ASTRO-F

Large-Scale Surveys
&
Mission Programs

2005/09/12

ASTRO-F Program Committee

List of Large-Area Surveys (LS) and Mission Programs (MP)

ID	Title	Contact Person	Planned No. of Pointings
LSASS	All-Sky Survey	H. Shibai	N/A
LSNEP	North Ecliptic Pole (NEP) Survey	H. Matsuhara	954
LSLMC	Large Magellanic Cloud (LMC) Survey	T. Onaka	866
LS Subtotal			1820

ID	Title	Principal Investigator	Approved Number of Pointhings		
			Priority A	Priority B	Priority A+B
AFSAS	ASTRO-F Studies on Star Formation and Star Forming Regions	M. Ueno	400	400	800
AGBGA	Mass Loss and Stellar Evolution in the AGB phase	Y. Nakada	112	112	224
AGNUL	Evolution of ULIRGs and AGNs	T. Nakagawa	50	50	100
CLEVL	Evolution of Clusters of Galaxies	H.-M. Lee	173	173	346
CNIRB	ASTRO-F Observations of Cosmic Near-Infrared Background Radiation	S. Matsuura	0	0	0
FBSEP	ASTRO-F Observations of Cosmic Far-Infrared Background Radiation and Distant Infrared Galaxies in Low-Cirrus Region near South Ecliptic Pole	S. Matsuura	270	0	270
FISS3	FIS Serendipitous Spectroscopic Survey	M. Kawada	0	0	0
FUHYU	Spitzer Well Studied Field Mission Program	C.Pearson	25	25	50
GALEV	Dusty Star-Formation History of the Universe	H. Matsuhara	40	26	66
ISMGN	Interstellar Dust and Gas in Various Environments of our Galaxy and Nearby Galaxies	H. Kaneda	250	242	492
MLHES	Excavating Mass Loss History in Extended Dust Shells of Evolved Stars	I. Yamamura	100	100	200
NIRLT	Near Infrared Spectroscopy of L and T Dwarfs	I. Yamamura	25	25	50
SOSOS	Origin and Evolution of Solar System Objects	M. Ueno	176	178	354
SPICY	Unbiased Slit-less Spectroscopic Survey of Galaxies	T. Wada	100	100	200
VEGAD	Debris Disks around Main Sequence Stars and Extra-solar Zodiacal Emissions	H. Murakami	216	216	432
MP Subtotal			1924	1639	3584
Total					5404

ASTRO-F Large-Scale Survey Program	Date: 05/08/12
Title (Abbreviation)	LSASS
Title (Full)	The ASTRO-F All-Sky Survey
Contact Person	Shibai, Hiroshi E-mail: shibai@nagoya-u.jp Graduate School of Science, Nagoya University
Total No. of Pointings	(N/A)

Abstract:

The ASTRO-F All-Sky Survey is an unbiased infrared survey of the whole sky, following the IRAS All-Sky Survey made in 1983. Compared to the IRAS Survey, the wavelength coverage is extended to longer, and the spatial resolution and the point source sensitivity are improved by a factor of several to several tens. The survey wavebands are centered at 9, 20, 60, 90, 140, and 160 microns, respectively. ASTRO-F will allocate the survey scans primarily in Phase I, and supplemental scans in Phase II for completeness of the sky coverage and for reliability and sensitivity. The result of them, more than 90 % of the whole sky can be observed two or three times, more than 40 % of the sky by six times, and much deeper at near the both ecliptic poles. The products planned are a bright point source catalog at the earliest stage, two ore more faint source catalogues at later stage, as well as maps of extended sources. Those products are expected to be a fundamental database for the next generation of advanced observatories, for example Herschel, and JWST, and will complement the SIRTF mission by virtue of its wide sky coverage. The scientific fields covered by the All-Sky Survey spread over most part of modern astronomy /astrophysics, such as, solar-system objects, star-forming regions, young stars, Vega-like stars, late-type stars, SNRs, interstellar matter, near-by galaxies (including Magellanic Clouds), AGNs, star-forming galaxies, large-scale structure of the universe, and cosmology. Follow-up studies are crucial to achieve significant scientific results in many topics.

Expected Performance of Instruments

The expected performance values concerning to the All-Sky Survey are listed in Table 1. The detection limit values are for 5 σ in one scan, though these values will possibly be updated on the ASTRO-F URL when new test data become available. Final values will only be fixed after the performance verification (PV) phase on orbit. By repeating scans, the detection limit can be improved by reducing the electrical noise and the random photon noise. The spatial resolution of 9 and 20 micron bands are limited by the pixel size (not a real size, but an effective size after summing up). The resolution of longer four bands are mainly limited by the diffraction limit which are 1.5 to 2 times larger than the pixel size listed. The comparison of the ASTRO-F performance with SST has been made in papers (e. g. Matsuhara et al. 2005 and Shibai 2004).

Table 1. Basic Performance of Focal Plane Instruments for All-Sky Survey

Band	S9W	L20W	N60	WIDE-S	WIDE-L	N160
Wavelength (μm)	6-11.5	14-26	65	90	140	160
Pixel Size	9.4”	10.0”	30”	30”	50”	50”
Point Source (mJy)	80	130	1000	200	400	800
Saturation Limit (Jy)	36	93	90 [b]	30 [b]	200	300
Diffuse Source (MJy/sr)	24	32	7.5 [a]	2.5 [a]	2[a]	5
Saturation Limit (GJy/sr)	-	-	0.6 [b]	2.3 [b]	3	12

a in Co-Add Mode, 3 times worse in CDS Mode.
b Photometric Saturation Limit

Observation Plan

For the All-Sky Survey, the survey mode operation is used. In this mode, the telescope direction scans along a circle perpendicular to the Sun with the period same as the revolution period of 100 minutes. The telescope direction can only be shifted by ± 1 degree from the direction perpendicular to the Sun. Hence, the survey paths are nearly aligned to the ecliptic longitudinal lines. As the orbit is a sun-synchronous one, the axis of the survey circle must be shifted with approximately 4.1 arc-minutes spacing in average. As the cross-scan width of the array is 8.2 arc-minutes (FIS-SW) or wider, each position of the sky can ideally be observed more than two times with subsequent orbits (“hours confirmation”), and the whole sky can ideally be achieved in a half year of Phase I.

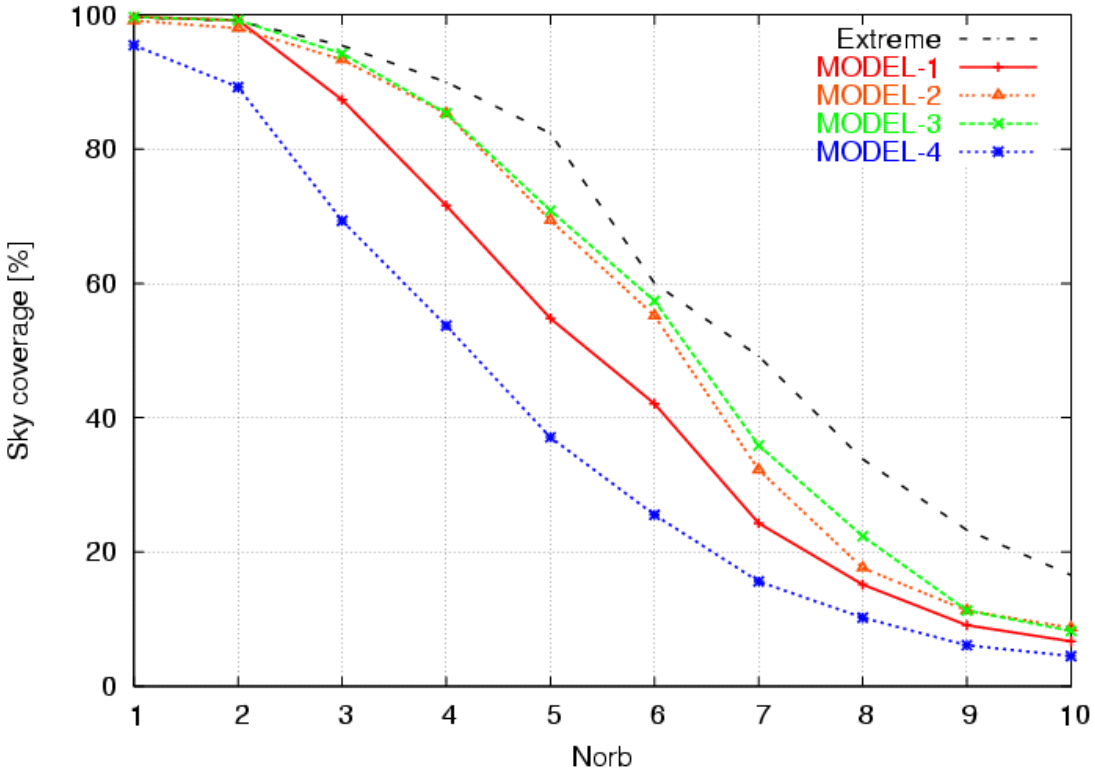

Figure 1. Result of Simulation of the sky coverage in case that the remaining time after allocation of pointing observations is allocated to all-sky survey. Models 2 and 3 are nominal cases.

3. Data Products

It is required to make and publish various data products as soon as possible and as perfectly as possible. Considering the case of ASTRO-F All-Sky Survey, we are planning to make and publish the following data products (see also Table 1).

The first catalog will be the "ASTRO-F Flux of Known Sources" containing known astronomical catalogues (primarily IRAS PSC and FSC) with the flux observed by ASTRO-F All-Sky Survey at the same position of the sky. Addition of the longer FIR fluxes and cross checking among both observations is useful as it alone. This product is expected to be automatically made during observation.

