AKARI OPEN TIME OBSERVING PROGRAMMES FOR PHASE 2

APPROVED PROPOSALS (JAPAN/KOREA TIME)

Proposal: AIKAWA_ISICE

Title: Formation and Evolution of Interstellar Ice

PI: Aikawa, Yuri (Dept. of Earth and Planetary Sciences, Kobe University)

Abstract:

We observe the absorption of ice bands in star forming regions. Most of the background stars behind molecular clouds, low-mass protostars, and protoplanetary disks are too faint for the spectroscopic observation from the ground. The high sensitivity of Astro-F is required to investigate the chemical composition of ice towards these objects. Spitzer Space Telescope is currently undertaking similar ice observations, but it is restricted to lambda > 5 micron. Astro-F is currently the unique space telescope to observe the wavelength region of 3-5 micron, which contains various important ice bands.

Proposal: DOI_FISPL

Title: Observation of FIR Polarimetry with FIS/FTS

PI: Doi, Yasuo (Department of Earth Science and Astronomy, Graduate School of Arts and Sciences, The University of Tokyo)

Abstract:

Far-infrared (FIR) polarimetry of interstellar dust particles by ASTRO-F/FIS is proposed. Polarimetry in a FIR waveband is a powerful tool to investigate interstellar magnetic fields especially in the deep core regions of interstellar clouds. Thanks to its low absorption rate, FIR light can penetrate into the core regions of star-forming clouds, in which magnetic fields may play important roles in star-formation processes. FIR polarimetry, however, has been rarely done so far, because of the technical difficulties. The ASTRO-F/FIS has high sensitivity in 50-180um and its beam-splitting polarizer in a Fourier spectrometer can be applied to a measurement of an astronomical polarization. By observing both in spectroscopic mode and in photometric mode, we can measure FIR polarization of an astronomical object. In addition to the study of magnetic fields, FIR polarimetry can be a unique technique to investigate dust properties, such as shape, size and degree of alignment, because the FIR polarimetry is a direct measurement of thermal emission from interstellar dust particles. We propose to observe N159/N160 HII complexes to study dust properties as well as distributions of interstellar magnetic fields. These regions are adjacent active high-mass star formation regions in the LMC. Though the two regions show almost the same H2 molecular line intensity, CO emission is 4 times stronger in the N159 than in the N160. So the N160 region is more evolved and photo-dissociated. By observing with the ASTRO-F/FIS, we can expect that we will be able to study the time evolution of interstellar magnetic fields as well as dust properties in such active star-formation regions.

Proposal: EGAMI_EGAMI

Title: Astro-F Ultra-Deep Imaging/Spectroscopy of the Spitzer/IRAC Dark Field

PI: Egami, Eiichi (University of Arizona)

Abstract:

We propose to conduct an ultra-deep imaging/spectroscopic survey with Astro-F on the IRAC dark calibrationa field, a dark and clean field near the northern ecliptic pole which is being imaged repeatedly by IRAC for dark calibration. Although not yet widely known among the astronomical community, this field will eventually achieve a depth with IRAC similar to that of the GOODS ultra-deep survey (100 hrs per band). The abundance of high-quality data together with the high visibility to Astro-F makes this field an ideal target for Astro-F to conduct an ultra-deep imaging/spectroscopy survey which will push the Astro-F sensitivity to its limit. We will conduct the deepest Astro-F imaging and multi-object spectroscopy observations on a 10'x10' area, and will study the properties and evolution of infrared-lumninous galaxies at high redshift.

Proposal: HIRASHITA_BCDDE

Title: Blue Compact Dwarf Galaxies as Laboratories of High-z Dust Enrichment

PI: Hirashita, Hiroyuki (Center for Computational Sciences, University of Tsukuba)

Abstract:

Blue compact dwarf galaxies (BCDs) are characterized by their compactness, small metallicity, and high star formation activity. These characteristics are similar to those expected for high-z primeval galaxies, which are difficult to detect. Here we propose to use nearby BCDs as laboratories of high-z primeval galaxies to infer the dust-enrichment history of the high-z Universe. Dust mass derived from this observation enables us to constrain the dust formation and destruction in a metal-poor (1/10Z_odot) phase. We also derive the dust optical depth, which affects the escape fraction of ionizing photons. Thus, if we apply our results to high z, we can quantify effects of dust on the cosmic reionization.

