities.
5. Propose and organize TDAMM sessions at conferences and arrange other public meetings as appropriate.
6. Establish and disseminate best practices for conducting TDAMM science, for missions both in development and in operations, and for observers and investigators, including in regards to sharing and citing data in an era of open data.

MEMBERSHIP

Membership of the TDAMM SIG is open to the national and international scientific community without regard to institutional affiliation, education or career status. A SIG has tens to hundreds of members. ~~The SIG values a community that is diverse and inclusive, consistent with NASA's core value of inclusion and the NASA Science Mission Directorate Science Strategy 4.1 which emphasizes that mission success requires diversity of thought at all levels.~~[1] Membership is identified by subscription to a dedicated email distribution list for the SIG that is maintained by the Physics of the Cosmos Program Office. Membership has no fixed duration and may be withdrawn at any time. There are no other rights or privileges of membership either expressed or implied.

GOVERNANCE

The TDAMM SIG will be led by a leadership team consisting of two members of the PhysPAG EC and one member each from the COPAG and EXOPAG ECs. These members will be appointed by NASA HQ on an annual basis, with an expectation of serving for two or three consecutive years, and with one of the PhysPAG members appointed as Chairperson.

Responsibilities of the Chairperson and the leadership team include leading the affinity group in achieving its goals which may be done by regularly organizing SIG meetings, promoting the SIG and its activities in the science community, and delivering an annual report to the PhysPAG, COPAG, and EXOPAG ECs. The Chairperson may decide to recruit other members of the SIG to assist with these activities. The Chairperson and leadership team will work directly with the Physics of the Cosmos program office to facilitate meetings and events as needed for the group to achieve its objectives, and will communicate plans for meetings and events to the Cosmic Origins and Exoplanet Exploration program offices for distribution to their communities.

MEETINGS

The TDAMM SIG will have at least one annual meeting to conduct governance functions, present findings and analyses, and provide a larger forum for discussing research and

[1] ~~Explore Science 2020-2024: A Vision for Scientific Excellence, available at https://science.nasa.gov/about-us/science-strategy, see especially strategy 4.1~~

exchanging ideas. Such meetings may be aligned with a major scientific conference. Additional meetings will be scheduled as needed during the year to organize SIG members to act in response to requests for analyses arising from either NASA HQ or from the community.

~~Meetings will be conducted in accord with NASA's Statement of Principles.[2]~~

REPORTING

Minutes of regular meetings of the TDAMM SIG will be kept in a publicly accessible area and be provided to the PhysPAG Executive Committee. The PhysPAG will be reporting to the APAC on SIG activities a few times per year. Activities and findings of analyses of the SIG will be reported to the PhysPAG EC which may submit the analysis to NASA HQ via the PhysCOS Program Scientist, as well as to the COPAG and EXOPAG ECs. All findings and analyses submitted to NASA by the SIG will be made publicly available through the Physics of the Cosmos website.

ADMINISTRATIVE PROVISIONS

Logistical and organizational support to the TDAMM SIG will be provided through the Physics of the Cosmos Program Office. This support includes such functions as maintaining the SIG page on the Physics of the Cosmos website and the email notification list, assisting with logistics for SIG meetings (e.g. arranging for meeting space in person and/or online, providing funds for travel where available), collecting presentations from SIG meetings, and posting presentations and minutes on the web site.

DURATION

The TDAMM SIG may be terminated at the discretion of the NASA HQ. If the SIG terminates, the SIG terms of reference also terminate, and all appointments to the SIG leadership also terminate.

~~[2] https://pcos.gsfc.nasa.gov/news/NASA_ASD_Statement_of_Principles.php~~