AKARI OPEN TIME OBSERVING PROGRAMMES FOR PHASE-3- II

APPROVED PROPOSALS (JAPAN/KOREA TIME)

Proposal: 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 AKARI 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 > 5 micron. AKARI is currently the unique space telescope to observe the wavelength region of 3-5 micron, which contains various important ice bands. So far, we have reduced phase II data and clearly detected water, CO2 and CO bands towards background stars and edge-on YSOs. Although we continued the observation in phase III-1, we assigned only 1 pointing (with grism mode) per coordinate, and thus cannot correct for the hot pixels. We request additional pointings for our phase III objects, so that we can analyze the phase III data.

Proposal: H2BCG

Title: 2.5-5um Spectroscopy of Infrared-Luminous Brightest Cluster Galaxies

PI: Egami Eiichi (Steward Observatory, University of Arizona)

Abstract:

Over the last few years, our team has discovered a number of extragalactic strong H2 emitters using IRS on the Spitzer Space Telescope. The amount of a warm H2 gas we find in some of these systems is spectacularly large, reaching up to 1010 Msun. As we discover more and more such sources, the scientific focus is now shifting toward the identification of the excitation mechanism. However, the pure-rotational lines we detect with Spitzer/IRS provide little information in this regard. Here, we propose to continue our Phase 3a AKARI/IRC spectroscopic follow-up observations of strong extragalactic H2 emitters, focusing this time on the population of infrared-luminous brightest cluster galaxies with exceptionally strong H2 emission. Through our Spitzer Cycle-5 program, which just completed, we have found such BCGs at lower redshift (0.1 and below), which would increase the observed line fluxes and enhance the chance of H2 line detections. The 2.5-5 μm range covered by AKARI/IRC is crucial to detect H2 rovibrational lines, which should enable us to decipher the excitation mechanism in these extraordinary objects.

Proposal: HASEO

Title: AKARI-Untouched AGB-rich old open cluster Berkeley 54

PI: Hasegawa Takashi (Gunma astronomical observatory)

Abstract:

Since no instruments that cover longer than 5 micron is available, we would focus on accumulating observational basis with respect to mass-loss (that can be covered from N3 and N4 band) on star clusters, with a few comparison clusters that show marked contrast in cluster properties. The main observable that we are going to obtain in this study is the time series mass-loss rate on the AGB stars on the various parts along AGB sequence. This is highly taking advantage of studying open clusters which are single population in age and metallicity by nature. By doing this, for example, we could have discriminate whether mass-loss events takes place constantly or periodically at various stages along AGB. We are going to continue photometry in the optical bandpass for two years at least, and therefore it is possible to establish the possible time-lag between optical and infrared.

Proposal: GOALS
Title: The Complete NIR Spectroscopic Survey of LIRGs in the Local Universe
PI: Inami Hanae (The Graduate University for Advanced Studies, ISAS/JAXA)
Abstract:

We request AKARI IRC spectroscopic observations to complete an unbiased near-infrared spectroscopic survey of Luminous InfraRed Galaxies (LIRGs, which have more than 1011 solar luminosities) in the local universe.

Our objectives are (1) to estimate the 3.3 microns PAH emission line flux and constrain the small grain properties such as the ionization state, (2) to measure the Br-alpha recombination line and study the ionized gas, (3) to evaluate the presence of hot thermal dust emission and search for buried AGN, and (4) to investigate starburst/AGN diagnostics as a function of morphology and luminosity. AKARI is the only platform sensitive enough to obtain spectra in the range 2.5-5.0 microns, of a large number of LIRGs and thus provide a solid, global estimate of the importance of AGN emission (via hot dust) and star formation (via cold dust, 3.3 microns PAH, and Br-alpha emission).

