

AKARI (ASTRO-F)

Mission Program  
Proposals Abstracts

Post-Helium (phase 3-II) mission

25 May 2009



<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	AGNUL	
<b>Title (Full)</b>	Systematic study of ULIRGs and AGN by AKARI/IRC spectroscopy	

<b>PI</b>	Nakagawa, Takao ISAS/JAXA		E-mail: nakagawa@ir.isas.jaxa.jp
<b>Co-I</b>	M. Shirahata, ISAS/JAXA M. Imanishi, NAOJ T. Miyaji, U. Mex. Y. Watabe, INAF H. Matsuhara, ISAS/JAXA H. Inami, ISAS/JAXA S. Oyabu, ISAS/JAXA T. Wada, ISAS/JAXA Y. Ohyama, ASIAA P. Barthel, Kaptyne Univ. Lee Armus, Caltech/SSC Jason Surace, Caltech/SSC M. Im, SNU M. G. Lee, SNU H. M. Lee, SNU		

<b>SAC Members</b>	N.Arimoto; S.Okamura; Y.Taniguchi
<b>Total Number of Pointings</b>	approved=840

NAKAGAWA\_AGNUL

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

AGNUL

**PI**

Nakagawa, Takao

**Abstract:**

We propose a systematic spectral study of Ultraluminous infrared galaxies (ULIRGs) and luminous infrared galaxies (LIRGs) in the local universe.

The primary goals of this proposal are to (1) determine the star-formation rates and ages, (2) search for buried AGN and determine their contribution to the bolometric luminosity, and (3) probe physical conditions in the circum-nuclear region of AGN.

Since most of the targets are heavily obscured, AKARI's unique near-infrared spectroscopic capability is indispensable for the current project. Together with our previous MP programs, the current study will provide an unprecedented spectroscopic database of a complete sample of luminous infrared galaxies in the local Universe.

<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	AGNMO	
<b>Title (Full)</b>	AGN monitor with AKARI/IRC	

<b>PI</b>	Enya, Keigo ISAS/JAXA	E-mail: enya@ir.isas.jaxa.jp
<b>Co-I</b>	Takehiko Wada, ISAS/JAXA Takao Nakagawa, ISAS/JAXA Hideo Matsuhara, ISAS/JAXA Yuzuru Yoshii, IoA/UT Yukiyasu Kobayashi, NAOJ Takeo Minezaki, IoA/UT Shintaro Koshida, UT Yu Sakata, UT Syouta Sugawara, UT Yuka Uchiich Katsuno, IoA/UT Tsutomu Aoki, Kiso Obserbatory/UT Bruce A. Peterson, MSSO/ANU	

<b>SAC Members</b>	N.Arimoto; S.Okamura; Y.Taniguchi
<b>Total Number of Pointings</b>	approved=36

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

AGNMO

**PI**

Enya, Keigo

**Abstract:**

We propose infrared monitoring of  $z=0.4-1.6$  Active Galactic Nuclei (AGN) by AKARI. The primary purpose of this observation is the search of dust reverberation to obtain unique information to understand structure and emitting mechanism of AGN. AKARI is needed, and the most suitable telescope for this work because infrared (2-4 micron at rest frame) monitoring of AGN close to the North Ecliptic Pole (NEP) is essential. Our proposing observation is essentially same to the observation of the AGN monitor in the Phase 3-I MP (AGNMO), i.e., this is a proposal to continue the monitoring. For this study, pre-observation with ground based telescope have been executed from 1995. 1) Near-IR variability of 200 AGN was investigated with 1.3m telescope at ISAS/JAXA. 2) Dust reverberation has been newly found and studied in nearby AGN by multicolor monitoring in optical and near-IR by the MAGNUM telescope. 3) Pre-monitoring at optical wavelength by the MAGNUM telescope has been executed for the targets of this MP observation, and promising variability was confirmed. 4) the first detection of AGN variability by AKARI is going to be confirmed using the data of the Phase 3-I MP. This study needs 1 pointings/month for 6 objects with IRC camera with AOTZ03. Long span of the observations is important, (2-3 years or more). The results of this work will be also useful for calibration of IRC, and the determination of distance to AGN and the cosmological parameter.

