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SANTA BARBARA • SANTA CRUZ

(510) 642-1149
(510) 643-8302 fax
rlin@ssl.berkeley.edu

SPACE SCIENCES LABORATORY
7 GAUSS WAY
BERKELEY, CA 94720-7450

February 10, 2008

Macelwane Medal Committee
c/o American Geophysical Union
2000 Florida Avenue, NW
Washington, DC 20009

Dear AGU Medals Committee:

I am pleased to enthusiastically support the nomination of Professor Robyn M. Millan for the AGU James B. Macelwane Medal. Her accomplishments in research, teaching, and leadership are, to my knowledge, the most outstanding by far of any young space plasma physicist in the past five years.

I have known Robyn since fall of 1996, when she started as a graduate student in physics at Berkeley. The previous summer we had serendipitously detected the most energetic terrestrial x-ray burst ever observed, extending up to >~1.4 MeV (the instrumental limit) and far more energetic than anyone in the field had expected. Robyn assisted in the analysis of this burst, and was a co-author on the discovery paper. With my help, she then prepared a proposal to NASA and NSF to follow up on this discovery with a long duration (>~14 day) balloon (LDB) flight in the Arctic. The primary scientific objectives were to see how common these burst were, and to assess their importance for relativistic electron losses from the radiation belts. This proposal was selected for funding. In addition, Robyn also proposed for, and was awarded, a NASA Graduate Student Research Program Fellowship.

Robyn took the lead (with very little help from me) on the entire LDB project (named MAXIS - MeV Auroral X-ray Imaging and Spectroscopy), which included instruments and collaborators from several other institutions,. She planned the balloon flight, dealt with the National Scientific Balloon Facility (NSBF) personnel (not an easy task) in the integration of the payload with the balloon gondola, prepared her own high-resolution germanium spectrometer experiment, and led the launch and flight operations in Alaska. The instruments operated perfectly, but because of a malfunction in the NSBF support instrumentation, only ~2 days of data were obtained, with no MeV events detected. A reflight was attempted in June 1999, but after a month of preparations in the field and declaring flight ready, the campaign was cancelled when the Russian government refused overflight permission. However, Robyn was able to take advantage of a last minute cancellation to do the flight in Antarctica instead, in January 2000. The payload performed perfectly, providing 18 days of the best terrestrial X-ray observations ever obtained. At least nine MeV events were detected, all in the 1400-2400UT local time sector. The average rate of precipitation in these MeV bursts would empty the outer radiation belts of relativistic electrons in

a few days, thus establishing that these types of events were a major, previously unknown, loss mechanism. Robyn's careful analysis of these observations became her Ph.D. thesis.

While still a student, Robyn followed this up by collaborating with Dr. David Smith (the PI, now an associate professor at UC Santa Cruz) on a proposal to NSF for a multiple LDB balloon campaign (MINIS) from SANAE, the South African station in Antarctica. Robyn was a major contributor to this proposal, although as a student she could not be a co-investigator. The objective was to obtain the spatial and temporal behavior of these bursts, and to understand the physics of the precipitation mechanism.

Robyn then accepted a Research Assistant Professor position at Dartmouth after graduation in 2002; this gave her a chance to teach, something she was eager to do. She quickly generated her own research funding through successful proposals to NSF for further analysis of the rich MAXIS data set, and for an experimental program of her own to provide balloon-borne X-ray and optical (searching for associated proton precipitation) measurements in the northern hemisphere, conjugate to and simultaneous with the MINIS Antarctic campaign. The MINIS Antarctic and Robyn's northern hemisphere campaigns (balloons launched in the middle of winter in Canada!) were remarkably successfully, catching a major solar event in January 2005, and detecting prompt simultaneous electron precipitation at two widely separated balloon payloads in the Antarctic and at one of Robyn's payloads in the Arctic, when the CME shock arrived at the Earth.

In 2005 Robyn was appointed as a tenure-track Assistant Professor in the Dartmouth Department of Physics and Astronomy, under the NSF Faculty Development in Space Sciences program. She is certainly one of the outstanding successes of that program. I'm sure her appointment was based also on her excellent teaching record, but others can provide information on that.

In 2006, NASA started the Radiation Belt Storm Probes (RBSP) program with the aim of understanding the dynamics of the Van Allen radiation belts. Robyn immediately realized that balloon measurements with multiple platforms were the right complement to the RBSP spacecraft observations, providing an ideal way to directly detect precipitation losses from the belts and determining their spatial extent, and to probe directly the wave-particle interactions that precipitate the relativistic electrons, using spatial conjunctions with the RBSP spacecraft. Her BARREL ("Balloon Array for RBSP Relativistic Electron Losses") proposal was one of three Mission of Opportunity (MOO) proposals chosen for a Phase A study. Last month, NASA selected BARREL as the only MOO to go forward. As Principal Investigator, she will lead a nationwide team of BARREL researchers who will develop and launch 40 long duration balloon payloads in two campaigns from Antarctica to provide widespread spatial coverage in conjunction with RBSP spacecraft (launch 2012).

I know that Robyn is continuing to develop new ideas for cutting edge experiments - she is playing a central scientific role in a Small Explorer proposal for radiation belt studies, and she is developing new techniques for studying electron acceleration in lightning and for imaging gamma-rays.

To summarize, Robyn's research accomplishments have been remarkable – I know of no other space plasma physicist, especially an experimentalist, with a better record at this point in his or her career. The measurements she has already made have identified processes with major impact

on the radiation belts. She has developed a highly productive long term experimental program at Dartmouth from scratch, with major funding from NASA, as well as NSF, to answer some of the key questions in radiation belts physics. She is already a leader in this field, and she is leading a large team of scientists in a major project. Furthermore, she is doing a fine job of teaching courses and training research students. Thus, in all respects Professor Robyn M. Millan is an exceptionally gifted and accomplished young scientist and leader, and I am pleased to provide my strongest support for her nomination for the AGU James B. Macelwane Medal.

Sincerely,

Robert P. Lin
Professor of Physics & Director of the Space Sciences Laboratory
AGU Fellow & Member of the National Academy of Sciences