



NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard
Arlington, VA 22230

DIVISION OF ATMOSPHERIC SCIENCES

UPPER ATMOSPHERE RESEARCH SECTION

Dr. Michael Mendillo
Boston University
Center for Space Physics
725 Commonwealth Avenue
Boston, MA 02215

Dear Dr. Mendillo:

I am pleased to inform you that the National Science Foundation has awarded support for your research entitled "CEDAR Post-Doc: Photo-Chemistry and Neutral-Plasma Coupling at Earth and Mars." My congratulations to you on this award to your institution.

It is important that NSF be kept informed of your research progress especially when you have significant results or unusual problems. I urge you to discuss any such issues with the NSF scientist responsible for your grant, Dr. Robert Robinson, Program Director, Aeronomy. The telephone number of the program is (703) 292-8529.

Please take a few minutes to read the Grant General Conditions, available in your business office, that deal with the reporting requirements of the grant. You should also note that any publication of grant results should contain the acknowledgment and, when appropriate, the disclaimer shown in the "acknowledgment and disclaimer" article of those general conditions.

I have enclosed copies of reviews received in the course of the evaluation of your proposal. I join the program staff in urging you to consider any constructive advice provided by the reviewers.

May I take this opportunity to extend our best wishes to you for a successful scientific undertaking.

Sincerely yours,

A handwritten signature in cursive script that reads "Richard Behnke".

Richard Behnke
Section Head

Enclosures

CEDAR FY04 Context Statement
Context Statement ID: CEDARFY04

A total of 16 proposals (15 independent projects) were submitted to NSF in response to Program Solicitation NSF 02-070, Coupling, Energetics, and Dynamics of Atmospheric Regions (CEDAR). Four of the 16 proposals were for post-doctoral research support. The Program Solicitation included special instructions for the preparation of the budgets and technical descriptions for post-doc proposals.

All the proposals were sent to three or more mail reviewers, and subsequently reviewed by a panel of five members. The panel review was done over two days via teleconference. The panelists used the FastLane Panel Review System and the Interactive Panel System (IPS) to see and review the proposals during the panel discussion.

Each proposal was read by at least two panelists (the Lead and the Secondary) prior to the panel meeting. The lead reviewers prepared written reviews prior to the panel meeting. The IPS rules were set so that the lead panelists had to submit a written review of a proposal before they could view the ad hoc reviews. On the day of the panel, the rule system was changed so that all panelists could see all the reviews (except in cases of a conflict of interest). Both the lead and secondary panelists presented their views of the proposal, after which there was a general discussion. After the discussion of each proposal, the panelists were asked to rate them individually with a grade ranging from poor to excellent. The averages of the grades submitted by all non-conflicted panel members were used to rank the proposals.

The discussion and grading of each proposal was done on the first day of the panel meeting. On the second day, the panel reviewed the ranked list of proposal and discussed the final ranking. The purpose of this discussion was to ensure that all panelists were satisfied with the ranking, as well as to identify any programmatic or budgetary issues that should be considered in the final recommendation. At least one NSF Program Officer was present during all the panel discussions. Final selections were made by Program Officers based on the review material and discussions subsequent to the panel review. The secondary panelists were responsible for writing the panel summaries for the proposals.

PROPOSAL NUMBER.: 0334383

INSTITUTION: Boston University

NSF PROGRAM: AERONOMY

PRINCIPAL INVESTIGATOR: Mendillo, Michael

PROPOSAL TITLE: CEDAR Postdoc: Photo-Chemistry and Neutral-Plasma Coupling at Earth and Mars

PANEL SUMMARY:

A variety of points were raised in the discussion. All agreed that Withers is an excellent young scientist who should be encouraged with funding. The MGS occultation data for Mars are of excellent quality and should be exploited. There was discussion of whether or not CEDAR is the right source of funding for this work. Comparing two planetary atmospheres/ionospheres would be breaking new ground for CEDAR, but perhaps this is an exciting new direction that we should follow? The most significant scientific reservation that was raised concerned the idea of comparing the effects of CMEs on Mars and Earth. A proper comparison would require the same CME to hit both planets, meaning the planets would have to be in opposition (which doesn't happen very often) when a strong CME occurred on the right part of the Sun. Any such events would thus be rare, but interesting if they occurred. Even if this never happened, though, the proposal is sound, and should be funded (perhaps with some contribution from the astronomy division of NSF?). The overall panel rating is between VG and Excellent, in good agreement with the written reviews.

