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Contract/Grant No.:	NASA-G-NAG5-2649
Project Name:	The encounter of P/Shoemaker-Levy 9 with the Jovian plasma and extended sodium cloud
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Preparation Date:	October, 1997
Report Type:	Final report
Period Covered:	July 1994 - July 1996
Project Director:	R. J. Niciejewski
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FINAL REPORT FOR GRANT NAG5-2649

I. Preamble

The grant entitled "The encounter of P/Shoemaker-Levy 9 with the Jovian plasma and extended sodium cloud" was submitted to NRA-093-OSS-07 in November, 1993, by Dr. R. Oliversen of NASA-Goddard Space Flight Centre. Co-investigators included the author of this report as well as Prof F. Scherb of the University of Wisconsin. Initial funding was received in July, 1994, in time to initiate observations of the Jovian plasma torus and extended sodium cloud. A no-cost extension to the original one year grant permitted continued study of cometary spectra as well as instrumental refinement.

This report describes the work performed for the grant. It consists of a brief synopsis of the goals of the grant and a summary of the observations conducted during the lifetime of the grant.

II. Introduction

The encounter of comet P/Shoemaker-Levy 9 with Jupiter during July, 1994, provided an unprecedented opportunity to observe any potential perturbations in the Jovian plasma torus and extended sodium cloud as the comet entered the planet's atmosphere. Though the most obvious affect of the encounter was the distinctive response of the visible disk to the impact of the cometary fragments, the potential disruptions to the extended Jovian atmosphere and the restoration of the system to equilibrium also provided a test for the current interpretation of the Jovian plasma torus and sodium magneto-nebula.

The observations that were performed for this grant were made by a complementary group of researchers and could not have been made if the individuals worked singly. In a sense, the exciting opportunity provided by this astronomical event also provided a mechanism to test the potential of pooling limited resources from several sources to construct a state-of-the-art spectrally resolving instrument, to acquire the necessary time and resources

from institutions that maintain world-class optical telescopes, to perform the observations with the assistance of students, and to analyze the data sets.

III. Scientific goals and accomplishments

The tasks outlined in the grant application and the methods by which they were accomplished are listed in the following table.

1. Construct an experiment for performing observations of plasma emissions in the vicinity of Jupiter.	A double-etalon scanning/imaging Fabry-Perot spectrometer was constructed and mounted on the MDM 2.4 m telescope at Kitt Peak.
2. Construct an experiment for performing observations of neutral sodium emissions in the vicinity of Jupiter.	A double-etalon scanning/imaging Fabry-Perot spectrometer was constructed and mounted on the McMath solar telescope at Kitt Peak.
3. Perform observations of plasma emissions in the vicinity of Jupiter.	Difficulties were encountered in observing Jupiter since the elevation of Jupiter in the dark sky was below the 'safety' elevation for the telescope.
4. Perform observations of neutral sodium emissions in the vicinity of Jupiter.	a) A series of observations were performed of neutral sodium in the vicinity of Jupiter. Since the elevation angle was low, the line of sight column included a great deal of terrestrial sodium emission. Attempts at extracting Jovian sodium emission were not successful. b) The observational cycle was disrupted by the appearance of monsoon related clouds and rain during most of July. The ratio of clear to cloudy nights during the cometary encounter period was less than 50%.

5. Student training	a) One student from the University of Michigan was trained in the use of instrumentation at Kitt Peak: Ms. Lisa Gillikin b) One student from the University of Wisconsin was trained in the use of instrumentation at Kitt Peak: Mr. Kurt Retherford

IV. No-cost extension remarks

In the the no-cost extension period of NAG5-2649, observations of Comet B-2 Hyakutake were performed at NASA Goddard's 36-inch telescope. This comet made its closest approach to Earth on March 25 and its nearest approach to the sun in early May. Observations of the comet using the Kitt Peak Fabry-Perot spectrometer were performed at the coude focus of the Goddard telescope. The success of this experiment was potentially much greater than that of the Shoemaker-Levy 9 Jovian encounter since i) a large block of telescope time was assured by the director of the Goddard observatory who was one of the original proposers for this project; ii) the comet was visible for a long portion of the night during late March, becoming circumpolar.

The goal for the observation cycle of Comet Hyakutake was to perform high spectral resolution measurements of the neutral and plasma wind field employing i) H_2O^+ filters; ii) an OI (6300Å) filter; and iii) an NaD filter. The measurements were to be completed by the end of April. Difficulties were encountered with opening the roof of the observatory as well as a degradation in the detector. The experience proved beneficial as a testbed for constructing another more sensitive system for the encounter with Comet Hale-Bopp.