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Abstract:

This report describes the first year of training and progress of Mr. J. J. Blanchette toward a Ph. D. in Physics, with specialization in Solar Physics. Mr. Blanchette has met all academic requirements to proceed with thesis research. He is a full-time graduate research fellow, and he has gained a good background in solar activity research. He has taken on the task of implementing the focal-plane functions of the Target Selector Telescope of the Flare Genesis Experiment, a balloon-borne telescope for solar activity research. During the report period, Mr. Blanchette presented a description of his work on solar active region NOAA 7260 at the 24th Meeting of the Solar Physics Division of the AAS.

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During this first year of his AASERT fellowship, Jeffrey J. Blanchette completed all academic requirements to proceed with full-time thesis research, The subject area of his thesis will be solar magnetic field measurements and their interpretation. Toward that end, Mr. Blanchette has been working with the Flare Genesis Experiment team to build a balloon-borne magnetograph. Under the guidance of his advisor at the Applied Physics Laboratory, Dr. David M. Rust, he has gained enough background in solar physics so that he can now contribute to observational, analytical, and presentation efforts. Mr. Blanchette is currently determining the precise topic of his thesis research.

Mr. Blanchette passed his Comprehensive Examination required by the Johns Hopkins University in October 1992. All coursework required by the Department of Physics and Astronomy was completed by the end of the '92 fall semester.

Now a member of the Flare Genesis Experiment team, Mr. Blanchette has been given the responsibility of integrating the Target Selector Telescope's optical assembly. This telescope will operate during a test flight of the balloon-borne solar magnetograph in January 1994. Mr. Blanchette is charged with identifying problems with the assembly's operation and recommending additional components, if any, required for its completion. Other project support activities included restoration of the 6-inch telescope in the APL Solar Observatory so that it could be used in testing magnetograph equipment and the planning of a single-mirror alt.-az. computer-operated heliostat to be used to test the Target Selector Telescope.

Mr. Blanchette's training as an observational astronomer has not been neglected by his advisor. Blanchette and Rust used APL's 10-inch Solar Vector Magnetograph (SVMG, the proof-of-concept instrument for the Flare Genesis Experiment) at the Sacramento Peak, New Mexico, facility of the National Solar Observatory. This magnetograph is operated by APL in cooperation with the staff of the Phillips Laboratory Solar Research Branch. During a ten-day observing effort, Mr. Blanchette became familiar with the instrument's capabilities. He is now proficient in its operation. He has also learned the theory behind the methodology used to analyze the observations. Mr. Blanchette has become a proficient user of the IDL programming language and now regularly uses the team's magnetograph software to analyze recent observations. As one of its primary users of the software, he is in a position to recommend improvements. Several upgrades of the magnetogram analysis software have resulted from his experience with it.

In August 1992, a new guider was installed on the SVMG and excellent observations of a large sunspot group (NOAA 7260) were obtained. An analysis of these observations were presented at the AAS Solar Physics Division meeting in July 1993. The title of the report was "Vector Magnetography of a Large Sunspot," by J. J. Blanchette, D. M. Rust, G. A. Murphy, (JHU/APL), G. Cauzzi (Arcetri Obs.), S. Keil (AF Phillips Lab), K. S. Balasubramaniam (NSO). Here is a short summary of the work: On August 18, 1992, a large and almost circularly symmetric spot crossed the central meridian of the Sun. Using the new solar vector magnetograph (Rust, O'Byrne and Harris, *Johns Hopkins APL Tech. Dig.* **9**, 349 (1988)), we measured the magnetic fields in this sunspot for several days prior to and after central meridian passage. Since there is general agreement on the principal characteristics of the magnetic fields in such spots, these observations offered an opportunity to check the validity of the SVMG measurements. And since there is still controversy about some details concerning sunspot magnetic fields and their evolution, our measurements may also be helpful in the broader context of the physics of sunspots. We used the so-called weak-field approximation to the Stokes profiles to convert our polarization signals into magnetic field maps. Since the spectral line used is the relatively insensitive Ca I line at 6122.2 Å, the weak field approximation extends to > 2000 G for the SVMG measurements. Comparisons of the SVMG data with those from Kitt Peak and Tokyo yielded good agreement. Independent, interleaved series of SVMG observations in two closely adjacent wavelengths yielded almost identical results. Qualitatively, the vector field maps show the effect of the changing line of sight as the large spot of NOAA 7260 moved from 27 degrees East to 25 degrees West of the central meridian. However, the field structure in the spot changed during the five-day interval. Comparison of the field direction with penumbral fibril direction did not always yield good agreement. This may be due to line-of-sight effects, as described, for example, by Kalman (*Solar Phys.* **135**, 299-317 (1991).

Mr. Blanchette will continue to work on the SVMG data and on a joint paper on the August 1992 observations that will be submitted for publication in The Astrophysical Journal. In the succeeding years of the fellowship period he will continue to combine instrument and software development with analysis of solar data. Soon Mr. Blanchette will be selecting his thesis research topic, one that will lean to the strengths of the balloon-borne magnetograph to make high resolution observations over a 10 - 14 day contiguous interval to study the evolution of magnetic field structure in solar active regions.