

For the development of magneto rotational instability, which drives mass accretion in protoplanetary disks, sufficient ionization degree is needed. Cosmic rays are believed to be one of the dominant ionization sources for protoplanetary disk gas. In previous studies, ionization rates are computed by considering the effect of attenuation of the cosmic ray (CR) intensity as a function of column density in an unmagnetized cloud. However, in reality particles should sweep up larger column density to reach at the midplane of disk due to their gyromotion. In this study, we investigate the propagation of CR protons in a protoplanetary disk by solving transport and energy loss equations. We discuss the change in CR intensity due to magnetic field in a protoplanetary disk.

[포 IM-03] 14 Planck Galactic Cold Clumps in the λ Orionis Complex: No dense cores detected with SCUBA-2

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We present preliminary results of the submillimeter continuum observations of 14 Planck Galactic Cold Clumps (PGCCs), located in the λ Orionis Complex. This region is the nearest large HII region, which is an ideal site for a study of the stellar feedback to its surroundings. We observed 14 PGCCs with JCMT/SCUBA-2 and used J=1-0 transitions of CO isotopologues from the PMO mapping observation. Several sub-clumps toward three PGCCs were detected at 850 μ m. In order to examine whether these clumps can be candidates for pre-stellar cores, we compared each clump mass calculated from the 850 μ m continuum map to its Virial mass and Jeans mass calculated from the ¹²CO and C¹⁸O (1-0) spectra, respectively. All clumps have masses smaller than their Virial and Jeans masses, indicating that none of them are gravitationally bound and thus in the pre-stellar core stage. Also, the CO depletion factor, which has been derived from the dust continuum and the C¹⁸O(1-0) line and can be an indicator of core evolution, toward the clumps is in the range of 1

to 5, suggesting that they are not very evolved dense pre-stellar cores. In addition, within individual PGCCs, we found clear gradients of velocity ($\sim 1 \text{ km s}^{-1} \text{ pc}^{-1}$) and temperature ($\sim 10 \text{ K pc}^{-1}$) in the ¹³CO (1-0) first moment map and the ¹²CO (1-0) excitation temperature map, respectively. This can be attributed to the compression and external heating by the HII region, which may prevent clumps from forming gravitationally bound structures and eventually disperse clumps. These results could be a hint about the negative effect of stellar feedback on core formation.

[포 IM-04] SgrA* 22/43GHz KaVA observation and its Amplitude Calibration

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We present the results of KaVA SgrA* observation together with Takahagi(32m), Yamaguchi(32m) and Nobeyama(45m) telescopes at 22 and 43GHz, respectively. In early 2014, G2 cloud was expected to encounter with SgrA* and to make a significant flux variation, but it has not been measured yet. So it's worth to check our amplitude calibration method to confirm if we have a missing flux caused by uncertainty in measuring it. We have tested both a standard method using system noise temperature(Tsys) with antenna gain information, and a template method in order to calibrate antenna gain using nearby maser source. As a result, we found that the latter method is useful for antennas which have inaccurate gain information or poor Tsys measurements, and is especially effective for sources at low elevation like SgrA*. In addition, the comparison shows that the amplitude calibration by standard method can be improved up to 10% with a correction factor using a template method. This result implies we can get more accurate flux from a standard method when any maser source not exists around target.

천문우주 관측기술

[포 AT-01] Comparison Surface Error Measurements of Aspherical Mirror (비구면 반사경 표면의 형상오차 측정법 비교)