The Bright source catalog is constructed as the next product by confirmation between two independent point source detections in one scan above 5 σ. In case of ASTRO-F, this is not "hours" confirmation, but has similar process to the "hours" confirmation of the IRAS survey. The coverage can be the whole sky, and the product will be completed within one year after the end of all necessary survey scans. The detection limit is not improved from the one-scan sensitivity.

The Faint source catalog is produced by point source extraction "after" merging all available scans. So, the detection limit will be improved ideally by a factor of square root of Norb. If this process is applied only to the sky for Norb ≥ 3, the detection limit is improved by almost twice. It is expected to be needed additional 1.5 years after the Bright source catalog.

Advanced point source catalogues can be made for a limited area of the sky which has Norb ≥ 6 or more so as to obtain much better sensitivity. The detailed plan has not been fixed yet.

Extended source images are highly required for ASTRO-F's unique sciences, and they will be made as the second priority after point source catalogues. However, since the amount of work needed to produce image maps depends on the detector characteristics in space (the instruments were designed mainly for point sources not for extended sources), it is not easy at present to assess the quality of products, man power and the time needed for it. As far as areas in which the detector is stable and can be well calibrated concerned, image maps will be able to be made not so late. On the contrary, the all-sky image will take much longer time for production.

Table 2. Data Products from All-Sky Survey

Product Name	Survey Area (Norb)	FIR Detection Limit	Release Date
ASTRO-F Flux of known sources	40,000 sq. deg. Norb ≥ 2	> 200mJy (WIDE-S) > 400mJy (WIDE-L)	During survey
Bright Source Catalog	40,000 sq. deg. Norb ≥ 2	200mJy (WIDE-S) 400mJy (WIDE-L)	EOS + ≤1 yr
Faint Source Catalog	36,000 sq. deg. Norb ≥ 3	120mJy (WIDE-S) 240mJy (WIDE-L)	BSC + ≤1.5 yr
Advanced Faint Source Catalog (T. B. D.)	16,000 sq. deg. Norb ≥ 6	80mJy (WIDE-S) 160mJy (WIDE-L)	
Deep Survey Catalog near Poles (T. B. D.)	7 sq. deg. Norb ≥ 100	20mJy (WIDE-S) 40mJy (WIDE-L)	
Extended Source Imagelets (T.B.D.)	40,000 sq. deg.		
ASTRO-F Intensity Maps (T.B.D.)	40,000 sq. deg.		

References

Matsuhara, H., Shibai, H., Onaka, H., et al., "The ASTRO-F Mission: Large Area Infrared Survey", Advances in Space Research, in press, 2005.

Pearson, C. P., Shibai, H., Matsumoto, T., et al., "ASTRO-F, super-IRAS, the All-Sky Infrared Survey", MNRAS, 347, 1113-1129, 2004

Shibai, H., "ASTRO-F mission", Advances in Space Research, 34, 589-593, 2004.

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ASTRO-F Large-Area Survey Program	Date: 05/08/12
Title (Abbreviation)	LSLMC
Title (Full)	The ASTRO-F LMC Survey
Contact Person	Onaka, Takashi E-mail: onaka@astron.s.u-tokyo.ac.jp Department of Astronomy, Graduate School of Science, University of Tokyo
Total No. of Pointings	866 pointings

Abstract:

This Large Area Survey (LSLMC) plans to observe about a 15-square-degree area of the Large Magellanic cloud with the ASTRO-F/IRC using 866 pointing observations. The area will be observed with 5 filters (N3, S9, S11, L15, and L24) and the prism (NP) of the IRC in the observing mode of 2-filter observation per pointing (IRC02). These observations together with the FIS all-sky survey observations provide a new significant database for the various researches of the LMC. Particularly mid-infrared images of S11 and L15, the NIR spectroscopy, and the FIS 4-band data are unique to the ASTRO-F, which the SST will not be able to provide. The expected data can address a number of astrophysical problems, ranging from birth to death of stars, including protostars, late-type stars, super nova remnants, and interstellar medium, and give us a first insight into detailed material circulation in a galaxy. The 5-band + prism data can distinguish and identify the nature of detected objects, such as proto-stellar objects, young stellar objects, or asymptotic giant branch (AGB) stars. This survey is expected to detect most of Herbig Ae/Be stars and easily find out dusty AGB stars in the LMC. The spectra will elucidate the physical conditions and properties of the interstellar dust and gas in terms of the unidentified infrared bands and the mid-infrared continuum. We plan to provide a point source catalog within a year after the completion of the observations, followed by a faint source catalogue, mosaic images, and spectroscopic data.

I. Background

The Large Magellanic Cloud (LMC) offers a unique place for the study of an extragalactic object in detail owing to its proximity (~50kpc) and nearly face-on geometry. The metallicity of the LMC is known to be one quarter of solar. Because of these characteristics there have been a number of survey projects of the LMC in various wavelengths to study and characterize its properties (HI: Luks & Rohlfs 1992; Kim et al. 1998, Hα: Kennicutt & Hodge 1986, Soft X: Snowden & Petre 1994; CO: Mizuno et al. 2001; NIR: Nakajima et al. 2002). The MSX mission has provided complete MIR data for the LMC (Egan et al. 2001), which is the deepest in the MIR at present, but whose detection limits are 45 and 1100mJy at 8 and 21μm, respectively, and still too shallow to compare with survey observations in other wavelengths. Therefore a deep MIR survey of the LMC will be a very valuable database for the various astronomical researches of the LMC.

The material in a galaxy is evolved through various processes. Stars are formed in interstellar clouds by accreting the interstellar matter and then become young stellar objects (YSOs), such as T Tauri stars or Herbig Ae/Be stars. Low-mass stars evolve into the Asymptotic Giant Branch (AGB), during which they lose their envelope by mass-loss and supply dust grains and gas to the interstellar space. High-mass stars end their lives as supernovae and enrich the interstellar medium with a large amount of synthesized elements. Supernova remnants (SNRs) are created by supernova explosion, which interact with the surrounding medium and may trigger next star-formation. Interstellar grains play an important role in every aspect of these interstellar processes, including star-formation. All of these phenomena can be studied most effectively in the infrared, from 2–200μm, and ASTRO-F observations of the LMC will provide a first opportunity to make a thorough study of these material circulation processes and local star-formation history of the LMC in a galactic scale owing to its wide spectral coverage and high sensitivities together with the sufficient spatial resolution.

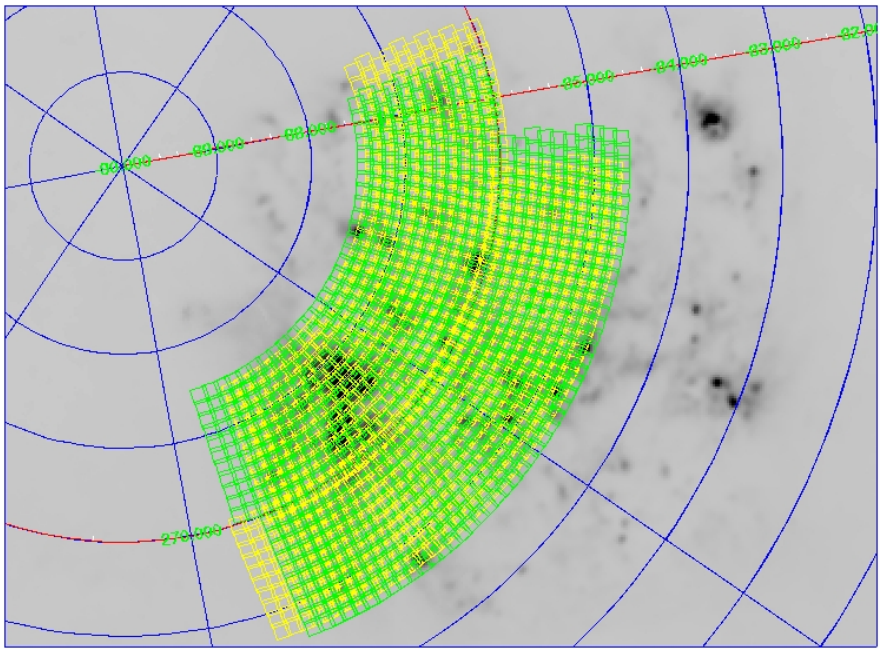

Figure 1. Observation area. The green grids indicate the field of view of the NIR/MIR-S and the yellow ones those of the MIR-L.

II. Observation Plan

We plan to carry out observations of a large area (~ 15deg^2) survey of the LMC with 5 filter bands of the IRC – N3, S7, S11, L15, and L24 and the NIR prism (NP). We plan to make 2 filters per pointing observations with the IRC02 mode. The area to be observed is shown in Figure 1. It consists of a fan-shaped area that includes the 30Dor and molecular ridge regions, the optical bar, several supergiant shells, and supernova remnants. The expected detection limits (5σ) are about 7μJy with N3, 60–70μJy with S7 and S11, and 120 and 310μJy with L15 and L24, respectively. In the prism mode (NP) the continuum of about 20μJy is expected to be detected with 5σ. However, the detection limits of N3 and NP are likely to be limited by confusion in crowded regions rather than the above values. Confusion will not be severe for the MIR bands (λ > 10μm) at all.

We will have 866 pointing observations (each field of view will overlap with the next field by 2 arcminutes) to cover the area shown in Figure 1. We will use about 5 orbits per day to complete the survey. The fields of view locations of the NIR/MIR-S and the MIR-L are different, but will overlap with each other by making observations of contiguous regions as shown in Figure 1. Additional 20 pointing observations with the IRC04 mode (spectroscopy in the MIR) are also planned to complement the present survey as part of the interstellar medium mission program (ISMGN).

