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Extrasolar Research Corporation

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Re: NAS5-97066

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Publication and Graphics Services Division
Goddard Space Flight Center, Code 253.1
Greenbelt, MD 20771

Dear Publication and Graphics Services Division,

Enclosed please find the item "NAS5-97066 Quarterly Report 7 of 8". An invoice for this item has been sent at this same time to the Financial Management Division.

With best regards,

Susan Terebey

Dr. Susan Terebey

Notes:

Contract Specialist: Loren Kruger
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NAS5-97066 Quarterly Report 7 of 8

22 Mar 1999

PROGRESS REPORT FOR ASTROPYSICS DATA PROGRAM CONTRACT NAS5-97066

by S. Terebey, Extrasolar Research Corp.

Progress report for the astronomy research proposal entitled "The Contribution of Ionizing Stars to the Far-Infrared and Radio Emission in the Galaxy"

by Dr. S. Terebey (PI), Extrasolar Research Corp., Pasadena CA,
Dr. M. Fich (co-I), Dept. of Physics; Univ of Waterloo, Waterloo CAN
Dr. R. Taylor (co-I), Dept. of Physics and Astronomy; Univ. of Calgary, Penticton CAN

PROGRESS THROUGH 1999 QUARTER 1, Feb 99 - Mar 99

Terebey continued analysis work on the W4 HII region, investigating a model where vigorous stellar winds are responsible for evacuating a cavity, pushing the interstellar material outward into a thin exterior shell.

During this quarter substantial progress was made on the analysis of the W4 shell.

1. Resolution matched IRAS and DRAO images were constructed. Software was writen in IDL to measure spatial resolution, and to compute the necessary gaussian beam matching kernel. Images were convolved to generate sets of images with the same spatial resolution. Set 1: IRAS 60 micron and DRAO 21 cm and 74 cm continuum. Set 2: IRAS 60 micron and 100 micron.

2. The IRAS dust temperatures were derived across the W4 image. There is a hot spot in the temperature map at the position of the IC1805 cluster which conclusively shows the cluster stars are indeed responsible for heating the surrounding dust. Elsewhere in the W4 shell the derived dust temperature is nearly constant, measuring 37K +/- 2K. The near uniform temperature suggests Lyman alpha heating of dust, a theoretical effect which this data nicely supports. The temperature map was constructed in a series of stages. Step 1- A model for the background emission was generated by making integrated 21 cm line images and multiplying by the HI to IRAS 100 conversion given in Terebey and Fich 1986, Astrophysical Journal Letters, vol 309, p73. This background model was subtracted from the IRAS 60 and 100 micron images, to remove structure unrelated to W4. Step 2- flux ratio maps were constructed from the beam-matched IRAS 60 micron and 100 micron. Step 3- the dust temperature was derived for each pixel, using an algorithm which color-corrected the IRAS data.

3. An optical depth map was derived using the IRAS 100 micron image and the previously derived dust temperatures. Typical optical depths are several by 10^(-4), which show the optical depth is small at 100 microns as expected. The total derived mass in the shell is about 10,000 solar masses. The optical depth image clearly shows there is dense interstellar material directly below the W4 shell; the detection of this dense gas and dust supports the hypothesis that the lower half of the W4 supershell "ran into a brick wall" and stalled, whereas the upper half achieved "breakout", forming a Galactic chimney.

PROBLEMS FOR CURRENT PERIOD

There were no significant problems encountered this quarter.

PLANS FOR 1999 QUARTER 2

Next quarter's goals are to make progress in the following area of the W4 HII region research:

1. Continue work writing a draft manuscript "Radio and Infrared Images of the W4 Supershell" which summarizes the main results of fitting the southern W4 loop using a wind-blown shell model.

2. Continue the quantitative calculations which are to be quoted in the text for the derived radio and infrared parameters such as optical depth, temperature, and luminosity.

REPORT DOCUMENTION PAGE

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13. ABSTRACT ***(Maximum 200 words)***

S. Terebey describes research activities undertaken during the seventh of eight quarterly reporting periods. These include progress on the analysis of the W4 HII region, by constructing dust temperature and optical depth maps from IRAS 60 and 100 micron images and DRAO 21 cm images. The temperature map conclusively shows that the IC1805 star cluster heats the W4 shell. The optical depth map shows dense interstellar material directly below the shell, showing the lower W4 shell "ran into a brick wall" and stalled, whereas the upper W4 shell achieved "breakout" to form a Galactic chimney.

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