<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	FBSEP	
<b>Title (Full)</b>	IRC follow-up observations of the AKARI Deep Field South (ADF-S)	

<b>PI</b>	Matsuura, Shuji ISAS/JAXA	E-mail: matsuura@ir.isas.jaxa.jp
<b>Co-I</b>	<p>Mai Shirahata, ISAS/JAXA  Toshinobu Takagi, ISAS/JAXA  Shinki Oyabu, ISAS/JAXA  Takehiko Wada, ISAS/JAXA  Takao Nakagawa, ISAS/JAXA  Hideo Matsuhara, ISAS/JAXA  Mitsunobu Kawada, Nagoya U.  Tsutomu Takeuchi, Nagoya U.  Kotaro Kohno, U. of Tokyo  Bunyo Hatsukade, U. of Tokyo  Youichi Ohyama, ASIAA  Tomotsugu Goto, U. of Hawaii  Hiroshi Shibai, Osaka U.  Hitoshi Hanami, Iwate U.  Chris P.Pearson, RAL  Glenn White, Open U.  Stephan Serjeant, Open U.  Agnieszka Pollo, IPJ  Katarzyna Malek, IPJ</p>	

<b>SAC Members</b>	Y.Taniguchi
<b>Total Number of Pointings</b>	approved=350

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

FBSEP

**PI**

Matsuura, Shuji

**Abstract:**

We propose follow-up observations with IRC multi-band imaging of the AKARI Deep Field South (ADF-S), where we have carried out a far-infrared deep survey with the AKARI/FIS. Far-infrared galaxy surveys provide us with a powerful tool to investigate the star-formation history in the Universe, because they measure thermal emission from dust heated by the UV light from massive stars. Far-infrared surveys also play an important role in tracing the large-scale structure, measuring the cosmic infrared background and analysis of the clustering of luminous infrared galaxies.

For these purposes, we have carried out a deep survey at 65, 90, 140, and 160 microns with the FIS instrument onboard the AKARI satellite. In order to minimize the contamination from the Galactic cirrus emission, we selected the lowest cirrus density region near the South Ecliptic Pole as a survey field (AKARI Deep Survey South: ADF-S). The area of the survey is  $\sim 12$  deg<sup>2</sup>. This survey is unique in having continuous wavelength coverage across four photometric bands including wavelengths not well explored by previous missions, and contiguous mapping in an unprecedentedly wide area.

We have successfully detected almost 2000 galaxies down to  $\sim 10$  mJy at 90  $\mu$ m, and measured infrared colors for about 500 of them. Galaxy counts provide useful constraints for the evolution scenario of galaxies and/or SEDs of galaxies. The galaxy counts obtained in the ADFS require a significant modification of currently accepted models of infrared galaxy evolution, mainly because of the lower counts found at the 90  $\mu$ m band.

In order to investigate the nature of detected galaxies such as the spectral energy distributions and redshifts, we propose multi-band near-infrared imaging with the IRC instrument in AKARI warm mission term. This multi-band imaging will enable us the estimation of photometric redshifts and will be the only way to identify the detected far-infrared sources. Moreover, since ADF-S is enough continues and wide to include the large scale structure at  $z \sim 1$ , we can discuss the environmental effect that the clustering gives the ratio of star-formation rate (SFR) and the mass assembly, which are traced by FIR luminosity and NIR luminosity, respectively.



<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	QSONG	
<b>Title (Full)</b>	QSO Spectroscopic Observation with NIR Grism 2	

<b>PI</b>	Lee, HyungMok Seoul National University	E-mail: hmlee@snu.ac.kr
<b>Co-I</b>	Myungshin Im, Seoul National University Myung Gyoon Lee, Seoul National University Hyungsung Jun, Seoul National University Do-Hyung Kim, Seoul National University Yiseul Jeon, Seoul National University Induk Lee, Seoul National University Jonghak Woo, UCLA Takao Nakagawa, ISAS/JAXA Hideo Matsuhara, ISAS/JAXA Takehiko Wada, ISAS/JAXA Shinki Oyabu, ISAS/JAXA Toshinobu Takagi, ISAS/JAXA Youichi Ohyama, ASIAA	

<b>SAC Members</b>	N.Arimoto; Y.Taniguchi
<b>Total Number of Pointings</b>	approved=260

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

QSONG

**PI**

Lee, HyungMok

**Abstract:**

We propose to continue our Phase-3 Mission Program, QSONG to obtain additional NIR Grism/Prism spectra of 43 low redshift bright PG QSOs, and 100 high redshift QSOs at  $z > 3.4$ . The wavelength region between 2.5–5.0  $\mu\text{m}$  contains a wealth of information on QSOs, but difficulties of accessing such a wavelength regime have hampered studies of spectra at the important spectral window. At low redshift, the 2.5-5.0  $\mu\text{m}$  window offers opportunities to study NIR Hydrogen lines which can give new insights into the AGN physics and also potentially provide useful AGN diagnostics for studying dust reddened systems. At high redshift, the H-alpha and H-beta lines – the popular estimators of the black hole mass – redshifts into 2.5-5.0 micron, making one to rely on much less robust mass estimators such as UV lines. By obtaining the 2.5–5.0 micron spectra of a carefully selected low redshift and high redshift QSOs, we will (i) assemble QSO spectra at the rarely studied wavelength regions of 2.5-5 micron; (ii) study the NIR Hydrogen lines such as Br, Br, and P as diagnostics to understand the nature of the Supermassive Black Holes (SMBHs); (iii) examine whether there is a trace of star formation activities in their host galaxies through PAH features, and (iv) study the mass evolution of the SMBHs at high redshift to today. The spectroscopic study of hundreds of high redshift QSOs will enable us to understand the evolution and the census of SMBHs in QSOs at high redshift.