III. Scientific Objectives

The ASTRO-F LSLMC will study astrophysical processes in a galaxy from the birth to death of a star. The IRAS survey has detected protostars in the LMC only brighter than 10^5Lo. The FIS survey will drastically improve the detection limit down to (2–5) ×10^3Lo owing to its smaller beam size and higher sensitivity, providing an unbiased sample of protostars for M > 10Mo in an extragalactic object for the first time. The IRC survey can detect Elias 29 at the distance of the LMC (L~36Lo; Boogert et al. 2002) and will detect the brightest end of low-mass protostars in the NIR to MIR. The wide spectral coverage (3–26μm) with a sufficient number of filters enable us to easily identify the nature of the detected objects. Particularly the spectroscopy in the NIR (NP mode) will provide an unprecedented database for the study of point sources in the LMC.

The present survey can detect most of Herbig Ae/Be stars in the LMC and distinguish them from other objects, such as regular Be stars. It can also detect dusty AGB stars that have undergone strong mass-loss (Tanabe et al. 2004). Mid-IR data of the present observation will facilitate the classification of M-type or C-type stars and allow us to estimate the mass-loss rate from the silicate band emission quantitatively.

There are more than 40 SNRs known in the LMC and only 10 of them have been detected by IRAS. The present observation will observe most of them and will study the spectral energy distribution (SED) and the interaction with the surrounding medium. The observation area includes several supergiant shells as well. The SED of the emission from interstellar matter with different

physical conditions (from vicinity of molecular clouds to supergiant shells) will be obtained and the evolution of interstellar matter can be investigated. The continuous coverage from 3 to 26μm and the FIS 4 bands in the FIR will provide the NIR to FIR SED over a galactic scale for the first time, from which the properties of the unidentified infrared (UIR) bands and the MIR excess emission can be studied with respect to the FIR emission (Onaka 2000).

IV. Data Products

We plan to produce the data products as summarized in Table 1. We will process the imaging data right after the observations through a standard pipeline and make it available for further study. The first point source catalog (PSC) will be created by a standard pipeline and planned to be released to internal use about within one year after the completion of the observations. A revised version of the PSC (Faint source catalog: FSC), which improves the detection limit of the first catalog, is planned to be prepared within a year after the first PSC. A mosaic image of the whole observation area is also planned to be made available. We hope to make it available about 4 to 5 years after the observations. We expect that the FSC will contain as many as 5×10^5 sources. Preparation of the extended source catalog is under discussion.

Table 1. Data products plan

Product	Description	Target data of release*
Image plate	Image of one field of view	Right after observation
First Point Source Catalog	Processed through Pipeline	2008
Faint Source Catalog	Lower detection limit	2009
Mosaic Image	Mosaic images on web	2010
Extended Source Catalog	Small extended sources	TBD

* The proposed schedule assumes early 2006 launch.

References

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Tanabe, T., Kicinskas, A., Nakada, Y., Onaka, T., & Sauvage, M. 2004, ApJS, 155, 401

ASTRO-F Large-Scale Survey Program	Date: 05/08/12
Title (Abbreviation)	LSNEP
Title (Full)	The ASTRO-F NEP Survey
Contact Person	Hideo Matsuhara E-mail: maruma@ir.isas.jaxa.jp ISAS/JAXA
Total No. of Pointings	954 pointings

Abstract:

We will perform coordinated pointing surveys toward the North Ecliptic Pole (NEP) as a large-area survey program with ASTRO-F. The NEP survey is an ASTRO-F legacy especially for extragalactic astronomy and cosmology: unveiling the dusty star-formation history of the universe out to z=2.5, mass assembly and large scale structure evolution of the universe out to z=4, and the nature of the cosmic infrared background (CIRB). The NEP survey also provides us with unique information on AGN-ULIRG connection, evolution of dwarf galaxies, and Galactic stars.

Two kinds of surveys, ``NEP-Deep" and ``NEP-Wide" are so far planned. ``NEP-Deep" will cover 0.5 square degree circular area with 28 pointing per FOV, while ``NEP-Wide" covers 6.2 square degrees circular area with 2 pointing observations per FOV. We aim to perform both surveys with uniform depth for all 9 imaging bands of the infrared camera covering 2-24μm wavelengths. In total 954 pointing observations are requested (483 in phase-1).

Ground-based optical, near infrared, and radio-wave pre-surveys of the area of the NEP survey have been obtained and analyzed, the images as well as the source catalogues will be soon open to the ASTRO-F team. Also submillimeter (with BLAST), UV (with GALEX), X-ray (with XMM) surveys are under consideration.

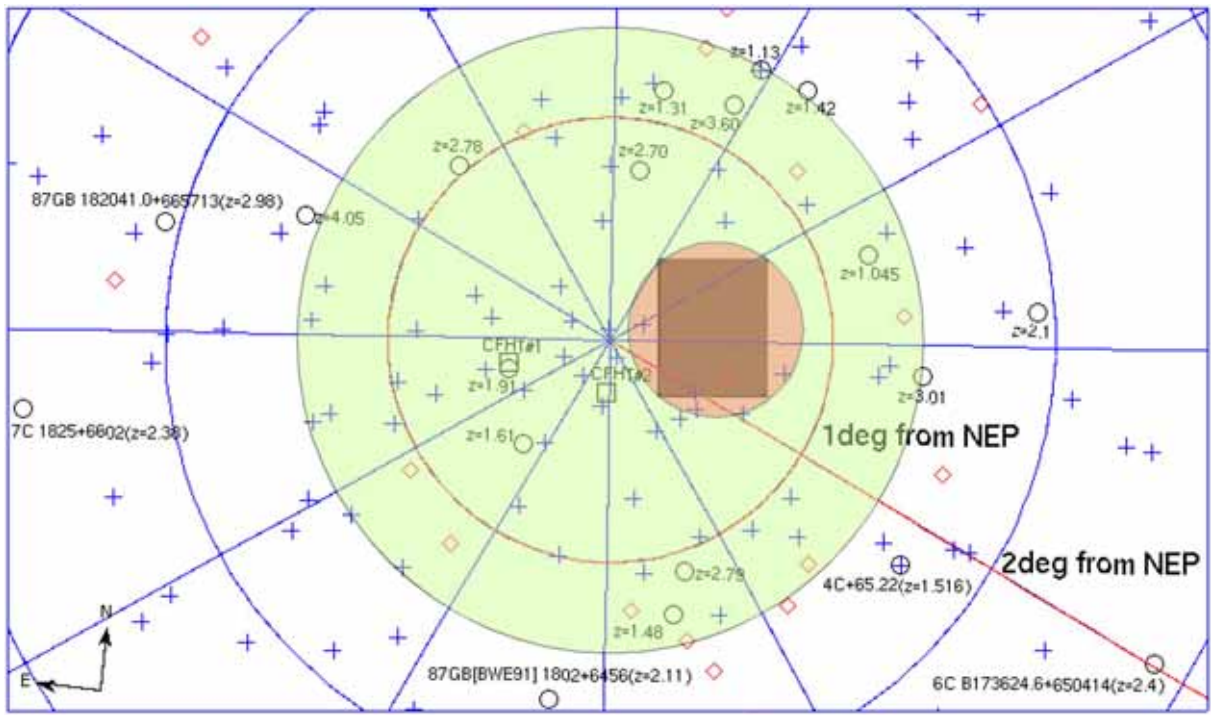

Figure 1. Survey Area. Red circle : "NEP-Deep", green circle: “NEP-Wide”. Also shown are the optical deep survey field with Subaru/Suprime-cam (brown rectangle) as well as the location of ROSAT X-ray clusters (red diamonds, Gioia et al. 2003), other ROSAT sources (galaxies, AGN, planetary nebulae: blue crosses) and high-z radio sources (circles, Brinkman 1999).