Proposal: HWANG_NULIZ

Title: The Nature of New ULIRGs at intermediate redshift

PI: Hwang, HoSeong (Astronomy Program, School of Earth and Environmental Sciences, Seoul National University)

Abstract:

We propose to obtain NIR spectra and NIR/MIR-S images of new ultraluminous infrared galaxies (ULIRGs) at intermediate redshift (mostly at $0.2 < z < 0.5$) using ASTRO-F. Recently, we found about 230 new ULIRGs from a cross-correlation of the IRAS Faint Source Catalog with the spectroscopic galaxy catalogs of SDSS, 2dFGRS and 6dFGS. These new ULIRGs are mostly at $0.2 < z < 0.4$, while previously known ULIRGs are mostly at $z < 0.2$. The observation of these new ULIRGs at $z>0.2$ using ASTRO-F extends our understanding about the nature of ULIRGs acquired from nearby universe. We are going to investigate the nature of these ULIRGs at intermediate redshift ($z>0.2$) using two modes of ASTRO-F observation: 1) NIR spectroscopy of 20 ULIRGs at $0.2 < z < 0.4$ and 2) NIR/MIR-S imaging of 12 ULIRGs at $0.35 < z < 0.7$. Primary goals of our study are 1) to obtain NIR spectra of new ULIRGs at $0.2 < z < 0.4$ and to measure the equivalent width of 3.3 micron PAH emission and the slope of the continuum covering the PAH feature; 2) to search for dust absorption features at 3.1 and 3.4 microns; 3) to estimate the activity of starburst or active galactic nuclei (AGN) in the targets using above features; 4) to obtain spectral energy distribution (SED) of the new ULIRGs at $0.35 < z < 0.5$ from NIR/MIR-S fluxes; and 5) to estimate the activity of starburst or active galactic nuclei (AGN) in the targets at $0.35 < z < 0.5$ from the SED. We are also going to investigate any luminosity dependence of IR activity from the comparison of ULIRGs and hyperluminous infrared galaxies (HLIRGs). Our study is complementary to the ASTRO-F Mission Program (Evolution of ULIRGs and AGNs: AGNUL) which is composed of (a) NIR spectroscopy of known nearby ULIRGs at $z < 0.2$ and (b) deep imaging survey and slit-less spectroscopic survey of mid to high-z ULIRGs. Our targets will make a critical role bridging the Mission Program's nearby ULIRGs and mid to high z ULIRGs, and will allow us to understand the nature and the evolution of ULIRGs.

Proposal: IM_GROTH

Title: 15 Micron Imaging of Extended Groth Strip

PI: Im, Myungshin (Seoul National University)

Abstract:

We propose to observe a 1200 sq.arcmin region of the Extended Groth Strip (EGS) at 15 micron with Astro-F IRC. EGS is a very unique galaxy redshift survey field where the high resolution Keck spectra enables us to construct the 3-D map of the universe comparable to the local universe surveys such as Las Campana Redshift Survey and Sloan Digital Sky Survey, while having a very extensive multi-wavelength coverages including the deep Spitzer IRAC (3-8 micron) and MIPS images (24 micron), HST ACS, radio, submm, and Chandra X-ray data. The highly complete redshift coverage of the entire region at the high spectral resolution enables us to identify different density environments (groups, clusters) and to measure the velocity dispersion of individual galaxy for dynamical mass estimate. The Spitzer and other multi-wavelength observations permit us to study the dusty nature of the universe in different environments out to z~2 and beyond. However, there is a large gap in the wavelength coverage between 8 and24 micron of the Spitzer data, which hampers the complete understanding of dusty star formation activities at z =1 - 1.5. Our observation at 15micron will fill the gap between Spitzer's 8 and 24 micron imaging data, and will allow us to (i) understand the influence of silicate absorption and AGN contribution on the star formation estimate for 0.5 < z < 1.5; (ii) sample 7 micron MIR light for z~1 galaxies to trace their dusty star formation history as a function environment; and (iii) understand the AGN/starburst connection at even higher redshifts. No other survey fields can be used for the proposed study, and with a moderate amount of investment (36 pointings), we will be able to gain a significant ground in the study of the environmental/mass dependence of star formation out to z~1 - 1.5.