Our study will also provide a uniform, extensive set of the rest-frame 2.5-5.0 micron spectra of QSOs for the first time, which can serve as a strong basis for the future studies of the less-extinct rest-frame NIR Hydrogen lines to understand the nature of distant QSOs.

The combined number of QSOs will be 229 for high redshift sample, and 122, providing a dataset of Legacy value until the launch of JWST.

<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	AMUSE	
<b>Title (Full)</b>	AKARI mJy Unbiased Survey of Extragalactic Sources in 5MUSES	

<b>PI</b>	Lee, HyungMok Seoul National University	E-mail: hmlee@snu.ac.kr
<b>Co-I</b>	Myungshin Im, Seoul National University Myung Gyoon Lee, Seoul National University Hyungsung Jun, Seoul National University Yiseul Jeon, Seoul National University Takao Nakagawa, ISAS/JAXA Hideo Matsuhara, ISAS/JAXA Takehiko Wada, ISAS/JAXA Shinki Oyabu, ISAS/JAXA Toshinobu Takagi, ISAS/JAXA Hanae Inami, ISAS/JAXA Youichi Ohyama, ASIAA George Helou, IPAC/Caltech Lee Arums, IPAC/Caltech Yanling Wu, IPAC/Caltech	

<b>SAC Members</b>	N.Arimoto; S.Okamura; Y.Taniguchi
<b>Total Number of Pointings</b>	approved=160

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

AMUSE

**PI**

Lee, HyungMok

**Abstract:**

We propose to take 2.5–5  $\mu\text{m}$  spectra of IR sources of the 5mJy Unbiased Spitzer Extragalactic Survey (5MUSES). 5MUSES is one of the Spitzer Legacy surveys which performed a MIR spectroscopic observation of sources brighter than 5 mJy at 24  $\mu\text{m}$  in the Spitzer First Look Survey field and SWIRE fields. The 5MUSES provides an unbiased library of IR spectra of sources bridging the gap between the bright nearby IR sources and faint, distant IR sources. Current 5MUSES spectral coverage is 5–40  $\mu\text{m}$ , missing the wavelength range of 2.5–5  $\mu\text{m}$  where the 3.3  $\mu\text{m}$  PAH feature and other interesting Hydrogen recombination lines fall. These lines are important for future investigation of dusty objects at high redshift and star formation activity in dusty systems. In this Mission Program, we will take AKARI IRC grism/prism spectra of 5MUSES sample whose 3.6  $\mu\text{m}$  flux density exceeds 0.7–1 mJy. By combining the current Spitzer 5MUSES IR spectra and the AKARI IRC spectra, we will provide a complete coverage of the IR spectra of 5MUSES sample over 2.5–40  $\mu\text{m}$ , which will be useful for understanding IR luminous objects for years to come.

<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	FUHYU	
<b>Title (Full)</b>	FUHYU - WELL STUDIED FIELD MISSION PROGRAM	

<b>PI</b>	Pearson, Chris RAL	E-mail: <a href="mailto:cpp@ir.isas.jaxa.jp">cpp@ir.isas.jaxa.jp</a>
<b>Co-I</b>	<p>Toshinobu Takagi, ISAS  Stephen Serjeant, Open University  Hideo Matsuhara, ISAS/JAXA  Takehiko Wada, ISAS/JAXA  Hyung Mok Lee, Seoul National University  Myungshin Im, Seoul National University  Woong-Seob Jeong, KASI  Mattia Negrello, Open University  Shinki Oyabu, ISAS/JAXA  Dimitra Rigopoulou, Oxford University</p>	

<b>SAC Members</b>	N.Arimoto; S.Okamura; Y.Taniguchi
<b>Total Number of Pointings</b>	approved=380

PEARSON\_FUHYU

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

FUHYU

**PI**

Pearson, Chris

**Abstract:**

We propose to carry out point source aperture spectroscopy of a large sample of intermediate redshift,  $z \sim 1$  luminous infrared galaxies using the IRC near-infrared grism spectrograph on board AKARI. The proposed targets are intended to bridge the gap between the local Universe and the high redshift Universe observed previously by the FUHYU Mission Programme. The proposed targets have all been detected in deep 70 microns surveys with the Spitzer Space Telescope. The primary target lines of our observations will be the Paschen alpha line where AKARI's IRC near-infrared grism spectrograph is the only instrument that combines sensitivity and wavelength coverage and is uniquely suited to study near-infrared Hydrogen recombination lines in medium redshift  $0.5 < z < 1.0$  galaxies. The observations will derive star formation rates which subsequently will be compared to SFRs derived from other indicators. The relationship with the IRAC 8 micron emission which correlates with the Paschen Alpha line luminosity will be investigated since the extended IR luminosity of our targets originate in deeply obscured star-forming regions making traditional star-formation rate (SFR) indicators, for example the UV continuum or the H-alpha line emission, unsuitable for use with LIRGs due to the heavy extinction caused by the dust associated with the star formation sites. We will also compare the near-infrared evidence for AGN activity with evidence from Spitzer mid-infrared colours via the hydrogen recombination lines.

