

Dr. Harry Teplitz (IRSA lead)
Dr. George Helou (Director of IPAC)
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Dear Harry and George,

I am writing to report on the IRSA User Panel meeting held in Pasadena on November 27, 2018. The members of the Panel attending were: Claudia Scarlata (UMN), Mike Person (MIT), David Tholen (University of Hawaii), Mark Lacy (NRAO), Klaus Pontoppidan (STScI, attending remotely), Alexandra Pope (UMass, attending remotely), Stephanie Juneau (NOAO), Bahram Mobasher (UC Riverside). The full day meeting consisted of presentations from Harry Teplitz, Vandana Desai, Luisa Rebull, Roberta Paladini and Steve Groom on the various activities within IRSA. The charter of the User Panel is to evaluate IRSA's content and services from the user's perspective, to advise on the priorities for ongoing/planned activities (in light of current funding level), and to suggest improvements or new services, not covered in the current work plan.

In this report, prepared by the Panel, we first overview the presentations delivered by members of the IRSA team and then make recommendations on the current IRSA activities and their priorities. IRSA continues to be NASA's primary archive for infrared and sub-mm astrophysics missions, and serves data from 16 observatories and major surveys. IRSA provides access to more than 100 billion measurements of astronomical sources, including all-sky coverage in 24 bands, from 1.2 microns to 1 cm. IRSA implements the Spitzer Heritage Archive for the Spitzer Space Telescope, one of NASA's four great observatories, and it currently maintains much of the technical expertise from the Cryogenic phase of the mission. It is also the data archive for the WISE and NEOWISE surveys, the US archive for the Planck mission. Soon, IRSA will become the archive for data from SOFIA. Finally, IRSA hosts contributed data products, that can be searched in a way consistent with the primary IRSA data.

IRSA is continuing to fulfill its role within the astronomical community. The number of queries remains steady, showing the continuous usefulness of the archived data, while the number of help-desk tickets has decreased in the same timeframe. The reduced number of helpdesk tickets may be due to IRSA's activities aimed at facilitating the use of IRSA tools, and increasing the visibility of the offered services. These activities include presence on social media, video tutorials and workshops and major conferences such as the AAS meetings.

IRSA is continuing to ingest new data from active NASA missions, as well as newly processed data from completed missions:

- *Spitzer* has been extended, and is now operating in the beyond phase until January 2020, that marks the end of data-taking phase. Instrument and data documentation will be completed by January 2021. The user panel found the close-out schedule realistic.
- IRSA continuing its archive functions for the latest NEOWISE-reactivation, with a submitted proposal to continue NEOWISE operations until June 2019 (with a final data release to take

place in Fall 2019). Currently, the release of the Year 5 NEOWISE images and source data is scheduled for Spring 2019. The dataset is impressive and will be of extreme value for the astronomical community.

- The user panel supports IRSA's early involvement in NEOCAM.
- IRSA should continue to serve the Planck dataset to the astronomical community, and include the ESA's Planck Public Release 3. The Panel continue to believe that IRSA should serve the alternate processed dataset by JPL, should it become available, within the limited funding allocated by the Senior Review.
- IRSA's activities to release the baseline archival interface for the NASA Infra-Red Telescope Facility (IRTF) have begun and are progressing on schedule. The panel supports the initial focus on raw and new data only, for the limited set of instruments (iSHELL, SpeX). At this point no visualization capabilities are being planned. See below for the User Panel recommendation.
- IRSA's plan to ingest the SOFIA archive is well under way. The User panel supports the plan of a first release in February 2019, that will cover GREAT, FORCAST, FIFI-LS, and only for the two cycles (4-5) during which the SOFIA pipeline for the data reduction was sufficiently mature. The User panel believes that adding capability to visualize IFU FIFI-LS data will greatly improve the utility of the archive. The updated schedule for a final release is reasonable and having SOFIA staff train their users to become familiar with the new IRSA archive during the transitional year is the way to go.