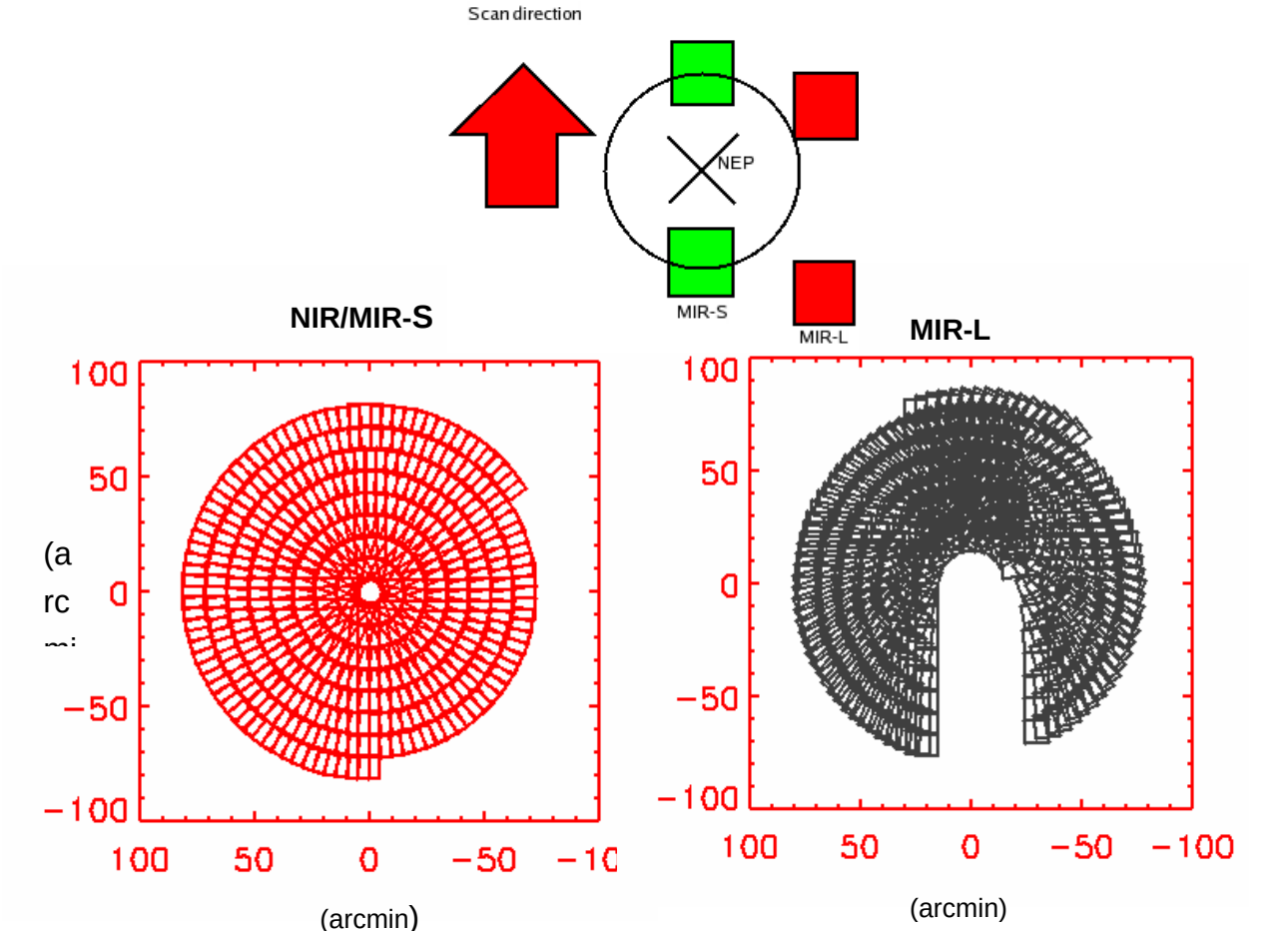

Figure 2. “NEP-Wide” mapping strategy when the survey is done only in Phase-1. IRC has two FOVs: NIR/MIR-S and MIR-L, separated by 20 arcmin. Thus, if NIR/MIR-S uniformly covers the circular area (bottom, left), MIR-L coverage is no longer uniform (bottom, right). (prepared by S. Oyabu)

[Details of the NEP Survey Plan]

1) 0.5deg^2 "NEP-deep" (504 pointing in total) with

Band	N2	N3	N4	S7	S9W	S11	L15	L18W	L24
λ [μm]	2.43	3.16	4.14	7.19	8.74	10.39	15.56	17.81	23.04
Flux Limit [5σ, μJy]	2.8	1.2	2.3	10.	9.2	12.	22.	31.	57.
Confusion limit *	<1	<1	<1	1	3	7.9	50	134	257

(*) confusion limit [40beams/source] by galaxies, based on Pearson 2005)

by using 28 pointing observations {

8 pointing with AOT-00-a (N2, S9W, L20W)

10 pointing with AOT-00-b (N3, S7, L15)

10 pointing with AOT-00-c (N4, S11, L24)} per FOV, and

A half of pointing observations(252) in "NEP-Deep" will be executed in Phase-1, and the rest will be done in Phase-2.

2) 6.2deg^2 "NEP-Wide" (450 pointing in total)

Band	N2	N3	N4	S7	S9W	S11	L15	L18W	L24
λ [μm]	2.43	3.16	4.14	7.19	8.74	10.39	15.56	17.81	23.04
Flux Limit [5σ, μJy]	12	5.5	11.	49.	39.	56.	100.	130.	270.
Confusion limit *	<1	<1	<1	1	3	7.9	50	134	257

by using 2 pointing per FOV with AOT-03 (three filter mode).

About a half of pointing observations (231) in "NEP-Wide" will be executed in Phase-1.

(NOTE: observation strategy has been changed. See Appendix)

Total number of pointing is 504(deep) + 450(wide) = 954 .

Appendix. Detailed Study of “NEP-Wide” mapping Strategy

Originally “NEP-Wide” was planned to be executed only in Phase-1 : however, during the recent detailed consideration of the mapping strategy, the survey area is found to be seriously non-uniform (see Figure 2). If we insist to keep the map uniform, we have to do with a half-circular area (see Figure 3), which no longer overlap well with the ground pre-survey areas (CFHT/Megacam, 2deg^2 & WSRT(radio), 1deg^2). Therefore, we decided to **separate the “NEP-Wide” observations in both Phase-1 and Phase-2(1st 6 months)** like “NEP-Deep”. The resulted performance of the areal coverage is shown in Figure 4.

This means the increase (219 pointings) of the NEP survey executed in Phase-2, however, if a part of MP targets near NEP (approximately 230, from SPICY and CLEVL) will be observed in Phase-1, **this NEVER affect the overall scheduling of the Mission Program and the Open Time Program, and the all-sky survey products.**

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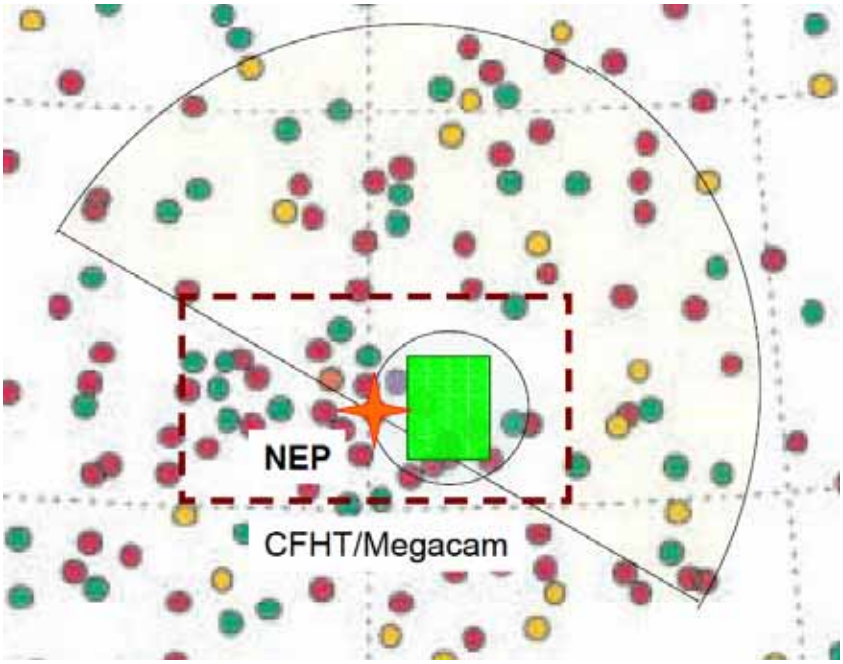

Figure 3. Alternative survey area of “NEP-Wide”, when the survey is done only in Phase-1. Mapping strategy is the same as that of the LMC survey, and resulted coverage is shown by the half-circular area. Orientation of this half circular area depends on the starting date of Phase-1.

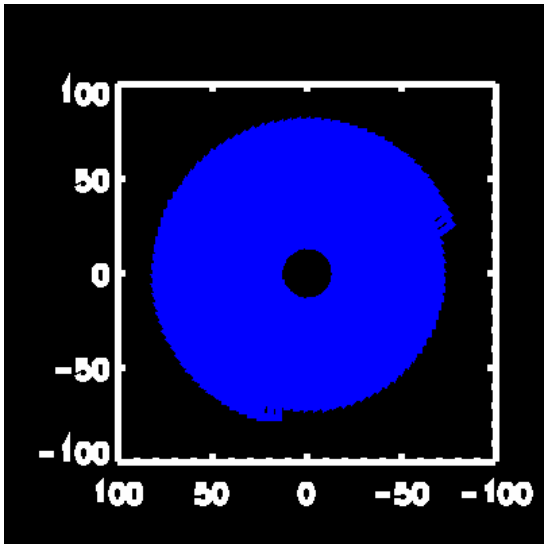

Figure 4. MIR-L survey area of “NEP-Wide”, when the observations are made in both Phase-1 and Phase-2 (1st 6 months) with periodic allocation of pointing opportunities, 1.25 pointing per day. (prepared by S. Oyabu)

(This page is opened to the ASTRO-F team members)

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/08

Title (Abbreviation)	AFSAS
Title (Full)	ASTRO-F Studies on Star formation and Star forming regions

PI	Ueno, Munetaka E-mail: ueno@provence.c.u-tokyo.ac.jp University of Tokyo
Co-Is	Kitamura, Yoshimi, ISAS/JAXA Kataza, Hirokazu, ISAS/JAXA *(Continued on the next page)*

Related SAC Members	M.Tamura, T.Hasegawa
Science Working Group	SF (Star Forming Regions)

Required Data Resources						
Large Area Survey	All-sky survey	◯	NEP survey	×	LMC survey	×
Total No. of Pointings	800 pointings (A=400, B=400, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	Yes					

