■ Session : 성간물질 (IM)
4월 28일(화) 16:00 - 17:45 제3발표장

[초IM-01] H3+, the New Astrophysical Probe

Takeshi Oka

Department of Astronomy and Astrophysics a(nd Department of Chemistry, The Enrico Fermi Institute, the University of Chicago, Chicago, Illinois, U. S. A.

After atomic hydrogen, H, and molecular hydrogen, H2, the protonated molecular hydrogen, H3+, is the third hydrogenic astrophysical probe which has been introduced recently. The infrared spectrum needed for its detection was discovered in the laboratory1 in 1980. The spectrum was discovered in Jupiter2,3 in 1989 and in interstellar space4 in 1996. The interstellar H3+ was first detected in dense molecular clouds4 where it had been predicted, but soon detected also in diffuse clouds5 where detectable H3+ was unexpected. Surprisingly, observations have established that the H3+ to H2 ratio is 10 times higher in diffuse clouds than in dense clouds6.Quite unexpectedly, H3+ has emerged as a powerful probe to study the diffuse interstellar medium. H3+ provides four kinds of astrophysical information: the temperature, T, the density n, the (cosmic ray) ionization rate ζ, and the radial length of clouds L. The surprising abundance of H3+ in diffuse clouds has revealed that the soft cosmic ray flux is 10 times higher in diffuse clouds than in dense clouds.7 H3+ is particularly abundant and ubiquitous in the Central Molecular Zone (CMZ), a region of radius ~200 pc near the Galactic center. Observations has led to the discovery of a vast amount of warm (T ~ 250 K) and diffuse (n ~ 100 cm-3) gas in the CMZ8,9. H3+ has also been detected in an ultra-luminous infrared galaxy IRAS 08572+3915 NW10. The recent results will be discussed.

[1] T. Oka, Phys. Rev. Lett. 45, 531 (1980)
[2] P. Drossart et al. Nature, 340, 539 (1989)
[3] T. Oka, Rev. Mod. Phys., 64, 1141 (1992)
[4] T. R. Geballe and T. Oka, Nature, 384, 334 (1996)
[5] B. J. McCall, T. R. Geballe, K. H. Hinkle, and T. Oka, Science, 279, 1910 (1998)
[6] T. Oka, Proc. Natl. Acad. Sci. USA, 103, 12235 (2006)
[7] N. Indriolo, T. R. Geballe, T. Oka, and B. J. McCall, ApJ, 671, 1736 (2007)
[8] T. Oka, T. R. Geballe, M. Goto, T. Usuda, and B. J. McCall, ApJ, 632, 882 (2005)
[9] M. Goto, et al. ApJ, 688, 306 (2008)
[10] T. R. Geballe, M. Goto, T. Usuda, T. Oka, and B. J. McCall, ApJ 644, 907 (2006)

[IM-02] The spatially resolved mid-infrared emissions in BD+30 3639

In-Ok Song[1], Thomas R. Geballe[2], Hyungmok Lee[1]

[1]Department of Physics and Astronomy, Seoul National University, [2]Gemini Observatory, Hilo Hawai'i, U.S.A

We present the mid-infrared emissions from the planetary nebulae, BD+30 3639 whose spectra are obtained from MICHELLE instrument at GEMINI-North Telescope (8m) covering 7.5 ~ 13.2㎛. The prominent broad emissions appear at 7.7㎛, 8.6㎛ and 11.3㎛ wavelength along with the strong NeII 12.8㎛ line. Those three emissions are unidentified yet, but PAH molecules and their derivatives are likely to be candidates. In order to help to identify these features, we probe into infrared emissions at high angular resolution and to analyse their dependences on location in the nebula of the strengths and profile shape. We investigate 1) the relative band intensity ratio and profile shape, 2) the degree of asymmetry for the 11.3㎛ feature and 3) a puzzling 12㎛ broad continua as a function of the distance from the central star. Specific PAH candidates along spatial distribution will be discussed.

[IM-03] Statistical Properties of the diffuse far-ultraviolet continuum radiation

Kwangil Seon

Korea Astronomy and Space Science Institute

The far-ultraviolet (FUV) continuum background at the wavelength longer than Lyα has been extensively observed (e.g., with FIMS), but the observations at the band shortward of Lyα have been scarce. The diffuse FUV radiation longward of Lyα is generally believed to correlates with the dust 100 μm emission. However, it has been known that the diffuse FUV radiation shortward of Lyα shows a weak correlation with the 100 μm emission, but shows large variations, probably due to differences in the local radiation field. We reexamine observations of the diffuse FUV radiation by the FUSE (Far Ultraviolet Spectroscopic Explorer) to investigate a correlation between the diffuse FUV radiation shortward of Lyα and 100 μm emission. We find that the quantities show a better correlation in the logarithmic scale than in the linear scale.

