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활동성은하핵(AGN)의 거대 블랙홀 주변에 존재하는 플라즈마 디스크의 구조나 물리적인 상태를 관측으로 직접 찾는 것은 AGN 중심부에서의 제트 형성, 방출과정이나 에너지 수송과정을 조사하기 위해 중요하다. 지금까지 주로 센치미터파장 영역의 다주파 VLBI 관측으로 우리은하에서 가까운 AGN 속에 존재하는 10 pc 정도의 플라즈마 디스크가 발견되어 있다만, AGN의 활동성을 정하고 있는 1 pc 이하의 스케일에서의 디스크 구조를 직접 관측한 결과는 아직 없다.

우리는 2015년8월부터 KVN 및 KVN과 일본 VERA로 구성되는 한일공동 VLBI 관측망(KaVA)을 이용해서 전파 은하 3C 84($z = 0.0176$, 1 mas = 0.36 pc)의 밀리미터파장 모니터링을 진행하고 있다. KVN과 KaVA를 이용하면 1 pc 이하의 스케일로 3C 84의 중심구조를 고감도에서 분해할 수 있다. 이번 발표에서는 KVN 및 KaVA로 거의 동시에 실시한 관측결과를 중심으로 보고한다.

관측은 2016년2월22일(KaVA 43 GHz) 및 23일(KVN 86 GHz)에 실시되었다. 양 주파수의 이미지에서 종래의 센치미터 ~ 밀리미터파장 VLBI관측으로도 검출되어 있는 중심핵(C1) 및 남쪽에 약 3 mas 떨어져서 위치하는 로브(C3) 성분 뿐만 아니라 C1으로부터 북쪽에 약 2.5 mas 떨어져서 위치하는 새로운 성분(N1)을 검출하였다. N1의 검출 수준은 43, 86 GHz 모두 6σ 이며, 양 주파수 사이에서 광학적으로 두꺼운 스펙트럼을 가지고 있다. 과거의 관측으로 측정된 C3의 겹보기 속도는 빛의 속도의 약 23%이며, 남북 로브의 구조와 운동의 대칭을 가정하면 N1이 도플러 분사출 효과 때문에 어두워지고 있는 가능성은 낮다. 따라서 C3에 대응하는 북쪽 N1로브로부터의 복사가 블랙홀 주변의 플라즈마 디스크로 인해 저주파수에서 강한 흡수를 받고 있는 결과로 생각된다.

[구 GC-11] Detection of short-term flux variability and intraday variability in polarized emission at millimeter-wavelength from S5 0716+714

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We report detection of short-term flux variability in multi-epoch observations and intraday variability in polarized emission at millimeter-wavelength from S5 0716+714 using Korean VLBI Network (KVN) radio telescopes. Over

the whole observation epochs, the source shows significant inter-month variations at K- and Q-band with modulation indices of 19% at K-band and 36% at Q-band. In each epoch, the source shows monotonic flux increase in Epoch 1 and 3, and monotonic flux decrease in Epoch 2 and 4. We found an inverted spectrum with mean spectral indices of -0.57 in Epoch 1 and -0.15 in Epoch. On the contrary, we found relatively steep indices of 0.24 and 0.17 in Epoch 2 and Epoch 4, respectively.

In the study of intraday variability of polarization, we found significant variations in the degree of linear polarization at 86 GHz, and in polarization angle at 43 and 86 GHz during ~10 h. The spectrum of the source is quite flat with spectral indices of -0.07 to 0.07 at 22-43 GHz and -0.23 to 0.04 at 43-86 GHz. The measured degree of the linear polarization ranges from 2.3% to 3.3% at 22 GHz, from 0.9% to 2.2% at 43 GHz and from 0.4% to 4.0% at 86 GHz, yielding prominent variations at 86 GHz over 4-5 h. The linear polarization angle is in the range of 4 to 12° at 22 GHz, -39 to 81° at 43 GHz, and 66 to 119° at 86 GHz with a maximum rotation of 110° at 43 GHz over ~4 h. We estimated the Faraday rotation measures (RM) ranging from -9200 to 6300 rad m⁻² between 22 and 43 GHz, and from -71000 to 7300 rad m⁻² between 43 and 86 GHz, respectively. The frequency dependency of RM was investigated, yielding a mean power-law index, a , of 2.0. This implies that the polarized emission from S5 0716+714 at 22-86 GHz moves through a Faraday screen in or near the jet of the source.