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본 연구에서는 비구면 반사경의 형상오차를 3가지 방법으로 측정, 비교하였다. 실험에 사용한 포물면 반사경의 구경은 108 mm, 유효초점거리는 444.5 mm 이다. 첫 번째로 접촉식 형상측정방식인 FTS(Form TalySurf)를 이용하여 표면 거칠기와 반사경의 최적 곡률 반경(BestFitt Radius) 값을 측정하였다. 두 번째로는 비접촉식 형상측정방식인 UA3P(Ultrahigh Accurate 3-D Profilometer)를 이용하여 반사경의 형상 정밀도를 측정하였다. UA3P를 이용할 경우 반사경의 전체 형상을 측정할 수 있다. 세 번째로 Shark-Hartmann 센서를 이용한 광학측정방법으로 반사경의 형상 정밀도를 측정하였다. 측정에 필요한 레이저 광학계는 레이저, 콜리메이터, 핀홀, 카메라 렌즈 및 비구면 광학계를 이용하여 설계하였다. 본 연구에서 도출한 각 측정 방법의 신뢰도를 바탕으로 간접계 사용에 제약이 있는 자유형상곡면의 반사경 표면의 형상오차 측정에 적용할 계획이다.

[포 AT-02] Upgrading Filter Position Mechanism of SQUEAN

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미국 텍사스 주 맥도날드 천문대에 위치한 2.1m 망원경에 부착된 SQUEAN (SED Camera for QUasars in EARly uNiverse)은 2010년부터 운용되고 있는 CQUEAN을 바탕으로 개발된 적외선 영역 광학기기이다. 20개의 필터 장착이 가능한 필터 휠 제어 시스템을 가지고 있는 SQUEAN 시스템은 SMOP (SQUEAN Main Observation software package), KFC82 (KHU Filter wheel Control software package for McDonald 82 inch Telescope), KAP82 (KHU Auto-guiding software Package for McDonald 82 inch Telescope) 등으로 구성되어 있다. 그러나 대형 필터 휠을 제어하는 모터의 토크부족과 감속기의 백래시(Backlash)의 영향으로 오프셋의 오차가 커서 초기위치의 재설정 없이 하룻밤 이상 관측을 지속하는데 어려움이 있었다. 토크가 크고 인코더가 장착된 모터 교체와 제어 프로그램 등을 변경하고, 백래시의 영향을 최소화할 수 있도록 소프트웨어로 보정하였다. 또한, SMOP로부터 네트워크 통신을 통해 초기화용 필터 마스크(Initial Filter Mask:IFM)를 제작하여 돔 플랫폼 이미지에서 정확한 필터의 위치를 측정하는 기능을 도입하였다.

이 발표에서는, 개선된 하드웨어 및 소프트웨어의 내용과 테스트한 결과에 대해 보여준다.

[포 AT-03] KVN Performance Evaluation of Simultaneous 4CH Observations

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It is important to know how well observation errors are removed in the calibration process prior to ensuing scientific research. In mm-VLBI observations, a radio wave suffers from an atmospheric propagation delay due to the rapid change of atmospheric refraction. It makes phases of VLBI correlation output fluctuate rapidly, which essentially decreases the coherence of phases and reduces the integration time. Consequently, it is challenging to achieve a high signal-to-noise ratio and enhance the quality of scientific output.

Among the causes of the atmospheric propagation delay, water vapor in the troposphere is the most decisive factor to affect phase errors in the high frequency range (> 10GHz). It is expected to have the non-dispersive characteristic that enables to introduce new calibration strategy, Frequency Phase Transfer (FPT). This new method utilizes low frequency phases to compensate phase errors in high frequency bands. In addition, Korean VLBI Network (KVN) which benefits from the simultaneous 4-channels (22/43/86/129 GHz) observations is ideal to probe FPT performance. In order to evaluate FPT performance of KVN, we present the results of FPT phase analysis and discuss its performance.

[포 AT-04] Final Results of WRC-15(World Radiocommunication Conference)

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국제전기통신연합 (ITU)에서 주관하여 2015년 11월 2일-27일 스위스 제네바에서 개최된 WRC-15(세계전파통신회의, World Radiocommunication Conference)회의에서는 28개 의제에 대한 각국 의견을 논의한 후 최종적으로 국제전파규칙(Radio Regulations)을 개정하였다.

WRC회의는 전세계의 공통적인 주파수 사용을 위한 국제법이라고 할 수 있는 국제전기통신연합 (ITU)의 전파규