PANEL RECOMMENDATION:

Recommendation Key: Fund = F, Fund If Possible = FIP, Do Not Fund = DNF

PROPOSAL NO.: 0334383

INSTITUTION: Boston University

NSF PROGRAM: AERONOMY

PRINCIPAL INVESTIGATOR: Mendillo, Michael

TITLE: CEDAR Postdoc: Photo-Chemistry and Neutral-Plasma Coupling at Earth and Mars

RATING: Very Good

REVIEW:

What is the intellectual merit of the proposed activity?

The proposed project addresses several questions about the ionospheres of Mars and Earth. The first objective, examining the scaling of electron densities with solar flux, is simple and straightforward. The second and third objectives (studying the ionospheric responses to CMEs and flares, and the effects of waves and tides) will be considerably more complicated, as they would seem to require identifying and extracting these transient effects from other large spatial/temporal variations in the MGS data. Finding Earth data with the same zenith angle, LST, and latitude as the MGS data at the same times that events of interest are occurring will likely also be a challenge. The plan to compare models with data is appropriate, although the proposal does not give much description how this will be done. The facilities and support at BU are very good.

Withers' scientific qualifications are excellent. He has successfully worked with MGS data, and has demonstrated the capability to make significant contributions in a number of fields. Even if the proposed research turns out not to be fully doable, it is clear he could readily adjust to work on other important problems.

Relevance to CEDAR: Good. Comparison of the ionospheres of Earth and Mars will contribute to the Solar-Terrestrial Interactions and Coupling with Lower Altitudes themes of CEDAR.

What are the broader impacts of the proposed activity?

This proposal will contribute to the development of scientific human resources by providing a postdoctoral scientist the opportunity to carry out significant research under the mentorship of a leading

scientist in the field.

Summary Statement

PROPOSAL NO.: 0334383

INSTITUTION: Boston University

NSF PROGRAM: AERONOMY

PRINCIPAL INVESTIGATOR: Mendillo, Michael

TITLE: CEDAR Postdoc: Photo-Chemistry and Neutral-Plasma Coupling at Earth and Mars

RATING: Very Good / *excellent*

REVIEW:

What is the intellectual merit of the proposed activity?

STRENGTHS:

As pointed out in the PI letter of support, this proposal addresses the issues of coupling between regions that CEDAR addresses. It extends terrestrial CEDAR to include Mars "CEDAR" and develop cooperative planetary CEDAR science. The science questions being addressed are central to core aeronomy. They are to be addressed by leveraging on the MARS planetary exploration missions. In this area the post-doc is an expert. Hence, the teaming of the PI, an ionospheric expert, and the post-doc makes this a very strong research team.

WEAKNESS:

The short proposal makes several wide sweeping statements that I don't fully appreciate. For example, the last sentence of Objective (1), page 2 of the Technical Plan. "In pursuing this objective, and in the details of production by photons and secondary electrons, CEDAR's 'Solar-Terrestrial Interactions' science initiative can be addressed, especially 'outstanding scientific questions' concerning the role of solar variability." My feeling on this is that it is over sold due to assumptions that will be made due to lack of observations, due to weather effects, etc., the results will be informative but not fundamental.

What are the broader impacts of the proposed activity?

STRENGTHS:

The grant will bring a planetary atmospheric post-doc into the CEDAR aeronomy community thereby creating stronger interdisciplinary links.

WEAKNESS:

The proposed research is not at the heart of CEDAR science. My view would be that it is excellent core aeronomy research.