[구 GC-12] Unification Model and Rayleigh Scattered Ly α in Active Galactic Nuclei

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The unification model of active galactic nuclei invokes the presence of a thick molecular torus that hides the broad emission line region from a line of sight toward observers with low latitude. It is expected that the illuminated side of the molecular torus may be photodissociated by strong far UV radiation from the central AGN, forming an H I region with a high neutral column density. We propose that the Rayleigh scattering optical depth of this H I region can be significant for most broad Ly α line photons with the Doppler factor not exceeding 104 km s⁻¹. Rayleigh scattered Ly α

photons can be characterized by strong linear polarization depending on their scattering optical depth. We performed Monte Carlo simulations of polarized radiative transfer of Ly α adopting simple scattering geometries relevant to the unification model of AGN. We find that for a low torus the Rayleigh scattered Ly α is polarized in the direction parallel to the symmetry axis with the polarization degree dependent on wavelength. In the case of a high torus, the core part of Ly α is polarized in the direction perpendicular to the symmetry axis whereas the wing part is parallelly polarized. We conclude that careful spectropolarimetry around Ly α can be useful in testing the AGN unification model.

[7 GC-13] BAT AGN Spectroscopic Survey-III. An observed link between AGN Eddington ratio and narrow emission line ratios.

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The ultra hard X-ray band (14-195 keV) provides an important and unbiased way to understand black hole growth and relationship to the host galaxy. The Burst Alert Telescope (BAT) instrument on the Swift satellite has surveyed sky to unprecedented sensitivity, improving the number of known hard X-ray sources by more than a factor of 20 to 836 nearby AGN. The BAT AGN Spectroscopic Survey (BASS) is a study for the first large (N>600) and complete sample of ultra hard X-ray selected AGN with optical spectroscopy. In this talk, I present the observed relationship between black hole mass, bolometric luminosity, and Eddington ratio with optical emission line ratios. We show that [NII]/Ha ratio exhibits a significant correlation with Eddington ratio. We propose that the [NII]/Ha ratio is a useful indicator of Eddington ratio with 0.6 dex of scatter, and that it can be used to measure Eddington ratio and thus black hole mass from the measured bolometric luminosity, even for high redshift obscured AGN.

[7 GC-14] A Mid-infrared View on the Fast Galaxy Evolution in Compact Groups

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We study the mid-infrared (MIR) properties of galaxies in compact groups and their environmental dependence using the Wide-field Infrared Survey Explorer data. We use a sample of 670 compact groups and their 2175 member galaxies with $M_r < -19$ and $0.01 < z < 0.0741$ from Sohn et al. (2016), which were identified through a friends-of-friends algorithm. We find that the MIR [3.4]–[12] colors of early-type galaxies in compact groups are on average bluer than those of early-type galaxies in clusters. Furthermore, we find that when compact groups have both early- and late-type member galaxies, the MIR colors of the late-type galaxies in those compact groups can be bluer than those of late-type galaxies in clusters. We also find that as background galaxy number densities of compact groups increase, compact group galaxies have higher early-type galaxy fractions and bluer MIR colors. These trends are also seen for background galaxies. However, at a given background density, compact group galaxies always have higher early-type galaxy fractions and bluer MIR colors than the background galaxies. Our findings suggest that the properties of compact group galaxies depend on both internal and external environments of the compact groups, and that galaxy evolution is faster in compact groups than in clusters.

[7 GC-15] Ram Pressure Stripping of an elliptical galaxy in Abell 2670

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Ram pressure stripping of early-type galaxies has been largely neglected until now because of their gas poor nature. MUSE IFU observation vividly reveal the presence of star-forming blobs and ionised gas tails, around an early-type galaxy in Abell 2670. The galaxy was identified as a post-merger galaxy with disturbed faint features, in MOSAIC 2 deep optical images. The imaging also revealed a series of star-forming blobs, situated in