<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	ISMGN	
<b>Title (Full)</b>	ISM in our Galaxy and nearby galaxies	

<b>PI</b>	Kaneda, Hidehiro                      E-mail: kaneda@u.phys.nagoya-u.ac.jp Nagoya University	
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<b>SAC Members</b>	Y.Nakada; T.Hasegawa
<b>Total Number of Pointings</b>	approved=552

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

ISMGN

**PI**

Kaneda, Hidehiro

**Abstract:**

We performed systematic studies on the ISM in various environments of our Galaxy and nearby galaxies in the AKARI Phase 2. In Phase 3a, we have started near-IR spectral mapping of our Galaxy and nearby galaxies to obtain AKARI legacy products combined with the results in Phase 2. In order to extend our studies, we propose to continue our MP observations in Phase 3b. Considering AKARI uniqueness, we lay stress on near-IR spectroscopy that Spitzer does not possess. In particular, we propose to strengthen our near-IR spectral database on our Galaxy by newly selecting observational area on the basis of the AKARI mid-IR all-sky survey and the NANTEN/NANTEN2 galactic plane survey data. This database combined with the AKARI mid-IR all-sky survey data will play a key role for our AKARI-Planck collaboration. We also continue near-IR spectral studies on SNRs and nearby galaxies by focusing on targets, for which we have already obtained notable results with AKARI and/or Spitzer.

Spectroscopic observations in the 2-5  $\mu\text{m}$  wavelength range covered by the AKARI/IRC provide many pieces of information about the properties of the ISM; ultra-small carbonaceous particles, such as polycyclic aromatic hydrocarbon (PAH) molecules, exhibit several spectral features at 3.3-3.5  $\mu\text{m}$  that are crucial probes into the physical/chemical states of the dust grains and their evolution. The chemical composition of molecular species can be studied through absorption features by interstellar ice/gas such as those of CO at 4.7  $\mu\text{m}$ , CO<sub>2</sub> at 4.3  $\mu\text{m}$ , and H<sub>2</sub>O around 3  $\mu\text{m}$ . For SNRs interacting with molecular clouds, many ro-vibrational emission lines from molecular hydrogen gas heated by shock are expected to emerge in the near-IR spectral range. In contrast, for UV-dominated regions with active star formation, hydrogen recombination lines from Brackett and Pfund series become dominant in the near IR, and therefore near-IR line diagnoses are very important to discuss whether observed regions are dominated by shock heating or not. On the other hand, the near-IR spectral continuum is sometimes dominated by photospheric emission from asymptotic giant branch (AGB) stars, and thus AGB stars in the aggregate can be studied for mature systems such as elliptical galaxies. Dust continuum emission is also expected to exist in the near-IR spectrum even after subtracting the stellar background.

The observation program consists of the following three sub-programs: (1) Galactic plane survey by near-IR spectroscopy (lead: M. Tanaka, A. Kawamura, & D. Ishihara), (2) Supernova remnants (B.-C. Koo) and supernovae (I. Sakon), and (3) Nearby galaxies (T. Onaka & H. Kaneda).



<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	SOSOS	
<b>Title (Full)</b>	Origin and Evolution of Solar System Objects	

<b>PI</b>	Ueno, Munetaka University of Tokyo	E-mail: m.ueno@exo-planet.org
<b>Co-I</b>	Ueno, Munetaka, University of Tokyo Ootsubo, Takafumi, ISAS/JAXA Ishiguro, Masateru, National Astronomical Observatory Hasegawa, Sunao, ISAS/JAXA Usui, Fumihiko, ISAS/JAXA Hong, SeungSoo, Seoul National University Pyo, JeongHyun, Seoul National University Kwon, Suk Minn, Kangwon National University Sekiguchi, Tomohiko, Hokkaido University of Education Kinoshita, Daisuke, National Central University Kawakita, Hideyo, Kyoto Sangyo University Furusho, Reiko, National Astronomical Observatory Sarugaku Yuki, Kiso Observatory, University of Tokyo Kuroda, Daisuke, National Astronomical Observatory Watanabe, Jun-ichi, National Astronomical Observatory Mueller, Thomas G., Max-Planck-Institut fuer extraterrestrische Physik Mukai, Tadashi, Kobe University	

