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 μm. In order to examine whether these clumps can be candidates for pre-stellar cores, we compared each clump mass calculated from the 850 μm continuum map to its Virial mass and Jeans mass calculated from the $^{12}$CO and C$^{18}$O (1-0) spectra, respectively. All clumps have masses smaller than their Virial and Jeans masses, indicating that none of them are gravitational bound and thus in the pre-stellar core stage. Also, the CO depletion factor, which has been derived from the dust continuum and the C$^{18}$O(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 (~1 km s$^{-1}$ pc$^{-1}$) and temperature (~10 K pc$^{-1}$) in the $^{12}$CO (1-0) first moment map and the $^{12}$CO (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.
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 Proflimeter)를 이용하여 반사경의 형상 정밀도를 측정하였다. UA3P를 이용할 경우, 반사경의 전체 형상을 측정할 수 있다. 세 번째로 Shark-Hartmann 센서를 이용한 광학측정방식으로 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 간섭계 사용에 제약이 있는 자유형상곡면의 반사경 표면의 형상오차 측정에 적용할 계획이다.

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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 (KIU Filter wheel Control software package for McDonald 82 inch Telescope), KAP82 (KIU Auto-guiding software Package for McDonald 82 inch Telecapo) 등으로 구성되어 있다. 그러나 대형 필터 휠을 제어하는 모터의 토크 부하와 증가하는 백래시(Backlash)로 인해 조작자의 고무는 이중점의 형상 오차가 있는 필터 휠의 원활한 전환에 방해되었다. SQUEAN은 여러 이상이 발생하는 경우 사용자에게 알리는 메시지를 제공한다. 또한, SQUEAN은 필터의 위치를 정확히 지정하고, 제어 프로그램 등을 변경하고, 백래시의 영향을 최소화할 수 있도록 소프트웨어로 보완하였다. 또한, SMOP로부터 네트워크 통신을 통해 초기화용 필터 마스크(Initial Filter Mask-IFM)를 제작하여 동 플랫 이미지 에서 정확한 필터의 위치를 측정하는 기능을 도입하였다. 이 발표에서는, 개선된 하드웨어 및 소프트웨어의 내용과 테스트한 결과에 대해 보여준다.

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As customized hardware and software are presented, 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.

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WRC회의는 전세계의 공동적인 주파수 사용을 위한 국제 제반법이라고 할 수 있는 국제전파통신연합 (ITU)의 전파규