These near-infrared LIRG observations will be combined with a comprehensive multi-wavelength imaging and spectroscopic survey (GOALS; The Great Observatories All-sky LIRG Survey) of 202 LIRGs in the nearby universe taken with Spitzer, Hubble, Chandra and GALEX. However GOALS lacks the near-infrared spectroscopic coverage needed to detect many important features (e.g. 3.3 microns PAH emission, Br-alpha recombination line) of LIRGs. Hence AKARI coverage is required, to build complete spectral energy distributions. This is the second OT proposal to request observations of the GOALS sample. In the previous proposal, we observed 39 sources to obtain an important sub-sample of LIRGs with luminosities greater than 1011.4 solar luminosities. In this proposal, we request to observe 19 lower luminosity galaxies and re-observe 31 sources in the previous proposal. Then we will combine them with the blocked targets from the archive to complete all of the GOALS sources.

We propose IRCZ4 observations of each of 50 LIRGs selected from the GOALS sample, to bring the total number of pointings per source, up to a number between four and 10, in order to achieve our signal-to-noise ratio goals. The total number of priority A and B requested pointings is 265. This will complete observations of all of the LIRGs in the local universe observed by GOALS, except the AKARI blocked sources of the MP observations. This will allow us, without any selection bias, to build accurate starburst/AGN diagnostics, to investigate a correlation between these diagnostics and both the merger stage and the luminosity, and to understand galaxy evolution caused by galaxy-galaxy interactions.

Proposal: YPNMG

Title: Search for Young Planets in Nearby Moving Groups

PI: Itoh Yoichi (Graduate School of Science, Kobe University)

Abstract:

Two models are currently proposed for planet formation; the disk instability model and the core accretion model. The previous search for extra-solar planets by the Subaru Telescope concluded that it is very rare chance for planet formation by disk instability, at least, with a large separation. We propose imaging search for young planets around 16 young dwarfs of the AB Dor group and the beta Pic group. If a planet forms by core accretion process, it should be detected in vicinity of a young dwarf by thermal infrared imaging with high sensitivity. Due to its proximity (< 30 pc) and youth (30 Myr), these groups are the best target for searching of young planets formed by core accretion process.

Proposal: UBSMG

Title: AKARI/IRC Observations of Ultra-bright Submillimeter Galaxies

PI: Kohno Kotaro (Institute of Astronomy, Univ. of Tokyo)

Abstract:

We propose to use AKARI in its warm phase to pinpoint the locations of 8 newly discovered extremely bright submillimeter galaxies (SMGs) during a course of our unprecedentedly wide (~ a few deg2) and deep (1 σ ~ 0.5--1 mJy) λ 1.1 mm sky survey using the bolometer camera AzTEC mounted on the submillimeter telescope ASTE in northern Chile. Due to our enormous survey coverage up to a few deg2, we could successfully uncover a very rare population of extreme starbursts; the flux densities of the targeted sources proposed here are ≥10 mJy at 1.1 mm, so they are one of the brightest populations of SMGs so far. These provide us with important samples of the extreme starburst populations (SFR ~ a few 1000 Msun yr-1), which was difficult to address with the previous limited area deep survey. The proposed AKARI/IRC observations will find a promising infrared counterpart of AzTEC-ASTE SMGs, because recent multi-wavelengths follow up observations demonstrate that the SMGs are often intimately associated with "red" sources in Spitzer/IRAC bands. The objectives of this proposal could be listed as follows. (1) we can pinpoint the possible location of the SMGs if we find a red IRC source within error circles of the SMGs. (2) we will then estimate their redshifts through a SED modeling from infrared to radio wavelengths. (3) eventually, the heating sources of such a ultra-bright galaxies will be investigated based on multi-wavelengths follow up observations. Recent results suggest that more luminous IR galaxies tend to host active galactic nuclei as well as dusty extremely starburst. Our ultra-bright SMGs will provide us with a unique opportunity to explore such an extreme populations.