Proposal: IM_HZQSO

Title: Astro-F Spectroscopic Observation of z = 6 QSOs

PI: Im, Myungshin (Seoul National University)

Abstract:

We propose to take the rest-frame optical spectra of 5 z = 6 QSOs discovered in the Sloan Digital Sky Survey. Although they are likely the most massive systems in the early universe, many properties of these objects remain unknown, in particular the black hole and chemical abundances. In order to better understand these intriguing yet mysterious QSOs, we propose to use the unique Astro-F capability of NIR/grsim observation to obtain the rest-frame optical spectra which will include important AGN lines such as H-alpha, H-beta, OIII, and Fe complex. This wavelength range is the missing-link of current spectral observationsof high-redshift quasars, while contains the most important diagnostic lines. The proposed observation will; (i) determine the mass of the supermassive blackhole by measuring H-alpha and H-beta velocity widths and the L(5100) continuum; (ii) test if the local correlation of L(5100) vs Balmer line fluxes holds; (iii) investigate the significance of the narrow line regions through the detection of OIII, (iv) investigate the chemical enrichment history through Fe complex; and (v) see any evidence if there is a significant amount of star forming activity by looking at OII. Our observation will shed a new light on the properties of z = 6 QSOs, and will serve as the scientific validation of the usage of NIR/grism mode on future high-z QSO studies.

Proposal: ITA_SMCPM

Title: The role of pulsation in mass loss along the Asymptotic Giant Branch

PI: Ita, Yoshifusa (Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency)

Abstract:

We propose to observe variable AGB stars in the SMC with the IRC AOT02 and AOT04. We carefully selected fourteen 10'x10' areas in the SMC based on our near-IR (NIR) variable star monitoring survey in the Magellanic Clouds. They contain statistically significant number of AGB stars, that is, dozens of heavily mass-losing AGB stars, hundreds of moderately mass-losing AGB stars, and thousands of weakly mass-losing early-AGB or RGB stars. From our NIR monitoring survey, most of them are now known to be variable stars of wide variety of types pulsating in various pulsation modes. The ASTRO-F mid-IR photometric data will enable us to estimate their mass loss rates and also its mid-IR spectroscopic data will tell us the chemical composition of their circumstellar dust grains. Therefore, the combined data between ASTRO-F and our NIR survey allows us to investigate directly the relationship between the pulsation and the mass loss. Our primary goal is to study the role of pulsation in the mass loss process and their infrared characteristics. We also aim to study the dependence of metallicity on the mass loss and the AGB evolution by comparing the results from this proposed observation with the ASTRO-F LMC Large Area Survey. The total pointings requested for this proposal is 35.

Proposal: ITOH_EXOSP

Title: Spectroscopic Search for Atmospere of an Extra-Solar Planet

PI: Itoh, Yoichi (Graduate School of Sci. and Tech., Kobe University)

Abstract:

We propose spectroscopic observations of atmosphere of an extra-solar planet, using Astro-F/NIR and MIR-S. We attempt to detect the wide and deep absorption band of methane at 3 micron from a hot Jupiter, using transit events. When the planet is located behind the central star, we detect a spectrum of the central star, whereas we obtain a composite spectrum of the central star and the planet at the rest of the period. We can extract the spectrum of the atmosphere of the planet with high precision by subtracting the spectrum of the central star from the composite spectrum. By ground-based observations, even wide and deep features of water and methane cannot be detected due to the telluric absorption. This observation can be carried out only by an infrared satellite. This will show the first definitive evidence for the atmosphere of an extra-solar planet.

Proposal: JEONG_DCFIB

Title: The Detection of Cosmic Far-Infrared Background

PI: JEONG, WoongSeob (Institute of Space and Astronautical Science)

Abstract:

The ASTRO-F observation of Cosmic Far-Infrared Background Radiation near South Ecliptic Pole (SEP) is the one of the ASTRO-F mission programs. This observation in FIS slow scan mode will map out the survey area of more than 15 square degrees. However, this observation is only limited near the SEP regions. In order to detect Cosmic Far-Infrared Background (CFIRB) fluctuation effectively, we have to analyse carefully the spatial structure of cirrus emission at different Galactic latitudes. We propose to carry out deep far-Infrared imaging of regions of different Galactic latitudes. The image patches in low-to-medium cirrus regions can be obtained to segregate the CFIRB fluctuation from the cirrus fluctuation expressed as the power spectrum with a simple power-law. In order to detect CFIRB fluctuation expected from our models, we require at least the sky area of 490 arcmin^2 which can be easily covered by 1 pointing observation of FIS slow scan mode. The detected CFIRB fluctuation will help us to distinguish the evolutionary scenarios of galaxies.