Summary Statement

The fact that the research is not, in my view, at the heart of CEDAR is offset by bringing a planetary scientist into the aeronomy area. The experience for the Post Doc will be an excellent and broadening one.

My rating is: Very Good to Excellent

PROPOSAL NO.: 0334383

INSTITUTION: Boston University

NSF PROGRAM: AERONOMY

PRINCIPAL INVESTIGATOR: Mendillo, Michael

TITLE: CEDAR Postdoc: Photo-Chemistry and Neutral-Plasma Coupling at Earth and Mars

RATING: Excellent

REVIEW:

What is the intellectual merit of the proposed activity?

The work proposed in this application is novel and ambitious. The novelty lies in using the similarities and differences in the responses of the Martian and terrestrial atmospheres to understand physical processes in the Earth's ionosphere. Both downward and upward coupling will be explored. While different dynamical forcing induced by significant differences in planetary topography will be a complicating factor, Withers' background makes him well equipped to deal with this problem.

The research plan and timetable are clear. The ambitious scope of the proposal makes it arguable whether all aspects will be achieved, but many worthwhile results should be obtained.

Withers has an impressive track record and a broad range of experience that should nicely complement that of Mendillo and his team.

What are the broader impacts of the proposed activity?

Comparative planetology takes CEDAR in somewhat new direction but I think that such a study would be highly beneficial to the program.

Summary Statement

Outstanding proposal from an outstanding team.

PROPOSAL NO.: 0334383

INSTITUTION: Boston University

NSF PROGRAM: AERONOMY

PRINCIPAL INVESTIGATOR: Mendillo, Michael

TITLE: CEDAR Postdoc: Photo-Chemistry and Neutral-Plasma Coupling at Earth and Mars

RATING: Good

REVIEW:

What is the intellectual merit of the proposed activity?

This postdoc proposal addresses comparative planetary aeronomy between Earth and Mars. The proposed postdoctoral fellow will extend his work on the neutral upper atmosphere of Mars to investigate how similar regions of the martian and terrestrial ionospheres respond to similar forcings, e.g., from CMEs or solar flares. Model predictions for Mars will be tested against MGS radio occultation results. Specifically, the three main objectives of the proposed research are 1) to extend the application of a simple photochemical model of the ionosphere of Mars from a small subset of MGS radio occultation data to the entire data set; 2) to examine the MGS radio occultation data set to find the response of the martian ionosphere to CMEs and flares (and look for the terrestrial response to the same events); and 3) to look for the effects of neutral atmospheric waves and tides on small scale structures in the ionosphere.

This proposal was very brief, and very much lacking in details. For example, no mention is made that, in order for the responses at Earth and Mars to be comparable at all, the flares or CMEs must occur when Mars is at (or very near to) opposition, i.e., only every 2.1 years (not a large duty cycle - it means only MGS data around 4/24/99, 6/13/01, and 8/29/03 are suitable). If Mars and Earth are not lined up, then it would be pretty hard to show that they are responding to the same event. It would have been nice if a cursory search of SOHO data around the opposition dates had been made and a list of candidate events provided in the proposal. In addition, it wasn't clear how comparing the responses over a restricted range of latitudes, local times, and solar zenith angles at each planet would be preferable to comparing global characteristics.

It would have been nice if a letter of support for this research from the MGS radio science team could have been provided.

What are the broader impacts of the proposed activity?

Comparative planetology is a good idea, as it can highlight which physical processes are common and which are unique to Earth. As noted in the proposal, this is a good method for separating natural and anthropomorphic effects (e.g., the well-known example of the recognition from the

study of chlorine chemistry on Venus that CFCs might become a problem on Earth). Little comparative planetology gets done, and very little comparative planetary aeronomy, so this is a good area for research.

Summary Statement

This is a good topic for research, but this was a disappointing proposal - too brief and too vague. There are probably only a few solar events that would look "the same" from Mars and Earth (e.g., something large and distinct when Mars is at opposition), and it is not clear that suitable MGS RS data would be available for those times.