<b>SAC Members</b>	T.Mukai
<b>Total Number of Pointings</b>	approved=275

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

SOSOS

**PI**

Ueno, Munetaka

**Abstract:**

Our knowledge of the origin and the evolution of the solar system comes from two ways, one is study of star formation and extra-solar planetary systems, and the other is study of our own solar system. Different from the macroscopic view for the other planetary systems, we can obtain plenty of information in details on the individual bodies in the solar system. The current solar system is, however, a highly evolved, and it is very important for us to recognize which qualities reflect the violent evolution and which truly record conditions at the time of solar system formation. Then, which solar system bodies leave a trace at early solar system? Minor bodies such as asteroids, comets, centaurs, and Trans-Neptunian objects must be remnants of planetesimals in the early solar-nebula. Meteorites which came from asteroids provide us the clock for timing and conditions in planetesimal formation by cosmochemistry and mineralogy. Minor bodies contain a relatively pristine record of the initial conditions that existed in our solar system nebula 4.6Gy ago. To know the origin and the evolution of early solar system, it is essential to study the small solar system objects. As questions about origin and evolution of the solar system, we have following three questions.

- I. What was compositional gradient from Mercury to beyond Neptune at the time of initial protoplanetary accretion?
- II. What fragments originated from the same primordial parent bodies, and what was the original distribution of those parent bodies?
- III. What are early steps in planetesimals and planet formation and evolution?

Observations of ices and silicate materials are important to solve these questions. These materials have spectral features in near-infrared wavelength. Spectroscopic observations of AKARI/IRC are very unique and are suited for the determinations of compositions and crystallinity of these materials. Thus, we propose 'near-infrared spectroscopic survey of small solar system objects.'

<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/01
<b>Title (Abbreviation)</b>	AFSAS	
<b>Title (Full)</b>	ASTRO-F/AKARI Studies on Star formation and Star forming regions	

<b>PI</b>	UENO, Munetaka                      E-mail: ueno@providence.c.u-tokyo.ac.jp University of Tokyo
<b>Co-I</b>	Kitamura, Yoshimi, ISAS/JAXA Kawamura, Akikom Nagoya University Aikawa, Yuri, Kobe University Ikeda, Norio, ISAS/JAXA Takita, Satoshi, ISAS/JAXA Ishihara, Daisuke, ISAS/JAXA Kandori, Ryo, National Astronomical Observatory Sato, Yaeko, National Astronomical Observatory Fukagawa, Misato, Osaka University Kataza, Hirokazu, ISAS/JAXA Okamoto, Yoshiko, Ibaragi University Ohnishi, Toshikazu Nagoya University Sunada, Kazuyoshi, National Astronomical Observatory Dobashi, Kazuhito, Tokyo Gakugei University Lee, Chang Won, Korea Astronomy Observatory Koo, Bon-Chul, Seoul National University Park, Yong-Sun, Seoul National University Toth, L. Viktor, ELTE TTK White, Glenn J., Open University Abraham, Peter, Konkoly Observatory Kun, Maria, Konkoly Observatory Tatematsu, Kenichi, National Astronomical Observatory Hasegawa, Tetsuo, National Astronomical Observatory Tamura, Motohide, National Astronomical Observatory

<b>SAC Members</b>	M.Tamura; T.Hasegawa
<b>Total Number of Pointings</b>	approved=378

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/01**Title**

AFSAS

**PI**

UENO, Munetaka

**Abstract:**

AFSAS MP in phase3 mainly focuses on the following topics using ASTRO-F/AKARI's uniqueness.

The first topic is the astro-mineralogy. ASTRO-F/AKARI's unique capabilities in 3 micron spectroscopies realize detailed analyzations of interstellar dust particle with icy mantle. To know the composition of icy material is essentially important to understand the chemical processes in interstellar matter, and the composition must be determined by the physical conditions such as temperature, density, and UV flux. The icy dust is also very important to control the speed of accumulations of planetesimal phase in proto-planetary disk. ASTRO-F/AKARI is the only mission which can examine a spectroscopic face of dust particle in various stage of star formation up to our solar system.

The second project is a deep survey for selected regions under collaboration with tie-up observations. The formation of brown dwarfs and planetary-mass objects and their abundance, and the very low-mass end of the initial mass function, are two of the central topics for both of the low-mass star and star formation studies.

The third project is a follow-up observations of Chamaeleon sky survey. Chamaeleon region is selected to be a test bench for our studies since it is situated in the excellent visibility area of ASTRO-F/AKARI. A full use of ASTRO-F/AKARI capabilities enables us to conduct an extended survey to cover from the diffuse interstellar matter up to rather evolved main sequence stars. This project is the first survey that has enough sensitivities to detect any stages of YSOs up to MS star and sufficient coverage in the sky, and which will provide us quantitative samples of stars with proto-planetary disks born in the cloud and will hopefully meet a brief phenomena with very short duration.