Proposal: NISIG

Title: Near infrared spectroscopy of star-forming infrared galaxies

PI: Lee JongChul (Seoul National University)

Abstract:

We propose near infrared (NIR) spectroscopy of star-forming (SF) infrared galaxies (IRGs). Targets are selected from the catalog of Hwang et al. (2007) based on Sloan Digital Sky Survey. We will measure the flux and equivalent width of 3.3 micron PAH emission line and the NIR continuum slope, and estimate the optical depth from 3.1 micron water ice absorption and 3.4 micron hydrocarbon absorption. Using these parameters, we will search for any hidden active galactic nuclei (AGNs), and determine the intrinsic power source in the SF IRGs. We will also investigate the dependence of SF/AGN contribution on IR luminosity and correlations between optical and NIR SF indicators. From this observation, we can understand the role of AGN in SF IRGs.

Proposal: SFICE
Title: Ices in Star Forming Cores
PI: Lee JeongEun (Sejong University)
Abstract:

We propose to use AKARI/IRC spectroscopy to observe 15 YSOs, VeLLOs, and background stars, in order to study the chemical and thermal conditions in the star forming cores. A wide variety of observations (including SST IRAC, MIPS, and IRS observations) have been acquired toward those sources, and these complimentary data set will be combined with the NIR spectra, which trace the composition of icy grain mantles. We have a self-consistent model for the process of star formation, which couples the chemical evolution with the dynamics of surrounding material and the evolution of the central luminosity. The ice features of H2O, CO, and CO2 covered by the AKARI/IRC spectra are vital to constrain the dust and chemical properties in our self-consistent model. In addition, comparisons of ice features of VeLLOs with those toward normal YSOs and background stars will provide a crucial opportunity to understand the dynamical process of VeLLOs. Therefore, the obtained NIR spectral data cubes acquired by the proposed observations will enable three scientific goals: (1) to compare ice features in various evolutionary stages of star formation from molecular clouds to Class 0, I, and II protostellar cores, (2) to understand the dynamical process in VeLLOs, and (3) constrain self-consistently our chemical and dynamical evolutionary model.

Proposal: BRSFR

Title: Extinction-Independent Measurement of Star Formation Rates in Galaxies

PI: Matsuhara Hideo (JAXA)

Abstract:

We propose to complete our survey of Star Formation Rates (SFRs) in galaxies in the local Universe. We can do this by comparing our existing Hα imaging with new IRC grism spectra of the Brα emission line and the 3.3μm PAH emission. The goal of this project is to produce the definitive calibration of SFRs as a function of cosmic time. We do this by correcting the Hα luminosities for reddening by measuring Brα luminosities in the same compact star-forming regions. SFR is one of the most fundamental properties of galaxies, and is currently determined from applying recombination theory to H emission lines to infer the ionizing photon luminosities produced by O/B stars. Unfortunately, the 'gold standard' line, Hα, is known to be very susceptible to extinction by interstellar dust. The limited measurements of H lines in the infrared suggest that Hα often misses MOST (> 80%) of the ionizing luminosity from newly formed stars, embedded in dust. Using the definitive Brα line (which suffers extinction of only 0.035Av), IRC has shown that this is indeed the case in some ULIRGs, as well as some more normal, less luminous star-forming galaxies. Our preliminary results indicate that the 'canonical' assumption of one magnitude extinction correction to Hα flux is often too low by an additional 1--1.5mags! Our reduced 3--4.5μm IRC/grism spectra also show that a sufficient sample of Brα detections can be obtained by further observations of high-surface brightness gas emission-line regions in a wide sample of star-forming galaxies, with the accumulation of 6 pointings-where possible-to provide high enough SNRs.

Proposal: MAGNE

Title: Emissson Mechanism of Magnetars: Disk or Magnetosphere?