Abstract:
The mission program is based on the three pillars (projects). The first project, survey of Chamaeleon region, is really unique and an unrivaled project. ASTRO-F slow scanning mode gains her sensitivities reaching detection level of the photosphere of stars, and also remains wide coverage enough to find out the orphan stars. Actual time scale in the proto-planetary disk will be determined by the quantitative samples of this survey. A full use of ASTRO-F capabilities enables us to conduct an extended survey to cover from the diffuse interstellar matter up to main sequence stars. This project is the first survey that has enough sensitivities to detect any stages of YSOs and sufficient coverage, giving quantitative samples of stars with proto-planetary disks born in the same cloud complex. The second project must be the legacyof ASTRO-F, as her atlas of various star forming sites, including a deep survey for selected regions, collaboration with other heritages of Nobeyama Radio Observatory, NANTEN and ASTE. The formation of brown dwarfs and planetary-mass objects and their abundance, and also the cut-off in the initial mass function, are major topics in tis project. The third pillar is the astro-mineralogy. ASTRO-F's unique capabilities in 3 micron, 20 micron and FTS spectroscopies realize detailed analyzations of interstellar dust particle with icy mantle and silicate dust in the circumstellar disk. To know the composition of icy material is essentially important to understand the chemical processes in the proto-planetary disk.
The whole sky survey of ASTRO-F is also very important part of the mission program, since it realizes a significant unbiased census of starforming cores in a large number of molecular clouds. The sensitivity of the ASTRO-F survey of the whole Galactic Plane, coupled with the small beam will detect pre-stellar cores to lower luminosity than previously detected. The 160 micron channel will detect cooler sources than have been found in the IRAS data. The ASTRO-F survey will be the first all-Galaxy measurement of the SED's of sources in star formation regions, allowing estimation of density and temperature gradients of a very large sample of young cores. ASTRO-F will have sufficient resolution to resolve the prestellar and protostellar clumps within individual molecular clouds to measure the radial density profiles in the extended envelopes of the protostars. The data will allow the measurement of temperature and density gradients, and the grain properties of material in the clouds. Viewed from a Galaxy-wide perspective, it should help to tell us how molecular clouds fragment into cores, at what stage IMF of the star forming region frozen in, how the disks dissipate their gas and dust, and eventually how planetary systems form in the disks.
We are propose to use the all-sky survey data, and to conduct slow-scanning observations and spectroscopic observations of protoplanetary disks around low-and intermediate-mass pre-main-sequence stars with the ASTRO-F. Our main goal is to reveal the evolution of the disks in the possible planet building stage of ∼10 Myr. The target list of this study consists of T Tauri and Herbig Ae/Be stars mainly located in the Chamaeleon and Taurus regions (d = 140 pc): the total number of the sources is ∼1500. This study will be done in the following two steps: First, we will perform a photometric survey of the disks around the pre-main-sequence stars with the FIS and the IRC in the survey mode. Second, we will make spectroscopic observations over 2 200 mm of the disks detected at the 1-st step toward the weak-line T Tauri and Herbig Ae/Be stars with ages of ∼10 Myr: the number of the pointings is roughly estimated to be 1000. Since the Astro-F survey can detect the circumstellar disks with very high sensitivity in gas mass of MEarth, we will be able to unveil the evolution of disk dust mass with good statistics during the weak-line T Tauri stage of ∼10 Myr. This survey is one of the most sensitive surveys of weak-line T Tauri stars over the whole sky. Furthermore, from the successive spectroscopic observations, we can obtain the detailed spectral energy distributions of the disks and can discuss the evolution of disk internal structures (i.e., the disk clearing in the innermost regions) relevant to planet building at ∼10 Myr. Our large sample over several star-forming regions also makes it possible to understand how the disk evolution depends on stellar masses and formation sites.

ASTRO-F Mission Programme Proposal (2/2)			**Date:** 05/08/08
Title	AFSAS	**PI**	Ueno, Munetaka

Co-Is:

(Continued from the previous page)

Kawamura, Akiko, Nagoya University
Okamoto, Yoshiko, Ibaragi University
Honda, Mitsuhiko, ISAS/JAXA
Sunada, Kazuyoshi, Nobeyama Radio Observatory, NAOJ
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Miyazaki, Atsushi, Nobeyama Radio Observatory, NAOJ
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Dobashi, Kazuhito, Tokyo Gakugei University
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Sugimoto, Kanako, Nagoya University
Murakawa, Koji, ASTRON
Lee, Chang Won, Korea Astronomy Observatory
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Park, Yong-Sun, Seoul National University
Pak, Soojong, Korea Astronomy Observatory
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White, Glenn J., The Open University
Murakami, Hiroshi, ISAS/JAXA
Tatematsu, Kenichi, National Astronomical Observatory
Hasegawa, Tetsuo, National Astronomical Observatory
Tamura, Motohide, National Astronomical Observatory

(This page is opened to the ASTRO-F team members)

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/08

Title (Abbreviation)	AGBGA
Title (Full)	Mass loss and stellar evolution in the AGB phase

PI	Nakada, Yoshikazu E-mail: nakada@kiso.ioa.s.u-tokyo.ac.jp University of Tokyo
Co-Is	Toshihiko Tanabe (U. Tokyo) Noriyuki Matsunaga (U. Tokyo) *(Continued on the next page)*

Related SAC Members	Y.Nakada
Science Working Group	STAR (Stars)

Required Data Resources						
Large Area Survey	All-sky survey	◯	NEP survey	×	LMC survey	◯
Total No. of Pointings	224 pointings (A=112, B=112, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	Yes					

Abstract:

We propose a systematic study of mass loss from AGB stars in the Milky Way globular clusters and the nearby dwarf galaxies. The targets are selected so that they span a wide range of age and metallicity.

The observations will be performed using the IRC and FIS pointing modes. The IRC images will be taken in six bands, N2, N4, S7, S11, L15, and L24. They are designed to provide information of mass-loss rate, silicate band strength, C-/M- star distinction, and stellar luminosity. The FIS observations are carried out only to globular clusters, in order to estimate total amount of mass lost from the stars in the system.

We plan to to make a point source catalog for each system. The evaluation of mass-loss rates for a number of AGB stars will be performed on this catalog. We will systematically investigate the effects of metallicity and stellar mass on the mass loss phenomena. The results will be of great importance on the understanding of the late evolution of low- to intermediate-mass stars as well as on the study of the galactic chemical evolution.

ASTRO-F Mission Programme Proposal (2/2)			**Date:** 05/08/08
Title	AGBGA	**PI**	Nakada, Yoshikazu

Co-Is:

(Continued from the previous page)
Hinako Fukushi (U. Tokyo)
Takashi Miyata (U. Tokyo)
Hiroyuki Mito (U. Tokyo)
Yoshifusa Ita (ISAS/JAXA)
Issei Yamamura (ISAS/JAXA)
Hideyuki Izumiura (NAOJ)
Nobuo Arimoto (NAOJ)
Chisato Ikuta (NAOJ)
Mikako Matsuura (U. Manchester)
Kyong Sok Jeong (SNU)

(This page is opened to the ASTRO-F team members)

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/08

Title (Abbreviation)	AGNUL
Title (Full)	Evolution of ULIRGs and AGNs

PI	Nakagawa, Takao E-mail: nakagawa@ir.isas.jaxa.jp ISAS/JAXA
Co-Is	C. Dudley, NRL J. Fischer, NRL *(Continued on the next page)*

Related SAC Members	Y.Taniguchi
Science Working Group	AGN (Active Galactic Nuclei)

Required Data Resources						
Large Area Survey	All-sky survey	◯	NEP survey	◯	LMC survey	×
Total No. of Pointings	100 pointings (A=50, B=50, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	Yes					

Abstract:

We propose to study the evolution of ULIRGs (ultra luminous infrared galaxies) and AGN (active galactic nuclei) using the ASTRO-F observations. Our proposal consists of several observation programs, which can be categorized into two; one is detailed study of nearby ULIRGs and AGN as templates, and the other is an investigation of the evolution of these objects toward mid- to high-z on the basis of the knowledge obtained in the local universe.

For the detailed study near-by ULIRGs and AGNs, we propose to make systematic spectroscopic observations of PAH features in ULIRGs and AGNs in near-infrared to make the quantitative estimate of star-formation activity in these dusty systems. These observations are to make the best use of the imaging spectroscopy over wide spectral regions, which is a unique capability of ASTRO-F. We also study Spectral Energy Distribution of representative objects in several types using the all sky survey data.

The other category is the study of the evolution of ULIRGs and AGNs to mid- and high-z universe. We plan number-count studies in a hierarchical manner; the number count study based on the allsky survey is useful especially for the study of the evolution in mid-z universe, and medium deep survey with multiple observations in the survey mode and deep surveys in the slow scan mode are useful for the study of universe with higher z. We also propose slit-less spectroscopic observations as the rst un-biassed 3-D survey in the infrared.

The proposed infrared observations are essential for the study of ULIRGs and dusty AGNs because a large fraction of emitted energy in these galaxies are reemitted by dust in the thermal infrared. The unique capability of ASTRO-F will enable us to make the rst systematic study of the evolution of dusty universe.

