

Reviewer 1:

Rating: Multiple Rating: (Excellent/Very Good)

Summary

In the context of the five review elements, please evaluate the strengths and weaknesses of the proposal with respect to intellectual merit.

The PI proposes to combine new spectroscopic data from the Milky Way Mapper project with existing theoretical supernova yields to investigate the black hole landscape in three local populations. They will incorporate binary SN progenitors into existing models to provide more physical yield predictions, testing the results against a simulated stellar population. The PI will also organize mentorship trainings and workshops for the existing CU Prime STEM mentoring program, as well as developing planetarium programs using MWM data.

The intellectual merit of the project is good: the proposal makes a strong case for the importance of a more detailed understanding of nucleosynthetic yields of various competing processes in understanding the Galactic enrichment history. The proposed work builds well on the PI's past experience and extends it in promising new directions. However, the project relies heavily on external collaborators and lacks some key details in the area of the proposed massive star modeling. It also seems potentially ambitious for the 3-year timeframe. Incorporating the proposed papers into the project timeline would have helped address this, as would discussing the anticipated availability of the necessary MWM data products.

In the context of the five review elements, please evaluate the strengths and weaknesses of the proposal with respect to broader impacts.

The broader impacts of the project are excellent. The PI lays out a very well developed and thoughtful plan to build on their past experience to establish and execute a mentoring training program for an existing group at CU Boulder, as well as creating a new planetarium program based on their research. Both projects have well defined goals and audiences and include appropriate plans for partnering with experts, assessing success, and creating documentation for future sustainability.

Please evaluate the strengths and weaknesses of the proposal with respect to any additional solicitation-specific review criteria, if applicable

The proposed work builds well on the PI's past experience, and the project is a good match for the host institution.

Summary Statement

Overall, this proposal has many strong elements. The scientific plan could have used some additional detail in places, but the educational and outreach initiatives are thoughtful and compelling.

Reviewer 2:

Rating: Excellent

In the context of the five review elements, please

evaluate the strengths and weaknesses of the proposal with respect to intellectual merit.

This proposal will take advantage of the Milky Way Mapper spectroscopic survey to derive the chemical enrichment of the disk, bulge, and Magellanic Clouds, with the goal to better understand the origin of the elements: what fractions were produced from core-collapsed supernovae, Type Ia's, and AGB stars.

Strengths: The Milky Way Mapper will obtain abundances for a billion stars or more. The PI has designed three complementary projects to use these data, along new, state-of-the-art theoretical yield calculations, to significantly advance our knowledge the chemical enrichment of the Milky Way and the Magellanic Clouds. These studies build upon the impressive work the PI did as part of her thesis. She has identified the right institution and collaborators to carry out this work. The proposal time-line is ambitious, but achievable if , and even partial completion will likely yield valuable insight. The program is well thought out, with clearly defined goals and products.

Minor Weakness #1: The proposal would have been a bit stronger if it had explicitly addressed the timetable for the availability of the Milky Way Mapper data. The pandemic has delayed the deployment of the robot positioners on SDSS-V. In the north, regular survey operations are expected to begin in March at Apache Point, and a year of plate data is already in hand. In the south, commissioning at the DuPont will likely begin in April, so the first Magellanic Cloud data will be taken in late 2022, and thus would be available in Year 2 of the proposal. This is consistent with the PI's work plan, which concentrates on the theoretical yield in the first year, but it would have been helpful to have had this stated in the proposal.

Minor weaknesses #2: Supernovae and AGB stars are not the only source of enrichment of the ISM. Stellar winds from massive stars also provide enrichment during the red supergiant and/or Wolf-Rayet phases, primarily of CNO products. The proposal could have been slightly strengthened by providing an estimate of their contribution relative to the explosive events that are at the heart of this proposal.

In the context of the five review elements, please evaluate the strengths and weaknesses of the proposal with respect to broader impacts.

The PI plans to use her considerable experience gained with Polaris to at OSU to help improve the skills of the mentors in the CU Prime program, including using part of her fellowship to engage the services of an equity consulting firm Movement Consulting to develop a workshop on near-peer mentoring of minority students. She will also work with the director of the Fiske planetarium to develop a planetarium show based that highlights the Milky Way Mapper results.

Strengths: the broader impacts of this proposal are innovative and well designed. It is one of the strongest broader impact proposals I've read. Further, it will serve not just the students at CU and the Boulder public, but have a wider impact by making the planetarium presenters' guide, script and software available to other universities.

Minor weakness: Although any existing program can be improved, there is an implicit assumption that the CU Prime program is deficient in some way. It was not clear from the text if the current leaders of CU Prime feels that these improvements are needed, or would even be welcomed.

Please evaluate the strengths and weaknesses of the proposal with respect to any additional solicitation-specific review criteria, if applicable

The proposal makes a strong case that CU Boulder is the best host institution. It will provide proprietary access to the SDSS Milky Way Mapper's data. The proposal is timely: she will be in a position to use these data just as they are becoming available. Her sponsor is an expert in galaxy evolution. Similarly, CU's Fiske Planetarium provides an opportunity for a broader impact, as does the existing CU Prime mentoring program. Carrying out this program will help further establish the PI as a leader in the field, and prepare her goal as an educator at a small liberal arts university or planetarium.

Summary Statement

This is ambitious program that will have significant scientific and societal impacts.

Pannel Summary

INTELLECTUAL MERIT

** Strengths:

The proposal aims to combine novel theoretical calculations with existing data plus new data from the Milky Way Mapper to provide a potentially exciting new take on Galactic and Magellanic Cloud chemical enrichment.

** Weaknesses:

Some members of the panel were concerned about the tractability of the problem. There are considerable model uncertainties in the supernova yields, and some processes, like Wolf-Rayet winds, binary stripping processes in evolved stars and pair instability supernovae do not appear to be under consideration. There are also potential degeneracies with star formation histories, chemical mixing, and variations in the initial mass function. It was unclear that even the Milky Way Mapper's impressive data set and the proposed new supernova yield calculations will be sufficient to break all the degeneracies and lead to real progress.

BROADER IMPACTS

** Strengths:

The project was very well planned, and had actual metrics for success laid out in addition to plans for establishing a mentor training program and developing planetarium materials.

** Weaknesses:

The panel had some minor concerns that it wasn't clear to what extent the applicant had discussed the proposed changes to the CU Prime program with the people who run that program.

SOLICITATION-SPECIFIC CRITERIA

The panel had mixed opinions about whether Colorado is an appropriate choice of institution for this project. The SDSS membership is clearly necessary for the project, and the broader impacts case meshes nicely with activities already taking place at Colorado. The major concern is that while the host scientist is very well respected, his past work is on topics rather far removed from the topic of the proposal. The connections with the other scientists at Colorado also did not seem to have clear paths for helping the applicant's development. The panel found these issues to be partly mitigated by external collaborations. There are some other SDSS institutions which might have been more natural scientific fits.

DATA MANAGEMENT PLAN:

This is sufficient.

SYNTHESIS AND SUMMARY COMMENTS:

The project attacks an extremely important scientific question, making use of a fundamentally novel data set, although the panel has mixed opinions about the feasibility of achieving all the proposed goals. The broader impacts case was viewed as excellent by the entire panel.

The summary was read by the panel and the panel concurred that the summary accurately reflects the panel discussion.