**FINAL REPORT** [1]

NASA Grant No. NAGW-3938

# JOINT U.S.–JAPAN OBSERVATIONS WITH THE INFRARED SPACE OBSERVATORY (ISO): DEEP SURVEYS AND OBSERVATIONS OF HIGH-Z OBJECTS

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Period Covered
January 15, 1994 to September 30, 1997

[1] This is a continuing multiyear project that has been reassigned by NASA to the ISO Block Grant NAG5-3370 to the University of Hawaii (Dr. Robert D. Joseph as the block grant Principal Investigator). This final report, which closes out NAGW-3938, is identical to the progress report for this project that has been submitted for NAG5-3370 since NAGW-3938 was given a no cost extension to overlap for one year with NAG5-3370.

Several important milestones were passed during the past year of our ISO observing program:

(1) Our first ISO data were successfully obtained. ISOCAM data were taken for our primary deep field target in the 'Lockman Hole'. Thirteen hours of integration (taken over 4 contiguous orbits) were obtained in the LW2 filter of a $3' \times 3'$ region centered on the position of minimum HI column density in the Lockman Hole. The data were obtained in microscanning mode. This is the deepest integration attempted to date (by almost a factor of 4 in time) with ISOCAM.

(2) The deep survey data obtained for the Lockman Hole were received by the Japanese P.I. (Yoshi Taniguchi) in early December, 1996 (following release of the improved pipeline formatted data from Vilspa), and a copy was forwarded to Hawaii shortly thereafter. These data were processed independently by the Japan and Hawaii groups during the latter part of December 1996, and early January, 1997. The Hawaii group made use of the U.S. ISO data center at IPAC/Caltech in Pasadena to carry out their data reduction, while the Japanese group used a copy of the ISOCAM data analysis package made available to them through an agreement with the head of the ISOCAM team, Catherine Cesarsky.

(3) Results of our LW2 Deep Survey in the Lockman Hole were first reported at the ISO Workshop "Taking ISO to the Limits: Exploring the Faintest Sources in the Infrared" held at the ISO Science Operations Center in Villafranca, Spain (VILSPA) on 3-4 February, 1997. Yoshi Taniguchi gave an invited presentation summarizing the results of the U.S.-Japan team, and Dave Sanders gave an invited talk summarizing the results of the Workshop at the conclusion of the two day meeting. The text of the talks by Taniguchi and Sanders are included in the printed Workshop Proceedings, and are published in full on the Web. By several independent accounts, the U.S.-Japan Deep Survey results were one of the highlights of the Workshop; these data showed conclusively that the ISOCAM S/N continues to decrease as the square root of time for periods as long as 13 hours.

New Publications:

Preliminary results of the ISOCAM deep survey for primeval galaxies, Taniguchi, Y., Kawara, K., Okuda, H., Matsumoto, T., Wakamatsu, K., Sato, Y., Cowie, L., Sanders, D. B., Joseph, R., Wynn-Williams, G., Chambers, K., Desert, F. X., Sofue, Y., & Matsuhara, H. 1997, in *Taking ISO to the Limits: Eploring the Faintest Sources in the Infrared*, eds. R.J. Laureijs, D. Levine (ESA Workshop Proceedings)

Review of Workshop, Sanders, D. B. 1997, in *Taking ISO to the Limits: Eploring the Faintest Sources in the Infrared*, eds. R.J. Laureijs, D. Levine (ESA Workshop Proceedings)

ISOCAM 7-micron deep survey of the Lockman Hole: A mid-infrared search for primeval galaxies, Taniguchi, Y., Cowie, L., Sato, Y., Sanders, D. B., Kawara, K., Joseph, R., Okuda, H., Matsumoto, T., Wynn-Williams, C. G., Matsumoto, T., Chambers, K., Wakamatsu, K., Desert, F. X., Sofue, Y., & Matsuhara, H. 1997, A&A, submitted

Plans for the coming year:

(1) It was recently agreed that the remaining 18 hours allotted to the Deep Survey Program would be used to obtain ISOCAM (LW2) data for a single field in the region SSA13. These observations are expected to be executed during July-August, 1997, and will be fully analyzed during the next year of the NASA grant.

(2) A more thorough analysis is planned for all of our deep survey data using better techniques for fitting cosmic ray 'glitches' and better registration techniques for coadding individual frames. Part of this work is planned to be carried out in consultation with ISOCAM experts at the ISOCAM data center in Saclay and with experts at the U.S. ISO data center at IPAC/Caltech.

(3) Comparison of the ISOCAM data with ground-based observations at optical and near-infrared wavelengths will be used to test the reliability of source identification and to identify extremely red sources seen in the LW2 filter but not at K-band.