PI: Morii Mikio (Tokyo Institute of Technology)

Abstract:

We propose to observe four magnetars with AKARI to understand the infrared/optical emission mechanism. Several models have been proposed for the emission mechanism, which are based on the magnetospheric emission and disk emission. By the SED fitting for the spectrum obtained by AKARI, Spitzer, and near-infrared/optical observations, the disk models can be tested. Emission features are expected in the mechanism of the magnetospheric origin (cyclotron line and maser frequency peak). By multiple observations with a half year interval, variability of the SED also can be checked and hence the correlation with the X-ray flux is also tested. Disk model would produce strong and wide impact on astrophysics, not only on pulsar astronomy, but also on mechanism of supernova explosion and planet formation.

Proposal: SENNA

Title: Spectral Evolution of Novae in the Near-IR Based on AKARI Observations

PI: Sakon Itsuki (University of Tokyo)

Abstract:

Attempts to understand the dust formation scenario as well as the process of chemical enrichment by low to intermediate-mass stars are important to explore the origin of dust contained in the Milky Way and to understand the chemical evolution of the current universe. For this purpose, Classical Novae are one of the most interesting targets and, in this program, we plan to carry out the near-infrared spectroscopic observations of recent novae with AKARI/IRC at multiple epochs within a few years after the outburst. The goal of this program is to systematically understand the material evolution including the formation of precursor molecules and the process of dust condensation in the nova ejecta. The homogeneous datasets of successive near-infrared spectra from 2.5 to 5 micron with AKARI/IRC collected in this program are extremely unique and crucial to infer the physical conditions of the shell formed by the ejected materials and to examine the elemental abundance in nova ejecta. The obtained information will surely enable us to illustrate the dust formation scenario by novae and to understand their contribution towards the chemical evolution of the ISM in the current universe and to inspect the chemical linkage with the solar system meteorites.

Proposal: BVIOG

Title: Blazar Variability in near-Infrared, Optical and Gamma-ray regions

PI: Sasada Mahito (Hiroshima University)

Abstract:

Blazars emit the broad band spectrum from radio to gamma-ray. The infrared data has been few because of the difficulty of observation in this range. We propose the infrared observations of blazars with AKARI IRCZ4. We will determine the synchrotron peak frequency and flux from simultaneous observations in the infrared range with AKARI, optical with KANATA, and gamma-rays with Fermi. The observation enables us to determine the physical parameters of the blazar, for example the strength of the magnetic field, unambiguously for the first time.

Proposal: PAHSR

Title: Searching for 3.3 um PAH Emission in SNRs with AKARI/IRC Spectroscopy

PI: Seok JiYeon (Seoul National University)

Abstract:

Recently we have detected 3.3 μm polycyclic aromatic hydrocarbon (PAH) features in a supernova remnant (SNR) for the first time using AKARI. This SNR, N49 in the LMC, is interacting with a molecular cloud and the PAH emission is limited to the interacting region, which indicates that the origin of the 3.3 μm PAH emission is closely related to the interaction with molecular clouds. We propose to carry out AKARI/IRC spectroscopic observations of 3.3 μm PAH emission in three Galactic SNRs interacting with molecular clouds; 3C391, W44, and W28. These SNRs are the ones that showed PAH features in Spitzer IRS spectra. We want to compare the relative strengths of different PAH features in these SNRs, which can probe how various-sized PAH molecules, especially small neutral PAHs emitting 3.3 μm features, can be formed and/or survive in fast SNR shocks. Also, the heating mechanism of PAH molecules will be verified.

Proposal: IPYSO

Title: Ices and PAHs around Massive Young Stellar Objects

PI: Shimonishi Takashi (Department of Astronomy, Graduate School of Science, University of Tokyo)

Abstract:

We propose to make near-infrared spectroscopic observations of 109 massive embedded young stellar objects(YSOs) in our Galaxy with AKARI/IRC. The proposed observations are to study Galactic massive YSOs complementarily to the Mission Program "Near Infrared Spectroscopic Observations of Red Objects in the Large Magellanic Cloud with AKARI in Phase III" (LMCNG; P.I. T. Onaka), which will observe a large number of extragalactic massive YSOs in the LMC and SMC. Near-infrared spectra of embedded YSOs show characteristic features due to ices and PAHs. These materials are important reservoir of heavy elements, and their features have potential to be a powerful diagnostics of circumstellar environments of YSOs. However, formation, evolution and diversity of ices and PAHs around embedded YSOs are not understood well due to the lack of systematic investigations of these features. The goal of the present observations is three-fold. First the CO2 ice formation process is investigated based on the data of a largest Galactic YSO sample ever studied. The second aim is to study spatial variations in the 3.3μm UIR band complex and investigate the properties and processing of the band carriers. The third aim is to search for new dust features in 2.5-5μm, including the deuterated PAH features. The proposed observation is crucial to investigate the formation, evolution and diversity of ices and PAHs around massive embedded YSOs. Also, near-infrared spectra obtained in the proposed observations should be a valuable dataset which for the first time enables us to compare the chemical properties of Galactic and extragalactic YSOs based on a large number of samples.

Proposal: SCKH2

Title: Shocked H2 Gas around SNRs and Jets of YSOs

PI: Shinn JongHo (Seoul National University)

Abstract:

We propose spectral observations with AKARI's slit spectroscopy to observe shocked H2 gas toward supernova remnants and jets around young stellar objects. AKARI's near-infrared wavelength coverage (~ 2.5-5.0 μm) is useful to study the population of H2 (v=0, J>7) states, together with those of some (v>0, low-J) states. The relative population between these states is a useful probe to identify the excitation mechanism of H2 gas, since shock and radiations make distinctive populations, respectively. In addition, from these observations, we could check the validity of the thermal admixture model of H2 gas, which was known to describe the population of shocked H2 gas well. We found many jet features around young stellar objects from Spitzer IRAC band images, which are thought to be shocked H2 emissions and where the H2 thermal admixture model was successfully applied. When we obtain the near-infrared spectrum toward these diffuse features, we could test the validity of the model, and obtain the true ortho-to-para ratio of H2 gas, which cannot be obtained from the band images.

Proposal: YTTNK

Title: Jets or Circumbinary disk? An AKARI Investigation

PI: Yasuyuki Tanaka (ISAS/JAXA)

Abstract:

From some of neutron star and black hole X-ray binaries, Spitzer have recently detected excess infrared emission with respect to the Rayleigh-Jeans tail of a companion star or a accretion disk. To account for this enigmatic excess, two possible scenarios are now proposed: a circumbinary dust disk illuminated by the donor star or a synchrotron radiation from a jet. Since the infrared data points are scarce, it is difficult to determine either of the two models are really responsible from spectral fitting alone. The jet emission is expected to be highly variable, while the circumbinary disk emission is thought to be steady. Therefore, a variability study is a promising method to determine which of the two possible mechanisms actually works. From this viewpoint, we propose AKARI/IRC imaging observation to investigate temporal variation of infrared fluxes. This observation definitely reveals the origin of the excess infrared emission.

Proposal: SYDUS

Title: Investigating the Nature of Dust in Active Galaxies

PI: Woo Jonghak (University of California Los Angeles)

Abstract:

In the standard unification model of active galactic nuclei, dust plays a key role in explaining the difference in the observed properties between Seyfert 1 and 2 galaxies. Investigating the properties of dust grains that are either part of the central torus or mixed in the ionization cones in Seyfert galaxies can shed light on the understanding of the unification model of AGN. Using a 12 micron sample of 116 nearby Seyfert 1 and 2 galaxies, for the first time, we will investigate how the carbonaceous dust feature at 3.4 micron is distributed among the various types of Seyfert galaxies, and systematically compare the strength of carbonaceous feature with that of silicate feature at 9.7 micron. We will also Investigate distribution of the micron-size dust particles in Seyfert galaxies by measuring reddening using near-IR hydrogen recombination line ratios. We request 108 pointing observation for 55 Seyfert galaxies without previous AKARI grism spectroscopy. Combining our new data with Phase I and II data for the other 61 Seyfert galaxies, we will study dust properties and test the unification model.