Proposal: KANDORI_DEMDC

Title: Deep Extinction Maps of Dense Cores

PI: Kandori, Ryo (National Astronomical Observatory of Japan)

Abstract:

Taking an advantage of high sensitivity observations from space, we propose to perform both near-infrared (2-5.5 micron; K, L, M band) and mid-infrared (5.8-8.4 micron) imaging observations toward 47 dense cores using the Astro-F/IRC. The aim of our research is to reveal density structure of dense cores on the basis of the measurement of dust extinction (Av). Since the column density of dense cores increases as gravitational collapse proceeds, the cores with large extinction should be in the late phase of dynamical evolution to form stars. However, the dynamic range of ground-based infrared observations (Av < 50 mag) is not enough to investigate the structure of such kind of cores. The measurement of extinction at both near- and mid-infrared wavelengths can reveal internal structure of highly opaque cores (Av > 50 mag) with high angular resolution (typically 2" - 10"). This study will enable us to investigate detailed density structure inside very dense cores.

Proposal: KAWARA_NSPHQ

Title: IRC NIR Spectroscopy of High-Redshift Quasars

PI: Kawara, Kimiaki (Institute of Astronomy, University of Tokyo)

Abstract:

A delay of 1-2 Gyr in Fe enrichment relative to Mg represents a potential chronometer for measuring the age of quasars. With this idea in mind, several groups plot the FeII/MgII as a function of redshift. However, there are no trends of the expected break in a plot of FeII/MgII up to z = 6.4. Two causes which might obscure the break in FeII/MgII are possible. (1) The emissivity of FeII emission depends on not only the iron abundance but also non-abundance factors such as radiation field and gas density in broad line region. (2) Subtracting power-law and Balmer continua, which significantly contributes to the wavelength range where FeII and MgII emission exit, does not be performed accurately because of narrow wavelength coverage of observed spectrum. By mean of correlation analysis for our low-redshift sample and comparison between observed spectra and synthetic spectra predicted by the photoionization code, we found that observing the optical FeII emission is necessary to correct for the non-abundance effects. We also found that the error and deviation of measured FeII/MgII from the spectra with wavelength coverage from UV to optical in rest wavelength become half of those from spectra without optical part. Thus, we propose to do IRC NIR spectroscopy of 11 quasars at z = 3.9-6.4 to observe optical spectra in rest wavelength. Obtained IRC spectra will be combined with spectra observed with ground-based telescopes, and we will obtain the spectra with wide wavelength coverage from 1200 to 6600 Angstrom in rest wavelength. This wide wavelength coverage allows us for the first time to observe FeII(UV) and FeII(opt) emission simultaneously, and allows us to correct for the non-abundance effects for high-redshift quasars. This may enable us to find the expected break in FeII/MgII, and also to derive Fe/Mg abundance ratio, which allows us to test various models of galaxy formation and chemical evolution.

Proposal: KITAMURA_WDISK

Title: Evolution of the disks around weak-line T Tauri stars in Chamaeleon

PI: Kitamura, Yoshimi (Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency)

Abstract:

We would like to propose a sensitive survey of protoplanetary disks around weak-line T Tauri 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, and therefore, the target list of this study consists of weak-line T Tauri stars (WTTSs) with ages of ~ 10 Myr in the Chamaeleon region (d = 140 pc). Although the target sources cannot be observed in the Star Formation MP owing to the limited number of pointing observations, they are of great significance in revealing the disk evolution at ~ 10 Myr. The total number of the sources is 49. In this study, to obtain the disk spectral energy distribution (SED) over 10 - 100 micron, we will perform pointing observations of the WTTS disks with both the FIS and the IRC: we adopt the AOTs of FIS01 and IRC11 (L and N). The number of the pointings, therefore, is estimated to be 147 (A: 49 with FIS, B: 49 with MIR-L, C: 49 with MIR-S). Since the Astro-F survey can detect the disks with very high sensitivity in dust mass of the lunar mass, comparable to that of debris disks around main-sequence stars, 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: the transition stage from a protoplanetary to debris disk due to planet building. Together with the SF MP, this survey is one of the most sensitive unbiased surveys of weak-line T Tauri stars in Chamaeleon. Furthermore, the detailed analysis of the disk SEDs based on theoretical models provides us useful information about the evolution of disk internal structures (i.e., the disk clearing in the innermost regions) relevant to planet building at ~ 10 Myr. Combining our sample with that of the SF MP also makes it possible to understand how the star/disk system forms and evolves in the Chamaeleon cloud.