ASTRO-F Mission Programme Proposal (2/2)			Date: 05/08/08
Title	AGNUL	**PI**	Nakagawa, Takao

Co-Is:

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K. Kawara, ISAS/JAXA
H. Matsuhara, ISAS/JAXA
S. Matsuura, ISAS/JAXA
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Y. Tsuzuki, IoA, UT
S. Oyabu, ISAS/JAXA
Y. Sato, IoA/UT
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S. Pak, KASI
M. Gu, KAO
M. Kim, KAO
R. Priddey, Imperial College
K. Isaak, University of Cabvridge
H. Mouri, MRI
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Y. Taniguchi, Tohoku U.
P. Barthel, Groningen
M. Rowan-Robinson, IC
T. Takagi, Kent U
T. Tamagawa, Riken
H. Urata, Riken
T. Kawaguchi, NAOJ
A. Yonehara, UT
N. Kawakatsu, SISSA
K. Enya, ISAS/JAXA
Y. Oyama, ISAS/JAXA
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T. Suzuki, ISAS/JAXA
T. Kii, ISAS/JAXA
K. Watanabe, ISAS/JAXA
M. Kawada, Nagoya U.
N. Murakami, Nagoya U.
M. Imanishi, NAOJ

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/09

Title (Abbreviation)	CLEVL
Title (Full)	Evolution of Clusters of Galaxies

PI	Lee, HyungMok E-mail: hmlee@astro.snu.ac.kr Seoul National University
Co-Is	Myungshin Im, Seoul National University Myung Gyoon Lee, Seoul National University *(Continued on the next page)*

Related SAC Members	N.Arimoto, S.Okamura
Science Working Group	GAL (Galaxies)

Required Data Resources						
Large Area Survey	All-sky survey	◯	NEP survey	◯	LMC survey	×
Total No. of Pointings	346 pointings (A=173, B=173, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	No					

Abstract:

In order to understand the formation and evolution of galaxies in cluster environment, we propose to study clusters of galaxies over a wide range of redshifts using the wide-field capability of ASTRO-F. Since different observational strategies are required for clusters at different redshifts, we divide our program into three major components according to the redshifts of targets: low redshift, intermediate redshift, and high redshift clusters of galaxies. For low redshift clusters ($z < 0.3$) we focus on the effects of environment on star formation activity by choosing samples with different merging stages: major merging, minor merging and quiescent clusters. For intermediate redshift clusters ($0.4 < z < 1.3$), we will study star formation activity, stellar mass function, and environmental effect on them by conducting deep NIR-MIR imaging of selected sample clusters of galaxies and their surrounding groups along the large scale structures at $0.4 < z < 1.3$. The high redshift cluster study can provide strong, direct constraints on the formation epoch of clusters galaxies. Since the sample of such high-z clusters is rather rare, we will focus on high-z objects with signs of overdensity based on other observational data, such as high-z radio galaxies, QSOs, and submm sources. Thus we propose to conduct NIR and MIR observations of overdense regions at $1.5 < z < 3.2$, and NIR observations at $z > 4$. Specifically, we intend to perform deep observations centered on high-z radio galaxies around the NEP region. Overall, our program will explore the properties of galaxies in large areas extending out to a significant distances from cluster's center(about Mpc), enabling us, for the first time, to investigate the interaction of clusters and its surrounding environment over a large redshift range ($0 < z < 5$) in infrared. We will also sample the same MIR star formation indicator over $0 < z < 3$ which will enable us to obtain a consistent IR SFR estimate.

ASTRO-F Mission Programme Proposal (2/2)			Date: 05/08/09
Title	CLEVL	**PI**	Lee, HyungMok

Co-Is:

(Continued from the previous page)
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Narae Hwang, Seoul National University
Sang-Hoon Oh, Seoul National University
Woongseob Jeong, Seoul National University
Hideo Matsuhara, ISAS/JAXA
Takehiko Wada, ISAS/JAXA
Takao Nakagawa, ISAS/JAXA
Chris Pearson, ISAS/JAXA
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Masami Ouchi, STScI
Katsuhiko Shimasaku, Univ. of Tokyo
Sadanori Okamura, Univ. of Tokyo
Masayuki Akiyama, Subaru Telescope
Shinki Oyabu, ISAS/JAXA
Hidenori Watarai, OSA/JAXA
Tadayuki Kodama, NAOJ
Hitoshi Hanami, Iwate University
Toshinobu Takagi, Univ. Kent

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/08

Title (Abbreviation)	CNIRB
Title (Full)	ASTRO-F Observations of Cosmic Near-Infrared Background Radiation

PI	Matsuura, Shuji E-mail: matsuura@ir.isas.jaxa.jp ISAS/JAXA
Co-Is	Mitsunobu Kawada, Nagoya University Toshio Matsumoto, JAXA/ISAS *(Continued on the next page)*

Related SAC Members	Y.Taniguchi
Science Working Group	CIRB (Cosmic Background)

Required Data Resources						
Large Area Survey	All-sky survey	×	NEP survey	○	LMC survey	×
Total No. of Pointings	0 pointings (A=0, B=0, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	Yes					

Abstract:

We propose observations of cosmic near-infrared background radiation (CNIRB) by the wide area survey at NEP of LS program. By previous background measurements in the near-infrared with IRTS and COBE satellites, strong background excess that is too bright to be accounted for by integrated light of faint galaxies was discovered. From a spectral signature of redshifted Ly-α in the background spectrum, the excess is attributed to integrated light from the first generation stars (Pop-III) populated at z$\sim$10. Motivation of this proposal is more accurate measurement and further study of the Pop-III background. Absolute sky brightness and its fluctuation at blank sky will be measured by imaging observations free from the contamination by foreground stars and galaxies, whose contribution was a major limiting factor for the accuracy of previous background measurements with large beam sizes. The angular power spectra of the background fluctuation will be measured in a wide range of angular scales from arcsec to degree. Based on the auto- and cross-correlation analysis for the multi-wavelength fluctuation data, the evolution and structure formation of Pop-III clusters will be investigated. In order to study further into the redshift distribution and surrounding nebula structure of Pop-III stars, spectroscopic measurements in near- and mid-infrared will also be performed by using the data taken for SPICY-MP and Solar-System-MP.

ASTRO-F Mission Programme Proposal (2/2)			**Date:** 05/08/08
Title	CNIRB	**PI**	Matsuura, Shuji

Co-Is:

(Continued from the previous page)
Hideo Matsuhara, JAXA/ISAS
Takehiko Wada, JAXA/ISAS
Masahiro Tanaka, NAOJ
Manabu Noda, Nagoya City Science Museum
Toshinobu Takagi, Kent University
James Bock, JPL/Caltech
Brian Keating, U.C. San Diego
Asantha Cooray, U.C. Irvine
Yoshiaki Taniguchi, Tohoku University

(This page is opened to the ASTRO-F team members)

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/08

Title (Abbreviation)	FBSEP
Title (Full)	ASTRO-F Observations of Cosmic Far-Infrared Background Radiation and Distant Infrared Galaxies in Low-Cirrus Region near South Ecliptic Pole

PI	Matsuura, Shuji E-mail: matsuura@ir.isas.jaxa.jp ISAS/JAXA
Co-Is	Mitsunobu Kawada, Nagoya University Hiroshi Shibai, Nagoya University *(Continued on the next page)*

Related SAC Members	Y.Taniguchi
Science Working Group	CIRB (Cosmic Background)

Required Data Resources						
Large Area Survey	All-sky survey	◯	NEP survey	×	LMC survey	×
Total No. of Pointings	270 pointings (A=270, B=0, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	Yes					

Abstract:

We propose the ASTRO-F observations of the cosmic far-infrared background radiation (CFIRB) and its fluctuation, resolving the background into point sources as much as possible. Objectives of this program are to provide, 1) accurate source counts avoiding the cosmic variance and extended source counts toward fainter flux below the confusion limit of the ASTRO-F telescope ($\sim$10 mJy) by the background fluctuation analysis, in order to probe infrared galaxies at z>1, 2) angular power spectrum of the background fluctuation to study clustering and large-scale structure traced by infrared galaxies at z$\sim$1, 3) statistically significant number of source samples for the study of evolution and emission mechanism of infrared galaxies including ULIRG and AGN, and finally, 4) mean flux level of CFIRB minimizing the contribution of foreground galaxies. In order to accomplish these tasks, we plan deep and wide survey in the lowest column density region near the south ecliptic pole, in which the best sensitivity in the far-infrared can be achieved. The survey area of more than 15 square degrees will be mapped out by the FIS slow-scan observations in the four wave bands with the sensitivity better than the confusion limit. To identify the far-infrared background sources and discriminate the population of detected galaxies, the IRC slow-scan observations in mid-infrared bands will also be done in parallel to the FIS observations. The optical observations of R<25mag in the FIS survey area have been planned and partly finished. These efforts are still on-going, and another optical follow-up in multi-bands from the ground are being planned.

ASTRO-F Mission Programme Proposal (2/2)			**Date:** 05/08/08
Title	FBSEP	**PI**	Matsuura, Shuji

Co-Is:

(Continued from the previous page)
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Yasuo Doi, University of Tokyo
Tsutomu T. Takeuchi, Laboratoire d'Astrophysique de Marseille
Stephan Serjeant, Kent University
Toshinobu Takagi, Kent University
Richard Savage, University of Sussex
Yoshiaki Taniguchi, Tohoku University

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/07

Title (Abbreviation)	FISS3
Title (Full)	FIS Serendipitous Spectroscopic Survey

PI	Kawada, Mitsunobu E-mail: kawada@u.phys.nagoya-u.ac.jp Nagoya University
Co-Is	All ASTRO-F members

Related SAC Members	Y.Taniguchi
Science Working Group	CIRB (Cosmic Background)

Required Data Resources						
Large Area Survey	All-sky survey	×	NEP survey	○	LMC survey	○
Total No. of Pointings	0 pointings (A=0, B=0, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	No					

Abstract:

We propose to operate the Fourier Transform Spectrometer (FTS) of the FIS at the pointing observations allocated for the IRC. It is expected that the FIS and the IRC works very well simultaneously, although the FOVs of both instruments are separated. The IRC is operated in the stealing mode of the attitude control system. In that case, the detection limit for each photometric band of the FIS achieves source confusion limit quickly, and there are no spatial information in sub-pixel scale. Then, the spectroscopic observation by using the FTS is effective with the IRC observations. In this proposal, we never request the additional pointing observations. We propose the operation of the FTS at the IRC observations proposed by other MPs. The observation is not systematic nor complete. If the FTS is operated at the large area surveys near the NEP, we expected to take rather systematic and complete datasets. According to the recent FTS performance, we can take spectra with full resolution by averaging with all pixels only for regions in $|b| < 15$deg. If we use the low resolution mode of the FTS, we can take spectral energy distributions with spectral resolution of 2.5cm-1 for a few Jy sources or for regions with surface brightness of about 10 MJy/sr by averaging all pixels. This sensitivity is improved by multiple observations or by reducing the spectral resolution. Using the dataset of this MP , we can discuss about the interstellar medium and, hopefully, Cosmic Infrared Background Radiation.