<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	AGBGA	
<b>Title (Full)</b>	Mass loss and stellar evolution in the AGB phase	

<b>PI</b>	Nakada, Yoshikazu      E-mail: nakada@kiso.ioa.s.u-tokyo.ac.jp University of Tokyo
<b>Co-I</b>	M. Matsuura (NAOJ, University College London; m.matsuura@nao.ac.jp) M. Otsuka (STScI; otsuka@stsci.edu) H. Fukushi (University of Tokyo; hina@ioa.s.u-tokyo.ac.jp) H. Mito (University of Tokyo; mito@kiso.ioa.s.u-tokyo.ac.jp) Y. Ita (NAOJ; yoshifusa.ita@nao.ac.jp) T. Tanabe (University of Tokyo; ttanabe@ioa.s.u-tokyo.ac.jp) H. Izumiura (NAOJ; izumiura@oao.nao.ac.jp) T. Ueta (University of Denver; tueta@du.edu) N. Matsunaga (University of Kyoto; matsunaga@kusastro.kyoto-u.ac.jp) I. Yamamura (ISAS, JAXA; yamamura@ir.isas.jaxa.jp)

<b>SAC Members</b>	Y.Nakada
<b>Total Number of Pointings</b>	approved=235

NAKADA\_AGBGA

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

AGBGA

**PI**

Nakada, Yoshikazu

**Abstract:**

We propose follow-up observations of our phase 3 I AGBGA, imaging and spectroscopic observations of evolved stars (Asymptotic Giant Branch (AGB) stars, post-AGB stars and planetary nebulae) in nearby galaxies and Galactic globular clusters. The primary aims of these observations are (1) establishing census of mass-losing stars in these galaxies and globular clusters, (2) understanding mass-loss process of these AGB stars, and (3) Investigating the influence of metallicities of galaxies on compositions of dust and molecules.

Targets of the imaging observations are six nearby dwarf galaxies. Furthermore, we request spectroscopic observations of stars in nearby galaxies and Galactic globular clusters in the NG and NP modes. AKARI near-infrared spectra will cover PAHs, C<sub>2</sub>H<sub>2</sub>, H<sub>2</sub>O and CO bands, and CO<sub>2</sub> ice bands. Particular interests will be PAHs and C<sub>2</sub>H<sub>2</sub>, which are likely to have metallicity dependence in their abundance. These observations will help understanding stellar evolution and chemical evolution of galaxies.

<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	NIRLT	
<b>Title (Full)</b>	Near-Infrared Spectroscopy of L and T Dwarfs	

<b>PI</b>	Yamamura, Issei ISAS/JAXA	E-mail: yamamura@ir.isas.jaxa.jp
<b>Co-I</b>	Tsuji Takashi, Univ. of Tokyo Toshihiko Tanabe, Univ. of Tokyo Tadashi Nakajima, NAOJ Satoko Sorahana, Univ. of Tokyo	

<b>SAC Members</b>	Y.Nakada
<b>Total Number of Pointings</b>	approved=24

YAMAMURA\_NIRLT

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

NIRLT

**PI**

Yamamura, Issei

**Abstract:**

We propose extension of the currently running Mission Programme, NIRLT in the second year of the Phase 3. Ground based observations of brown dwarfs, including L and T dwarfs are almost limited to the NIR shortward of 2.5 micron, with the exceptional case of Gl 229B and two other stars. Although mid-infrared region ( $> 5.0$  micron) can be observed with Spitzer, there is no possibility of the near-infrared spectroscopy. The NIR region is especially important for brown dwarfs, because this region includes CO fundamental bands and CH<sub>4</sub> nu<sub>3</sub> 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. Recent analysis of the Spitzer mid-infrared data of the brown dwarfs indicates a remarkable contribution of the non-equilibrium effect such as vertical transport in the abundance of NH<sub>3</sub>. To clarify the non-equilibrium chemistry in other major molecules such as CO and CH<sub>4</sub> is an important next step to a more realistic modeling 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. AKARI provides a unique and exclusive opportunity to take high-quality NIR spectra of brown dwarfs. Its data shall progress our understanding of the atmospheres of brown dwarfs significantly. In the extension period in the Phase 3-II, we do not add any new targets as no more brown dwarfs that are bright enough to be observed with AKARI. Instead we intend to complete the observation previously observed, i.e., supplemental pointings for the targets not allocated yet, in addition, additional pointings to increase the redundancy against hot pixel problem. In total we request 45 pointed observations of 32 objects.