Proposal: KITAYAMA_FIREC

Title: Far-infrared Emission from the Coma Cluster of Galaxies

PI: Kitayama, Tetsu (Department of Physics, Toho University)

Abstract:

We propose FIS observations of the Coma cluster of galaxies (A1656), aiming at the first firm detection of intergalactic dust grains. Clusters of galaxies provide a unique environment of dust-gas interactions; the X-ray emitting plasma can heat the dust to 10-20 K via collisions, as well as destroy small grains via sputtering. Recent claim of detecting collisionally heated dust grains in Coma by ISOPHOT (Stickel et al. 2002), however, has been questioned owing to insufficient quality of the data. With FIS on ASTRO-F, we can test their result unambiguously for the first time. In addition, multi-wavelength detections enable us to determine both the amount and the mean temperature of the grains. Combined with X-ray and optical data, they further provide powerful clues to understanding the dust-gas interaction and the ejection history of dust from galaxies. In case of no detection, we are still able to place severe constraints on its amount, which is a meaningful step forward in the long-standing argument regarding the intergalactic dust. Our observation will therefore provide a unique opportunity of probing the nature of dust grains in relation to the ambient hot gas and host galaxies.

Proposal: KODAMA_CLNEP

Title: Deep IR Imaging of the Unique NEP Cluster at z=0.813

PI: Kodama, Tadayuki (National Astronomical Observatory)

Abstract:

We propose to take much deeper IR imaging on the unique X-ray selected NEP cluster (RXJ1716.4+6708) at z=0.813 with IRC on Astro-F than is planned as a part of the Mission Program (CLEVL). With its excellent visibility of Astro-F and lowest zodiacal light contribution offer us a unique opportunity for us to take unprecedentedly deep IR imaging on an intermediate redshift cluster down to 2 x 10^9 Msun for passively evolving galaxies at 3 micron and to 4 Msun/yr for star-forming galaxies at 15 micron. We have already completed a deep and wide multi-colour (VRi'z') optical imaging on this cluster with Suprime-Cam on Subaru, reaching down to M*+4 (well matching to 2 x 10^9 Msun) over a large field of view (30'). Also, we plan to conduct a panoramic narrow-band imaging survey with MOIRCS targeting Halpha emissions from cluster members at 1.19 micron in the near future. The unique aspects that this proposed IRC observation will provide are two-fold: (1) dust-free properties such as stellar masses of IR selected galaxies, and (2) dusty star forming activities traced by PAH features. Both are crucial to form a general view of galaxy evolution in dense environment at z=0.8 which may be largely hidden in the ground-based optical-NIR observations.

Proposal: LEE_VELLO

Title: A Search for Very Low Luminosity Objects in Dense Molecular Cores

PI: Lee, ChangWon (Korea Astronomy and Space Science Institute)

Abstract:

Recently discovered Very Low luminosity Objects toward dense molecular cores open a new pathway of the very early processes of the low star formation because the nature of the VeLLO is very different from that of the typical protostar. It is even less fainter (< ~ 0.09 lsun) than any other protostar, but showing the smallest outflow in its extent (~ 500pc) and mass (< 10^-4 msun), and the smallest accretion rate (10^-9- 10^-8 msun yr^-1). These properties were found from only one VeLLO. Whether these are generally applied to other VeLLO is totally questionable at this moment. A systematic study of the large sample of the VeLLO is necessary. We propose to observe 20 starless cores showing 'expansion' asymmetry, a complex mixture of 'infall' and 'expansion' asymmetry in the molecular lines, and showing unusually broad line width, to search for a VeLLO. This survey will help to collect a whole ensemble of VeLLOs discovered in Infrared Space Telescopes, to clarify the physical properties of the VeLLOs, and eventually to understand the physical process in the very low mass protostar or proto-brown dwarf.