ASTRO-F Mission Programme Proposal (2/2)			**Date:** 05/08/07
Title	FISS3	**PI**	Kawada, Mitsunobu

Co-Is:

(n/a)

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/08

Title (Abbreviation)	FUHYU
Title (Full)	FUHYU - SPITZER WELL STUDIED FIELD MISSION PROGRAM

PI	Pearson, Chris E-mail: cpp@ir.isas.jaxa.jp ISAS
Co-Is	Hideo Matsuhara - ISAS/JAXA Toshinobu Takagi - University of Kent *(Continued on the next page)*

Related SAC Members	N.Arimoto, S.Okamura, Y.Taniguchi
Science Working Group	GAL (Galaxies)

Required Data Resources						
Large Area Survey	All-sky survey	×	NEP survey	×	LMC survey	×
Total No. of Pointings	50 pointings (A=25, B=25, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	Yes					

Abstract:

We propose MIR imaging of several well studied Spitzer fields. This imaging fills in the bands lacking from the Spitzer surveys and gives an extremely high scientific return for minimal input for ASTRO-F. We select fields already rich in multi-wavelength data from radio to X-ray wavelengths to optimize the impact of the ASTRO-F observations. The deepest observations at 15microns with ISO unveiled a large population of luminous Infrared galaxies at redshifts around 0.8 that are responsible for the peak of the cosmic infrared background (CIRB) at 140microns. These galaxies are strongly evolving with co-moving densities of infrared light 40 times larger at z=1 compared to the local universe. Deep counts with Spitzer at 24microns have confirmed this strong evolution of the infrared luminosity function from redshift unity and have also detected a new population of luminous infrared galaxies at higher redshifts previously unpredicted by model fits to the ISO 15micron surveys. To link these populations and break the degeneracy in contemporary evolutionary scenarios, observations at multiple mid-infrared wavelengths that fully sample the PAH emission are demanded. In particular, observations deeper than 1mJy at 15microns will be of particular value in deciphering the dominant population responsible for the evolutionary upturn in the 15micron source counts. Spitzer has extremely restricted imaging capability between 8-24microns so ASTRO-F observations of the Spitzer fields will be vital to unravel the nature of the infrared populations in these fields thus linking the ISO-Spitzer populations.

ASTRO-F Mission Programme Proposal (2/2)			**Date:** 05/08/08
Title	FUHYU	**PI**	Pearson, Chris

Co-Is:

(Continued from the previous page)
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Toru Yamada - NAOJ
Steve Serjeant - University of Kent
Hyung Mok Lee - Seoul National University
Myungshin Im - Seoul National University
Woong-Seob Jeong - Seoul National University/ISAS
Eiichi Egami - University of Arizona
Casey Papovich - University of Arizona

(This page is opened to the ASTRO-F team members)

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/09

Title (Abbreviation)	GALEV
Title (Full)	Dusty Star-Formation History of the Universe

PI	Matsuhara, Hideo E-mail: maruma@ir.isas.jaxa.jp ISAS, JAXA
Co-Is	Takehiko Wada, JAXA Shuji Matsuura, JAXA *(Continued on the next page)*

Related SAC Members	N.Arimoto, S.Okamura, Y.Taniguchi
Science Working Group	GAL (Galaxies)

Required Data Resources						
Large Area Survey	All-sky survey	×	NEP survey	○	LMC survey	×
Total No. of Pointings	66 pointings (A=40, B=26, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	Yes					

Abstract:

One of the key scientific goals to be performed with ASTRO-F deep surveys is to unveil the dusty star formation history of the Universe. The NEP survey, however, is not sufficient to perform this science goal. When the NEP survey will be performed, more than ten thousands of infrared galaxies will be detected. Since the spectroscopic follow-ups for such a large sample are still not realistic, we should rely on the so-called "photo-z" technique: estimation of the redshift by fitting the SED template to the obtained multi-wavelength data. Therefore, it is essentially important to establish the reliable SED templates of various star-forming galaxies with their physical understandings. Another weakness of the NEP survey is the lack of the far-infrared data with sufficient depth (i.e. confusion limit by the distant galaxies) to detect even z<=1 starburst galaxies, although the far-infrared flux is the direct measure of the star-formation rate of the dusty galaxies. Therefore, we propose the following strategy: 1. Mid-infrared SED studies of local star-forming galaxies in Virgo cluster, generating their SED templates (this MP). 2. The slitless spectroscopic survey in order to obtain the unbiased SED samples upto z=1 over the NEP survey field (separate MP : SPICY). 3. Far-infrared Deep Survey of the NEP deep survey field below the confusion limit by the galaxies with the FIS slow-scan survey (this MP). 4. The NEP survey (LSNEP). Determine the photometric redshifts of the detected sources by using the SED templates derived, and then we will address the evolution of the star-formation rate of the Universe with small uncertainties.

ASTRO-F Mission Programme Proposal (2/2)			**Date:** 05/08/09
Title	GALEV	**PI**	Matsuhara, Hideo

Co-Is:

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Naofumi Fujishiro, JAXA
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Hiroshi Shibai, Nagoya University
Toshinobu Takagi, University of Kent
Stephen Serjeant, University of Kent
Hitoshi Hanami, Iwate University
Nobuo Arimoto, NAOJ

(This page is opened to the ASTRO-F team members)

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/08

Title (Abbreviation)	ISMGN
Title (Full)	Interstellar dust and gas in various environments of our Galaxy and nearby galaxies

PI	Kaneda, Hidehiro E-mail: kaneda@ir.isas.jaxa.jp ISAS/JAXA
Co-Is	H. Takahashi, Univ. of Tokyo T. Onaka, Univ. of Tokyo *(Continued on the next page)*

Related SAC Members	Y.Nakada, T.Hasegawa
Science Working Group	ISM (Inter Stellar Medium)

Required Data Resources						
Large Area Survey	All-sky survey	◯	NEP survey	×	LMC survey	◯
Total No. of Pointings	492 pointings (A=250, B=242, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	Yes					

Abstract:

The aim of this MP is to perform systematic studies on interstellar dust and gas in various environments of our Galaxy and nearby galaxies. Considering the ASTRO-F uniqueness, we place particular importance on (A) detailed MIR-FIR SED studies of interstellar dust for moderately large (5-10 arcmin) targets, and (B) FIR imaging and MIR slit-less spectroscopic studies of interstellar gas and dust for bright targets. The ISM can be found in various neutral and ionized phases: hot plasma, warm ionized medium, classical HII regions, warm neutral medium, and cold neutral medium. Owing to its wide and fine spectral coverage as well as good angular resolution, ASTRO-F is best suited to study the processing, evolution, and destruction of dust components spatially resolved in each ISM phase, and their connection with physical and chemical conditions of gas and star-forming activity. Our Galactic objects allow detailed studies of the ISM in various conditions of gas phases and density, while our sample of nearby galaxies provides us much more extensive ranges in ISM environments and star formation history; the LMC/SMC serves to bridge the gap between our Galaxy and the other external galaxies. A membership of this program includes several members of the UK and Korean teams; imaging analyses of the galactic plane will be carried out in collaboration with the UK team, while the SNR survey is one of the key observations for collaborative research with the Korean team.

ASTRO-F Mission Programme Proposal (2/2)			Date: 05/08/08
Title	ISMGN	**PI**	Kaneda, Hidehiro

Co-Is:

(Continued from the previous page)

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H-G Lee, SNU
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W-S Jeong, SNU
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(This page is opened to the ASTRO-F team members)

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/07

Title (Abbreviation)	MLHES
Title (Full)	Excavating Mass Loss History in Extended Dust Shells of Evolved Stars

PI	Yamamura, Issei E-mail: yamamura@ir.isas.jaxa.jp ISAS/JAXA
Co-Is	Hideyuki Izumiura, Okayama Astrophysical Observatory, NAOJ, NINS, JP Toshiya Ueta, NASA Ames Research Center/SOFIA, USA *(Continued on the next page)*

Related SAC Members	Y.Nakada
Science Working Group	STAR (Stars)

Required Data Resources						
Large Area Survey	All-sky survey	◯	NEP survey	◯	LMC survey	×
Total No. of Pointings	200 pointings (A=100, B=100, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	Yes					

Abstract:

Exploiting the superb sensitivity and mapping capabilities of ASTRO-F/FIS, we will perform a far-IR imaging survey of the circumstellar envelopes of evolved stars. Our primary goal is to fully understand the mass loss phenomena in the latest stages of stellar evolution by tracing the history of mass loss carved in the structure of very extended, cold dust shells around those evolved objects. We will obtain maps of 10x20 size of those extended dust shells with FIS by detecting thermal emission arising from cool dust grains and reconstruct the history of mass loss along the latest stages of stellar evolution. We will systematically examine the mass-loss history during the last 1E5 years with a time resolution of 1,000 years. From our set of coherent FIS data having variety of evolutionary state and chemistry, we will examine (1) if mass loss history can be affected by some stellar characteristics, and if so, how it happens, (2) if mass loss variation really occurs, and if so, how it occurs, (3) if mass loss is constant over the course of the mass loss history, and if not, if there is really a superwind, and (4) if the shell structure formation really begins early in the AGB phase. We will also perform a mid-IR imaging with IRC of some selected objects to examine physical conditions of dust in their shells, which would greatly improve our detailed modeling for the FIS far-IR imaging survey.