[IM-04] AKARI near-infrared spectra toward shock-cloud interaction regions of two supernova remnants HB21 and IC443

Jong-Ho Shinn[1], Bon-Chul Koo[1], and Ho-Gyu Lee[2]

[1]Department of Physics and Astronomy, Seoul National University, [2]Department of Astronomy, University of Tokyo

We present near-infrared (2.5-5.0 μm) spectra toward shock-cloud interaction regions of two supernova remnants, HB21 and IC443. The spectra were observed with the AKARI satellite during the post-Helium phase, and revealed several H_2 emission lines. In case of HB21, we could obtain the true ortho-to-para ratio from these near-infrared spectra, which was assumed to be 3.0 during the previous analysis on the mid-infrared images obtained with the Infrared Camera onboard AKARI. With this true ortho-to-para ratio, we re-characterized the excitation state of shocked H_2 gas observed in mid-infrared images with the power-law admixture model (Shinn et al. 2009), and compared its prediction for near-infrared spectra with the observed spectra. For IC443, we derived the excitation state of shocked H_2 gas, and compared with previous observations. We discussed the obtained results with previously proposed pictures on the shocked H_2 gas.

[IM-05] Supernova Remnants in the Large Magellanic Cloud with AKARI Observation

Ji Yeon Seok

Astronomy Program, Department of Physics and Astronomy, Seoul National University, Seoul, KOREA

We present an infrared study of supernova remnants (SNRs) using the AKARI IRC Survey of the Large Magellanic Cloud (LMC) as well as a preliminary result of follow-up near-infrared spectroscopic observations by AKARI. The AKARI LMC survey covered about 10 square-degree of the LMC including 21 SNRs, a half of the known SNRs. Among those, we found that 8 SNRs have distinguishable infrared emission in NIR and/or MIR bands. We explore the statistical properties of their infrared colors and discuss the origin of the infrared emission. For the further analysis, we have performed NIR spectroscopic observations on four NIR bright LMC SNRs during the AKARI warm phase. We examined their NIR spectra and identified strong hydrogen recombination lines with several H2 molecular lines in most SNRs. We discuss their implications for the SNRs with their environment and the nature of the IR emission.

[IM-06] Measurements of relative abundance of high-energy cosmic-ray nuclei in the TeV/nucleon region

Shinwoo Nam, Jina Jeon, Gowoon Na, Jiwoo Nam, Il H. Park, Nahee Park, and Jongmann Yang

Department of Physics, Ewha Womans University

We present data for the relative abundance of cosmic-ray nuclei measured in the TeV/nucleon region from the second flight of the Cosmic Ray Energetics And Mass (CREAM) balloon-borne experiment. Energy was determined using a sampling tungsten/scintillating-fiber calorimeter, while charge was identified precisely with a dual-layer silicon charge detector installed for this flight. The data for the primary-to-primary element ratios C/O, Ne/Si, and Mg/Si agree with measurements at lower energies. The source abundance of N/O is found to be $0.08 \pm 0.06 \pm 0.02^{+0.01}_{-0.02}$, assuming an escape parameter of 0.6. The comparison to local galactic abundance is made as a function of first ionization potential.

■ Session : SLR (SLR)

4월 28일(화) 16:00 - 17:45 제4발표장

[초SLR-01] 국내 이동형 우주측지 레이저 위성 추적(SLR) 시스템의 개발과 그 현황

조중현, 임형철, 서윤경, 임홍서, 박종욱, 방승철, 이진영, 전현석

한국천문연구원 우주물체감시연구그룹

한국천문연구원 우주물체감시연구그룹은 2008년도부터 우주측지용 레이저 위성 추적(Satellite Laser Ranging: SLR)시스템을 개발하고 있다. 이 SLR시스템은 국내 최초로 개발되는 것으로써, 관련 기술을 확보했거나 개발이 가능한 관련 정부출연연구원 및 국외 우주측지 선도 연구기관과의 협력체제를 필요로 한다. 2011년까지 이동형을 개발한 후에 고정형 시스템이 개발될 예정이다. 현재 개발 중인 시스템은 운영제어시스템, 광학계, 마운트, 광전자계, 레이저 등 5개의 서브시스템으로 구성되어 있으며, 시스템요구사항 검토회의를 거쳐 기본설계 검토회의로 진행 중에 있다. 이 SLR시스템의 기능적 특징은 주야간 원격 운영을 지향한다는 것이고, 성능적인 특징은 2KHz 반복율 레이저 펄스를 이용하여 우주측지용 위성 및 우주 잔해물(space debris)의 추적을 목표로 한다는 것이다. 현재 국내 우주 측지연구를 위한 관측자료 생성은 GNSS 분야가 유일하다. 우주측지 관측 분야에서 VLBI, 위성 중력 및 SLR 관측은 아직까지 국내에서 몇몇 시험관측을 제외하고는 일반적인 상시관측이 이뤄지지 않고 있다. 따라서 국내 이동형 우주측지 SLR 시스템이 개발되면 우주측지 위성 정밀궤도 결정, 지구 자전 상수(Earth rotation parameter), 지구 자전속도 (length of Day), 국제기준좌표계(International Terrestrial Reference Frame) 에 대한 연구활동의 증대를 기대할 수 있다.

[SLR-02] 인공위성 레이저 거리측정(SLR)을 위한 망원경 시스템의 세계 기술 현황

김은실[1], 이준호[1], 임홍서[2]

[1]공주대학교 영상광정보공학부 기하광학 연구실,

[2]한국천문연구원

인공위성 레이저 거리측정(Satellite Laser Ranging, SLR) 시스템은 펄스폭이 매우 짧은 레이저를 이용하여 위성과 지상의 위