<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	LMCNG	
<b>Title (Full)</b>	Near Infrared Spectroscopic Observations of Red Objects in the Large Magellanic Cloud	

<b>PI</b>	Onaka, Takashi                      E-mail: <a href="mailto:onaka@astron.s.u-tokyo.ac.jp">onaka@astron.s.u-tokyo.ac.jp</a> Department of Astronomy, University of Tokyo
<b>Co-I</b>	Yoshifusa Ita, National Astronomical Observatory Japan Akiko Kawamura, Nagoya University Hidehiro Kaneda, Nagoya University Itsuki Sakon, University of Tokyo Toshihiko Tanabe, University of Tokyo Daisuke Kato, University of Tokyo Takashi Shimonishi, University of Tokyo Mikako Matsuura, National Astronomical Observatory Japan Issei Yamamura, JAXA/ISAS Yasuo Doi, University of Tokyo Daisuke Ishihara, University of Tokyo Takehiko Wada, JAXA/ISAS Youichi Ohyama, ASIAA Bon-Chul Koo, Seoul National University Ho-Gyu Lee, Seoul National University Ji-Yeon Seok, Seoul National University

<b>SAC Members</b>	M.Tamura; Y.Nakada; T.Hasegawa
<b>Total Number of Pointings</b>	approved=525

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

LMCNG

**PI**

Onaka, Takashi

**Abstract:**

We propose to carry out about 750 pointing observations of red objects detected by AKARI or Spitzer Sage surveys of the Large Magellanic Cloud (LMC) with the grism mode (NG; 2.5–5 micron) of the IRC. The AKARI/IRC has a unique capability of the high-sensitivity near-infrared (NIR) spectroscopy, which can clearly distinguish young stellar objects (YSOs) from evolved stars enshrouded by dust shells. The present observation not only makes the correct classification of red objects, but also enables us to quantitatively study the physical properties of these objects, such as the ice chemistry in YSOs, photosphere chemistry of asymptotic-giant branch stars and interaction of supernova remnants with the interstellar medium. It will provide a unique dataset, which cannot be obtained by any other current facilities, for the study of a wide range of astronomy, from star-formation, mass-loss process in the late stellar evolution, and the energy to the mass budget of the interstellar medium. The proposed observation will make a significant contribution to the study of the material circulation in a galaxy, a primary goal of the AKARI LMC survey.

<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	MSAGN	
<b>Title (Full)</b>	Mid-infrared all-sky survey follow-up program: search for missing Active Galactic Nuclei	

<b>PI</b>	Oyabu, Shinki ISAS/JAXA	E-mail: oyabu@ir.isas.jaxa.jp
<b>Co-I</b>	Daisuke Ishihara(ISAS/JAXA) Keigo Enya(ISAS/JAXA) Youichi Ohyama(ISAS/JAXA) Takehiko Wada(ISAS/JAXA) Hirokazu Kataza(ISAS/JAXA) Takashi Onaka(U-Tokyo) Hideo Matsuhara(ISAS/JAXA) Takao Nakagawa(ISAS/JAXA) Issei Yamamura(ISAS/JAXA) Yoshifusa Ita(NAOJ) Satoshi Ray Takita(ISAS/JAXA) Fumihiko Usui(ISAS/JAXA) Myungshin Im(SNU) Munetaka Ueno(U-Tokyo) Hideaki Fujiwara(U-Tokyo) Sunao Hasegawa(ISAS/JAXA) Chris P. Pearson(RAL) Mattew Malkan(UCLA) Tsutomu T. Takeuchi(Nagoya-U) Takeo Minezaki(U-Tokyo) Anybody who is interested in it.	

<b>SAC Members</b>	N.Arimoto; S.Okamura; Y.Taniguchi; Y.Nakada
<b>Total Number of Pointings</b>	approved=200

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

MSAGN

**PI**

Oyabu, Shinki

**Abstract:**

This is the continuation proposal for a follow-up program of AKARI mid-infrared all-sky survey sources. Main purpose is to search for Active Galactic Nuclei (AGNs) in the all sky using mid-infrared excess over 2MASS  $K_S$ -band. Our survey can find not only normal AGNs but also very dusty AGNs which are excluded by selection criteria of other AGN surveys with optical as well as X-ray, radio and near-infrared. Spitzer can perform a deep, but small field of view survey in the infrared, while IRAS made all-sky survey with shallow sensitivities in the mid- and far-infrared. Instead, our AKARI mid-infrared all-sky survey brought us wider area than the Spitzer's survey and deeper sensitivities and higher resolution than the IRAS.

IRC NG spectroscopy can escape from dust extinction and provide their evidence of AGNs which have broad emission lines and/or steep continuum of hot dust. If it is very dusty, there might be molecule absorptions in the spectra. The contamination of sources are star-forming galaxies with strong PAH emissions. We distinguish them using  $3.2\mu\text{m}$  PAH emission and flat continuum of such galaxies on IRC NG spectra.

Using their spectra, we will make new AGN sample. We are going to discuss real AGN population in near-by universe. We also note that our survey have a possibility to find quasars at  $z \sim 4$  like the luminous and lensed quasar, APM 08279+5255.