Proposal: MATSUO_ETASP

Title: Far-Infrared Spectroscopic Observation of Eta Carinae

PI: Matsuo, Hiroshi (National Astronomical Observatory of Japan)

Abstract:

We are going to make far-infrared spectroscopic observation of one of the most massive star in our galaxy, Eta Carinae. The observation will be made by far-infrared spectrometer with high frequency resolution mode to make spectroscopic image of dust and gas distribution around the star. This is the first spectroscopic imaging observaiton of Eta Carinae and could be a good observing targe for FTS/FIS. From the observation we can estimate evolutional history of the the most massive stars in the universe, which could be a template for masive stars in the early history of the universe itself.

Proposal: NAKAGAWA_COABS

Title: Probing molecular tori n Obscured AGN through CO Absorption

PI: Nakagawa, Takao (ISAS/JAXA)

Abstract:

In order to observe the molecular tori in Seyfert2 directly and to reveal their physical conditions, we propose to obtain spectra of fundamental vibration-rotation band line absorption of gaseous We propose to make CO around 4.7 micron towards the nuclei of bright Seyfert~2 galaxies and ULIRGs, using the central engine as a background continuum source. This is a new and unique technique which allows us to determine temperatures and column densities of molecular clouds very accurately. It is now generally accepted that much of the variety in Active Galactic Nuclei (AGN) types is just the result of varying orientation relative to the line of sight (unified model for AGN). The molecular torus is the key element for this model. However, physical conditions of the tori themselves have never been measured directly, and the exact nature of the molecular tori is still controversial, The proposed observation, with the detection of R- and P-branches of many lines at different excitation levels, will enable us to make the first "direct"' observation of the physical conditions of molecular tori themselves. This will serve as the critical test for the "unified model".

Proposal: ONISHI_COLVN

Title: Extreme Colors: The smoking Gun of Dust Aggregation and Fragmentation

PI: Onishi, Toshikazu (Nagoya University)

Abstract:

Dust is implicated in a wide variety of interstellar physics ranging from photoelectric heating to molecule formation. In order to understand these processes it is necessary to know the properties of dust in some detail, including size distribution and size-related changes in grain composition. Furthermore, dust properties evolve as dust cycles through different Galactic environments. It is by examination of such changes that more confidence can be gained regarding the underlying physical mechanisms. Most of the dust destruction takes place in the diffuse ISM, where IR color variations show a flattening of the dust size distribution due to shock-induced grain-grain and gas-grain collisions. Dust fragmentation must be compensated by efficient grain aggregation, mainly in denser molecular regions. The selection of regions in the diffuse ISM suitable for observations is rather challenging since the dynamical history and the physical parameters (shock velocity, energy) are generally unknown. In addition, aggregation and fragmentation are usually intermixed, complicating physical interpretation. Here, we propose an original approach, focusing on two clouds which exhibit large color variations and have been affected recently by the passage of a slow shock causing dust fragmentation but not powerful enough to have affected the gravitational integrity of the clouds. The AstroF data will allow us to fully characterize the dust size distribution and to pinpoint precisely the spatial locations and spectral signatures of its variations, providing a unique perspective on the processes regulating dust fragmentation and aggregation in space.

Proposal: PEARSON_IRSEP

Title: Mid-Infrared Imaging of the ASTRO-F Deep SEP Field

PI: Pearson, Chris (ISAS/JAXA)

Abstract:

The ASTRO-F Deep Field at the South Ecliptic Pole (SEP) has been secured as an ASTRO-F mission program. This field will be imaged in all 4 FIS bands and will be the deepest image ever taken of the Universe at far-infrared wavelengths far exceeding the All Sky Survey in depth. However, this field is at present devoid of any deep mid-infrared imaging and thus will suffer severe constraints in the interpretation of the detected far-infrared sources. We propose deep mid-infrared imaging with the IRC over some portion of this field to identify and characterize the emission from the sources detected by the FIS deep survey. This mid-infrared imaging will allow the estimation of photometric redshifts and will be the only way with which it will be possible to identify the sources responsible for the far-infrared background and to solve the degeneracy between the temperature of the dust emission spectra with redshift by classifying the infrared galaxy populations. Deep mid-infrared observations with the IRC in this field will be vital if the FIS SEP survey is to provide a valuable legacy from the ASTRO-F mission to the investigation of galaxy evolution in the infrared.