ASTRO-F Mission Programme Proposal (2/2)			**Date:** 05/08/07
Title	MLHES	**PI**	Yamamura, Issei

Co-Is:

(Continued from the previous page)
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(This page is opened to the ASTRO-F team members)

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/07

Title (Abbreviation)	NIRLT
Title (Full)	Near Infrared Spectroscopy of L and T Dwarfs

PI	Yamamura, Issei E-mail: yamamura@ir.isas.jaxa.jp ISAS/JAXA
Co-Is	T. Tsuji, Institute of Astronomy, The University of Tokyo T. Nakajima, National Astronomical Observatory T. Tanabe Institute of Astronomy, The University of Tokyo

Related SAC Members	Y.Nakada
Science Working Group	STAR (Stars)

Required Data Resources						
Large Area Survey	All-sky survey	×	NEP survey	×	LMC survey	×
Total No. of Pointings	50 pointings (A=25, B=25, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	Yes					

Abstract:

Ground based observations of ultracool dwarfs, including L and T dwarfs are almost limited to the NIR short-ward of 2.5 micron, with the exceptional case of Gl 229B. Although MIR (5.012.0 micron) is observed with Spitzer, there is no possibility of the NIR spectroscopy. The NIR region is especially important for ultracool dwarfs, because this region includes CO fundamental bands and CH4 nu3 fundamental bands. It was suggested from a very noisy spectra of Gl229B obtained with the ground-based observation that CO is over-produced by the non-equilibrium process as is known in Jupiter atmosphere. So far, the modelings of the atmospheres of brown dwarfs are mostly based on the equilibrium chemistry including the dust formation, and to clarify the nonequilibrium chemistry is an important next step to a more realistic modelings of the atmospheres of brown dwarfs. This can also be an important preparatory step for spectroscopy and modeling of extra-solar giant planets in the near future.

We propose to observe the NIR spectra of selected L and T dwarfs by ASTRO-F. ASTRO-F provides a unique and exclusive opportunity to take high-quality NIR spectra of ultracool dwarfs. Its data shall progress our understanding of the atmospheres of brown dwarfs significantly. Total number of targets listed here is 30, in which 9 are priority A and other 10 are B. Observations will be carried out in the AOT IRC04 with a selection of NG. Two to six pointings per object, depending on their brightness, are requested.

ASTRO-F Mission Programme Proposal (2/2)			**Date:** 05/08/07
Title	NIRLT	**PI**	Yamamura, Issei

Co-Is:

(n/a)

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/08

Title (Abbreviation)	SOSOS
Title (Full)	Origin and Evolution of Solar System Objects

PI	Ueno, Munetaka E-mail: ueno@provence.c.u-tokyo.ac.jp University of Tokyo
Co-Is	Ishiguro, Masateru, ISAS/JAXA Kwon, Suk Minn, Kangwon National University *(Continued on the next page)*

Related SAC Members	T.Mukai
Science Working Group	SSO (Solar System Objects)

Required Data Resources						
Large Area Survey	All-sky survey	◯	NEP survey	×	LMC survey	×
Total No. of Pointings	354 pointings (A=176, B=178, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	Yes					

Abstract:

There are large and small bodies in our solar system, and are also other objects such as comets and dust particles, but we do not fully understand the linkage among themselves yet. To establish a concrete idea on the inter-planetary dust (IPD) cloud complex under the planetary system must be one of the most important issue, since the mechanism of continuous supply of interplanetary dust particle is still in the haze of the solar system.

Big problem on the zodiacal dust cloud is its origin, since the lifetime of the interplanetary dust under the Poynting-Robertson drag is much shorter than the age of the Solar System. ASTRO-F capabilities on good sensitivities for extended sources, better calibration accuracy, fine spatial resolutions and spectroscopy in middle infrared bands will open a new horizon for IPD studies. IRAS dramatically changed the smooth featureless picture of the zodiacal dust cloud by revealing numerous bands of asteroidal debris, several narrow trails of cometary dust, and a clumpy dust ring. However, problems of calibration drifting and half degree resolution hindered us from fully identifying dynamical origins of the IPD cloud complex in general and of the symmetry plane's tilt. COBE/DIRBE also mapped almost entire sky with a 0.7 arc-degree size beam and with better calibration, and confirmed the mean motion resonance (MMR) dust ring, and an isolation of the leading and trailing blobs in the MMR feature. The mission's coverage of the solar elongation angle is limited to very narrow span from 89 to 91 arc-degree but the mission has superbly high sensitivity and fine spatial resolution. Its pointing and calibration stability promises to make mission products trustworthy. The spectrum of the zodiacal emission also provides essential information on the composition and size distribution of the IPD, and it is a clue for understanding the origin and evolution of the IPD particles. We are also going to study IPD cloud complex using ASTRO-F scanning observations, because the morphology includes inportant hints for its origin, and also to analyze its attribute using her spectroscopic capabilities, and finally to comprehend the IPD cloud complex problem.

On the other hand small bodies in the solar system are also very important targets as well-known samples for the primordial conditions even after the evolution, since the minor bodies such as asteroids, comets, centaurs, and EKBOs are thought to be remnants of the planetesimals, and contain a primitive record of the initial conditions of the solar system nebula about 4.6Gy ago.

ASTRO-F Mission Programme Proposal (2/2)			**Date:** 05/08/08
Title	SOSOS	**PI**	Ueno, Munetaka

Co-Is:

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Mukai, Tadashi, Kobe University

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/09

Title (Abbreviation)	SPICY
Title (Full)	Unbiased Slit-Less Spectroscopic Survey of Galaxies

PI	WADA, Takehiko E-mail: wada@ir.isas.jaxa.jp ISAS/JAXA
Co-Is	Youichi Ohyama, ISAS/JAXA Toshinobu Takagi, Kent Univ. *(Continued on the next page)*

Related SAC Members	N.Arimoto, S.Okamura, Y.Taniguchi
Science Working Group	GAL (Galaxies)

Required Data Resources						
Large Area Survey	All-sky survey	◯	NEP survey	◯	LMC survey	×
Total No. of Pointings	200 pointings (A=100, B=100, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	Yes					

Abstract:

Using the ABSOLUTELY UNIQUE capability of ASTRO-F's NIR/MIR slit-less spectroscopy, we propose an unbiased slit-less spectroscopic survey of galaxies.
The purpose of this survey is as follows. 1) Construction of the SED templates of the galaxies. With the redshift derived from PAH/silicate features and/or emission lines, 2) Investigations of PAH features along with the redshift, especially the MIR(PAH)/FIR(SFR) relationship. 3) Constraint on the galaxy evolution model by the luminosity function with type-classification, not by the galaxy counts. This survey will give a clear answer to the nature of excess in ISO 15um and SST 24um source counts around 1mJy. This survey also gives, 4) Discovery of spectroscopically peculiar galaxies such as ELGs, high-z QSOs, Lya/Ha emitters at the re-ionization era. 5) Strong constrains onto origin of the EBL.
The survey will use IRC prism and grisms (NP,SG1/2,LG1/2) in the slit-less spectroscopy mode and provide large number of unbiased galaxy samples with low resolution spectrum which covers wavelengths of 2-26 [um]. Together with FIS 4 band photometric data, the survey will provide SED template of galaxies which cover from NIR to FIR.
Ten pointed observations in AOT04 per FOV in the NEP survey (LSNEP) area (1 sq. deg.) will cover the sources brighter than 0.7[mJy@24um] and provide more than 600 SED template of galaxies.

ASTRO-F Mission Programme Proposal (2/2)			**Date:** 05/08/09
Title	SPICY	**PI**	WADA, Takehiko

Co-Is:

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Itsuki Sakon, U-Tokyo

ASTRO-F Mission Programme Proposal (1/2)	**Date:** 05/08/09

Title (Abbreviation)	VEGAD
Title (Full)	Debris Disks Around Main Sequence Stars and Extra-solar Zodiacal Emissions

PI	Murakami, Hiroshi E-mail: hmurakam@ir.isas.jaxa.jp ISAS/JAXA
Co-Is	Hirao, Takanori, Nagoya University Hirokazu Kataza, JAXA *(Continued on the next page)*

Related SAC Members	M.Tamura
Science Working Group	VEGA (Vega-like Stars)

Required Data Resources						
Large Area Survey	All-sky survey	◯	NEP survey	◯	LMC survey	×
Total No. of Pointings	432 pointings (A=216, B=216, C=−)					
Any Follow-Up or Pre-Survey Observations by Other Facilities?	Yes					

Abstract:

The main purpose of this mission program is to trace the formation and dispersal processes of the debris disks around main sequence stars as well as to study whether the debris disks directly connected to the zodiacal dust or not. From the IRC and FIS all-sky survey data, new Vega-like star candidates with relatively large infrared excess can be discovered from the sample of stars that have not been observed with previous missions. IRC is capable of detecting stars having large excess such as betaPic out of more than 1000 stars. FIS is useful for the stars lack of warm dust such as Vega. The precise relative photometry is planned to detect very faint disks, showing less than a few percent excess from the photosphere emission. IRC (MIR-S and MIR-L) in pointing mode will mainly be used for this observation. Since this kind of "faint disk" may be the analog of the zodiacal dust of out solar system, the investigation of the relationship to the planet formation is an important point of view. For this reason, more than 100 stars are selected from the TPF target list considering the instruments' specifications. In addition, some nearby stars from AFGKM spectral types, stars in Coma Berenices open clusters and known Vega-like stars will be observed to widen our knowledge of the properties of the debris disks. We are also planning to use FTS for the mineralogy of the bright debris disks around betaPic, alphaPsA and HR4796 if the performances of FTS will be improved on the orbits.

ASTRO-F Mission Programme Proposal (2/2)			**Date:** 05/08/09
Title	VEGAD	**PI**	Murakami, Hiroshi

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