<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	MSFGO	
<b>Title (Full)</b>	Mid-infrared all-sky survey follow-up program including Galactic objects	

<b>PI</b>	Ishihara, Daisuke                      E-mail: <a href="mailto:ishihara@ir.isas.jaxa.jp">ishihara@ir.isas.jaxa.jp</a> U-Tokyo	
<b>Co-I</b>	Takashi Onaka, (Univ. of Tokyo) Hirokazu Kataza, (ISAS/JAXA) Yoshifusa Ita, (ISAS/JAXA) Hideo Matsuhara, (ISAS/JAXA) Takao Nakagawa, (ISAS/JAXA) Shinki Oyabu, (ISAS/JAXA) Satoshi Takita, (ISAS/JAXA) Takehiko Wada, (ISAS/JAXA) Issei Yamamura (ISAS/JAXA)	

<b>SAC Members</b>	M.Tamura; Y.Nakada; T.Hasegawa
<b>Total Number of Pointings</b>	approved=600

ISHIHARA\_MSFGO

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

MSFGO

**PI**

Ishihara, Daisuke

**Abstract:**

Main purpose of this proposal is a systematic follow-ups of newly detected sources in AKARI mid-infrared all-sky survey targeting identification of sub sample of these objects and finding new kind of objects or populations. AKARI mid-infrared all-sky point source catalog will provide over 700,000 sources including many unidentified sources (>70% of 9um detections are without IRAS detections and >60% of them are without SIMBAD IDs). Our targets are “red” objects thus expected to be surrounded by larger amount of gas and dust and show many kinds of spectral features. We will cover lower galactic latitude ( $|b| < 30$  deg) thus complementary with those of another follow-up program of AKARI mid-infrared all-sky survey : MSAGN (PI: S.Oyabu) .

<b>AKARI Mission Program Proposal (1/2)</b>		<b>Date:</b> 09/03/02
<b>Title (Abbreviation)</b>	SPICY	
<b>Title (Full)</b>	Unbiased Slit-Less Spectroscopic Survey of Galaxies for the Phase 3-II	

<b>PI</b>	WADA, TAKEHIKO ISAS/JAXA	E-mail: wada@ir.isas.jaxa.jp
<b>Co-I</b>	Youichi Ohyama, ISAS/JAXA Shinki Oyabu, ISAS/JAXA Kentaroh Watanabe, ISAS/JAXA Tomotsugu Goto, ISAS/JAXA Tsutomu T. Takeuchi, Nagoya-U Myungshin Im, SNU Yutaka Komiyama, NAOJ Hideo Matsuhara, ISAS/JAXA Shuji Matsuura, ISAS/JAXA Mai Shirahata, ISAS/JAXA Chris Pearson, RAL and the SPICY team	

<b>SAC Members</b>	N.Arimoto; S.Okamura; Y.Taniguchi
<b>Total Number of Pointings</b>	approved=260

**AKARI Mission Program Proposal (2/2)****Date:** 09/03/02**Title**

SPICY

**PI**

WADA, TAKEHIKO

**Abstract:**

Using the ABSOLUTELY UNIQUE capability of AKARI's NIR slit-less spectroscopy, we propose an unbiased slit-less spectroscopic survey of galaxies. The purpose of this survey is as follows.

- 1) Construction of a library of accurate SED templates of galaxies.
- 2) Determination of the redshifts of galaxies by 3.3 $\mu$ m PAH features and other emission lines.
- 3) Investigation of the PAH features, especially, the PAH/SFR relationship in a variety of clustering environment.
- 4) Constraints on galaxy evolution models by type dependent luminosity function classification, rather than galaxy counts.
- 5) Discovery of spectroscopically peculiar galaxies such as ELGs, high- $z$  QSOs and Ly- $\alpha$ /H- $\alpha$  emitters at the re-ionization era.
- 6) Detection of H $\alpha$  emission from high redshift Lyman- $\alpha$  emitters.

This survey will also give strong constraints on the origin of the EBL. This survey will mainly use IRC prism (NP) in the slit-less spectroscopy mode and provide us with a large number of unbiased samples of galaxies with low resolution spectrum covering wavelengths from 2.5 to 5  $\mu$ m. Together with existing or on-going GALEX, CFHT, Uzbekistan 1m telescope, KPNO 2m telescope, Spitzer, and AKARI photometric data, this survey will provide us with a complete correction of SEDs of local ( $z=0.1-0.4$ ) star forming galaxies with a coverage from UV to FIR wavelengths, with spectroscopic redshifts determined by the 3.3 micron PAH feature. This survey also search for H $\alpha$  emission from high-redshift LABs and LAE. 521 pointed observations by AOTZ4 (partly AOTZ0) mainly in the NEP regions are requested for this unique survey.