Proposal: PYO_DSTGC

Title: Dust in Globular Clusters

PI: Pyo, Jeonghyun (Seoul National University)

Abstract:

We propose to search and obtain far-infrared (FIR) emission of dust in the cores of globular clusters (GCs) and to understand the mechanism of dust formation and stripping in metal-rich and metal-poor GCs. The apparent absence of dust and gas in globular clusters had been a long standing problem in Galactic astronomy. Recent observations from ISO and Spitzer, however, revealed FIR emission by dust in the center of NGC 7078 with somewhat lower brightness than expectation. Therefore, it is opportune to survey the central regions of globular clusters and to differentiate the clusters having dust from the ones not having. This research aims at understanding the mechanisms of the removal of the cluster dust under the Galactic environment. The targets are selected within 30 kpc from the solar neighborhood with variety of metallicity and Galactic height. The observations will be performed with FIS slow-scan mode.

Proposal: SAKON_SHARP

Title: ASTRO-F/IRC Slit-less Spectroscopy of Hickson Compact Groups

PI: SAKON, ITSUKI (Department of Astronomy Graduate School of Science University of Tokyo)

Abstract:

We propose near- to mid-infrared slit-less spectroscopy of Hickson Comapact groups (HCGs) to investigate the chemical processing of ubiquitous Poly-cyclic aromatic hydrocarbons (PAHs) in on-going evolutional site of galaxies. HCGs in our samples are all detected by IRAS and present the signs of Wolf-Rayet activities with several stages of interactions classified into three groups: merging, strongly interacting, and mildly interacting groups. These targets are quite unique in that they provide us environments with ranges of interactions among group members resulting in induced intense star forming activities and the formation of tidal dwarf galaxies. Especially HCG 31 as well as HCG 92 is one of the best studied compact groups and is made up of 8 galaxies including active central starburst (in the merging region of Galaxy A+C) and the tidal dwarf galaxies (Galaxy E and F). The ISO spetra of the merging region of A+C has revealed the possible primitive species of PAHs. Since PAHs are supposed to be changed in nature and chemivally evolve in these highly dense environments, they are quite useful to constrain the dust environment in each of the group members with various evolutional stages. For this purpose, near- to mid- infrared spectra of whole members of a system is needed, which are brought from the ASTRO-F IRC slit-less spectroscopy (NIR/NP, MIR-S/SG1 and SG2) with, by far, much more efficiency and effectiveness than SPITZER IRS; every group has entirely a size of several arcmin made up of some relatively compact (~several arcsec) galaxies, which enable us to obtain the spectra from 2um to 13um of whole members at once with only one pointing. In these spectra, we can pick up the various UIR features at 3.3, 3.4, 6.2, 7.7, 8.6, 11.0, 11.2, 12.0, and 12.7um, whose relative band ratios as well as each intensity relative to the underlying continuum can be used effectively to determine the nature of PAHs and how they chemically evolve, which would potentially give us a scenario of transmigration of ubiquitous PAHs; where and how PAHs are created from the small carbonaceous materials in the inter stellar medium supplied by supernovae and/or Planetary Nebulae and, in reverse, how PAHs are collapsed back into them under the rule of galaxy evolutions. The Slit-less spectroscopy of HCGs with ASTRO-F IRC will surely lead us go further insight into the evolutional scenario of interstellar dust in the on-going evolution of galaxies.

Proposal: SHIM_Z1LBG

Title: UV-selected Lyman Break Galaxies at 0.6<z<1.3 in the Spitzer FLS

PI: Shim, Hyunjin (Astronomy Program, Seoul National University)

Abstract:

We proposed to image Spitzer First Look survey area with ASTRO-F/IRC to obtain 11micron/15micron flux for 0.6<z<1.3 star forming galaxies. The sample galaxies are selected using rest frame UV colors, which is comparable to lyman break galaxies at higher redshift in the point of UV luminosity and morphology. The stellar mass and dust properties of lyman break galaxies at z>3 are still intriguing issue, because they are too faint to be detected at infrared regime. The alternative method is to study dust-related properties of lyman break galaxy counterparts at closer universe. We expect to detect enough(a few hundreds) number of sample objects with a depth of 40microJy at 11micron. Since 11micron and 15 micron imaging represent 6.7micron PAH emission of z=1 galaxies, the result can be directly imply the meaning of 24micron flux from z=3 LBGs. Our main scientific goals are: (1) to construct MIR luminosity function of lyman break galaxy counterparts at 0.6<z<1.3 (2) to see the evolution of MIR spectral energy distribution along the redshift. The observed datasets will be applicable to broad range of other topics including the correlation of SFR with morphological characteristics and the method to weed out AGNs from starburst samples. With the wide area coverage and the existence of multi wavelength data including UV/u band imaging, our observation will allow us profound understandings on star formation in early universe.