Dr. Desai presentation highlighted the progress made to serve multi-resolution images as part of the archive in order to facilitate science projects that require access to either large areas with few details, or small regions with high level of details. The User panel supports the plan forward to create new high-quality HiPS maps of IRSA data, with priority given to Spitzer data using Montage. Lower priority should be given to WISE, Herschel, and contributed datasets. Additionally, the creation of Hips maps allows the creation of Multi-Order Coverage (MOC) Maps, that can provide more general and faster ways to search the archive (including data outside IRSA). The User panel believes this is the direction in which IRSA should go. We also support the planned effort to improve the HiPS viewer (refine coordinate grid, refine WCS/match lock behavior, allow user to pan coordinate, click to search functionality, intersection of table and MOC) as well as the integration of HiPS viewer in more tools (e.g., data discovery, Atlas, finder chart GUI and API).

The IRSA Data Discovery Service (DDS, powered by Radar) increases the visibility of IRSA datasets. The capabilities that could be implemented within DDS (both in terms of improving the data search and the presentation of the results) are numerous, but would also require substantial effort. At this point, the User panel supports IRSA's plan to prioritize a more realistic approach that exploits the MOC files generated as part of the HiPS image creation. Enabling DDS to use MOCs will allow fast comparison between position and coverage of many surveys. The use of MOC maps will also enable future implementation of search by coverage, wavelengths, time and instrument. This kind of searches should be of high priority in the future plans for IRSA. The panel also supports the integration of data discovery tools into IRSA Viewer (with the associated API required development). The User panel recommends that the moving objects search tool should also be linked from the main page, in order to increase its visibility. We believe that enhancing the SED viewers in finder chart should be of lower priority at this

point, given the substantial effort required in matching PSF, units, modes, etc., and that it could be one of the budget items in the upcoming proposal. Spectra visualization, on the other hand, should be a high priority for IRSA. The panel was strongly in favor of IRSA devoting a substantial effort and resources to the improvement and development of tools for the visualization of spectroscopic data (including Integral Field Unit data).

Steve Groom presented updates on IRSA's role in the era of Big Data, and on the status of the tech-initiative. Clearly the approach to astronomical research is shifting and different needs have been emerging from the community. As mentioned earlier, the user panel supports the continue growth of script/program interfaces, with support for visualization tools. We also strongly support, and believe should be a priority, the idea of bringing computing/analysis environments close to the data. The development of data science skills and supporting services, however, was felt by the User panel to be of lower priority, given that existing data modeling tools (e.g., astropy, sklearn) are being continuously developed and maintained. These tools should be made available for users within science platforms close to the data (e.g., the possibility to access IRSA data through JupyterLab notebooks).

We believe that the effort IPAC is making in increasing the visibility of the IPAC archive and its tools in the astronomical community is producing the right results. In particular, we find the workshop at meetings (such AAS) as well as the constant presence in social media with posts and video tutorials a useful way to reach the broader young community. On a similar note, IRSA's effort to have a strong scientific presence in the ASTRO2020 decadal survey should continue during 2019, identifying science cases that will be best addressed with the combination of new and archival data.

As far as priorities for the coming year are concerned, the panel believes the high priority should be given to the creation of MOC maps and their use in current IRSA's tools. Additionally, the panel would like to see an effort in the direction of improving the visualization of spectroscopic data. We believe this is more and more important now that the IRSA archive includes data from SOFIA, and with future spectroscopic surveys either close to launch (e.g., Euclid), planned (e.g. WFIRST) or proposed for (e.g., SPHEREx). The User panel also recommends that IRSA, as part of the tech-initiative should push the development of science platforms to bring the "analysis to the data". We recommend IRSA works on a basic functionality to have as a starting point to be used in the preparation of the upcoming proposal.

Sincerely yours,

Claudia Scarlata,

on behalf of the IRSA User Panel members: Stephanie Juneau, Mark Lacy, Barham Mobasher, Mike Person, Klaus Pontoppidan, Alexandra Pope, David Tholen