

measurement of the disk thicknesses and the derived radial profiles of gas and stars, we estimate the corresponding volume densities. The gravitational instability parameter Q follows a fairly uniform profile with radius and is ≥ 1 across the star-forming disk. The star formation law has a slope that is significantly different from those found in more face-on galaxy studies. The midplane gas pressure appears to roughly hold a power-law correlation with the midplane volume density ratio ($\rho_{\text{H}_2}/\rho_{\text{HI}}$).

[7 GC-07] The Virial Relation and Intrinsic Shape of Elliptical Galaxies

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Early-type galaxies (ETGs) are supposed to follow the virial relation $M \sim \sigma^2 * R_e$, with M being the galaxy mass, σ being the stellar velocity dispersion, and R_e being the (2D) effective radius. I apply this relation to (a) the ATLAS3D sample and (b) the sample of Saglia et al. (2016). The two datasets reveal a statistically significant tilt of the empirical relation relative to the theoretical virial relation such that $M \sim (\sigma^2 * R_e)^{0.92}$ with zero intrinsic scatter. This tilt disappears when replacing R_e with the semi-major axis of the projected half-light ellipse, a . Accordingly, a , not R_e , is the correct proxy for the scale radius of ETGs. By geometry, this implies that early-type galaxies are axisymmetric and oblate in general, in agreement with recent results from modeling based on kinematics and light distributions.

[7 GC-08] KOREAN VLBI NETWORK CALIBRATOR SURVEY (KVNCS): 1. SINGLE DISH FLUX MEASUREMENT IN THE K AND Q BANDS

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We present the catalog of the KVN Calibrator Survey (KVNCS). This first part of the KVNCS is a single dish radio survey conducted at 22 (K band) and 43 GHz (Q band) simultaneously using the Korean VLBI Network (KVN) from 2009 to 2011. A total 2045 sources selected from the VLBA Calibrator Survey (VCS) with an extrapolated flux limit of 100 mJy at K band. The KVNCS contains

1533 sources in the K band with a flux limit of 70 mJy and 553 sources in the Q band with a flux limit of 120 mJy; it covers the whole sky down to $-32.^\circ 5$ in declination. Five hundred thirteen sources were detected in the K and Q bands, simultaneously; $\sim 76\%$ of them are flat-spectrum sources ($-0.5 \leq \alpha \leq 0.5$). From the flux-flux relationship, we anticipated that the most of the radiation of many of the sources comes from the compact components. Therefore, the sources listed in the KVNCS are strong candidates for high frequency VLBI calibrators.

[7 GC-09] MASK: Multi-frequency AGN Survey with the KVN

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Available VLBI sources at high frequencies (e.g. $>22\text{GHz}$) are very limited - mainly due to atmospheric fluctuations that degrade coherence time and a power-law energy distribution of particles in case of AGNs. However, simultaneous multi-frequency VLBI receiving system of the Korean VLBI Network (KVN) and its powerful VLBI phase calibration technique offer benefits in finding more weak sources at millimeter wavelengths. Based on this aspect, multi-frequency AGN survey with the KVN (MASK) project, which aims to densify an existing a VLBI catalog of extragalactic radio sources at 22/43/86/129GHz is proposed as a KVN legacy program.

We selected 1220 sources of AGNs that include known VLBI sources and new fringe-detected sources using the KVN at K-band (22GHz). Among them, 138 sources were observed as pilot experiments at 22/43/86/129GHz simultaneously and excellent VLBI detection results are achieved. Therefore, we expect that MASK will open a new era in VLBI science at millimeter wavelengths by providing unprecedented number of available sources in the Universe.

[7 GC-10] Discovery of Sub-pc Scale Plasma Torus in the Nearby Radio Galaxy 3C 84 with the KVN and VERA Array (KaVA)

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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