Proposal: TAKAGI_FIRCL

Title: ULIRGs in clusters of galaxies at z~1

PI: Takagi, Toshinobu (University of Kent)

Abstract:

We propose confusion limited far-infrared surveys of eight clusters at z~1, in order to identify ultraluminous infrared galaxies (ULIRGs) in these distant clusters. While no nearby ULIRGs found by the IRAS all-sky survey reside in cluster regions, submillimetre observations with SCUBA revealed ULIRGs in (proto-)cluster regions at z>~1. Nevertheless, the sample of ULIRGs in clusters are very limited. Our targets are adopted from the Mission Program, CLEVL for which N3 and L15 observations are allocated. This program is complementary to this Mission Program. Far-infrared observations allow us to estimate the total infrared luminosity in clusters more reliably than using mid-infrared observations in the Mission Program, which observes the redshifted 7.7 micron PAH feature. On the other hand, we require sensitive mid-infrared observations with high angular resolution to identify optical counterparts of far-infrared sources. With this program, we intend to obtain a complete picture of star formation activity hidden by dust in clusters at z~1. With the help of panoramic deep optical images, we also study the environmental effects to trigger intense dusty starburst event.

Proposal: TAMURA_SGPWD

Title: Search for Giant Planets around White Dwarfs

PI: Tamura, Motohide (National Astronomical Observatory of Japan)

Abstract:

We propose to survey a sample of 25 white dwarfs (WDs) with ASTRO-F and IRC to search for mid-IR excesses using its prism spectroscopy mode (NP) at the wavelengths between 1.7 and 5.5 microns. The aim of our proposal is to detect planets around WDs. WDs are typically 1,000-10,000 times less luminous than their progenitors, thus in the IR wavelengths, the contrast between a self-luminous planet and a WD is much more favorable than between a planet and a main-sequence star. The gain in contrast and IR excess is strongest in the mid-IR, where the planet's thermal emission peaks well into the WD's Rayleigh-Jeans tail. Since all field WDs are descended from stars more massive than the Sun, our results will constrain the frequency of planets of down to a few Jupiter masses around intermediate-mass stars.

Proposal: YAMAMURA_SPECS

Title: NIR--MIR Spectroscopic Survey of Selected Areas in the Galactic Plane

PI: YAMAMURA, Issei (ISAS/JAXA)

Abstract:

We propose a spectroscopic survey of selected areas in the Galactic plain. The observation is carried out in the AOT IRC04 (spectroscopic mode), with an option of a;Nc (prism + imaging field). Target positions are l = +-45, +-90, +- 135, and 180 deg. b = 5 deg. Five fields continuously connected along the scan direction are observed. Total number of requested pointing is A = 35, B = 35, C= 35, respectively. Main target of this programme is stars of M or later spectral types. These stars are in the last phase of their evolution, the Asymptotic Giant Branch (AGB) phase. These stars show various molecular bands in the near- to mid-infrared wavelengths. These features arise from the region just outside of their photosphere. This “extended atmosphere” is known to play an important role on the formation of dust grains and their subsequent acceleration as stellar wind (mass-loss wind). ASTRO-F/IRC is an only instrument currently available for observing spectra in the near-infrared region. In addition, MIR-S channel simultaneously takes the data in the mid-infrared range, which provide additional information of dust envelope. With these NIR--MIR spectra, we plan to carry out following three studies. (1) spectral classification of stars and their distribution in the Galaxy, (2) statistical study of relation between NIR molecular bands and dust emission, (3) search for peculiar stars, such like silicate carbon stars. At some of the target position we may be suffered by source confusion. Even such case we still can take hundreds of spectra of bright sources. The expected number of spectra obtained is something 10000--30000.