BCCOMICS is based on the linear perturbation theory including the mode-mode coupling terms, and generates cosmological initial conditions for the SPH-basded code GADGET and the AMR-based code ENZO. We also present our preliminary result on the cosmic variance of the first galaxy formation, studied by using BCCOMICS.

[구 GC-19] Formation of globular clusters in cosmological radiation hydrodynamic simulation

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This is a presentation of the paper published as Kimm et al. 2016, ApJ, 823, 52. We investigate the formation of metal-poor globular clusters (GCs) at the center of two dark matter halos with Mhalo~ 4×107Msun at z>10 using cosmological radiation-hydrodynamics simulations. We find that very compact (≲1 pc) and massive (~6×105Msun) clusters form rapidly when pristine gas collapses isothermally with the aid of efficient Lyα emission during the transition from molecular-cooling halos to atomic-cooling halos. Because the local free-fall time of dense star-forming gas is very short (<< 1Myr), a large fraction of the collapsed gas is turned into stars before stellar feedback processes blow out the gas and shut down star formation. Although the early stage of star formation is limited to a small region of the central star-forming disk, we find that the disk quickly fragments due to metal enrichment from supernovae. Sub-clusters formed in the fragmented clouds eventually merge with the main cluster at the center. The simulated clusters closely resemble the local GCs in mass and size but show a metallicity spread that is much wider than found in the local GCs. We discuss a role of pre-enrichment by Pop III and II stars as a potential solution to the latter issue. Although not without shortcomings, it is encouraging that a naive blind (not tuned) cosmological simulation presents a possible channel for the formation of at least some massive GCs.

천문우주 관측기술

[구 AT-01] Evaluation of Phase Calibration Performance with KVN

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In mm-VLBI, the quality of observation data is largely affected by atmospheric effect. The most challenging matter is that the phase of correlator output fluctuates rapidly resulting from a variation of atmospheric propagation delay. Consequently, it is demanding to achieve high Signal-to-Noise ratio by integrating data in time domain before calibrating atmospheric delay. However, Korean VLBI Network (KVN) has a unique system to make a 4-frequency (22/43/86/129 GHz) simultaneous observation in mm-wavelength and Frequency Phase Transfer (FPT) calibration technique has effectively removed atmospheric delay in the simultaneous multi-frequency observation of the KVN.

For astrometric and astrophysical studies, we evaluated the FPT performance of KVN in various observing conditions. Using the total 38 bright AGNs, we have compared atmospheric conditions such as ground-based weather information, system temperature, atmospheric delay with the calibration results of FPT at 22/43/86/129 GHz during the five experiments in 2013, and quantified its performance in terms of coherence function and Allan variance. We present the analysis result of the relation between the FPT performance and observing conditions.

[구 AT-02] Development of Error Compensation Software, ECS

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ECS(Error Compensation Software)는 알루미늄 자유곡면 반사경의 형상정밀도를 향상시키기 위해 개발된 보정가공 소프트웨어이다. DTM(Diamond Turning Machine)을 이용한 가공공정에서 가공오차의 변화를 쉽게 확인하며 형상을 보정할 수 있도록 설계되었다. 보정가공 공정은 (1) 10차 다항식을 이용하여 표면을 설계한 후 DTM에 입력할 가공경로 계산, (2) DTM에 가공경로를 입력하여 가공, (3) 3차원 초정밀 형상측정 장비로 반사경의 가공오차 분석, (4) 가공오차를 보정하여 새로운 10차 다항식 설계, (5) 보정가공경로 계산 후 재가공으로 이루어진다. 그동안의 공정은 다항식의 설계, 가공경로 계산, 반사경의 가공오차 분석을 위해 다수의 프로그램들을 실행해야만 했다. 본 연구에서는 ECS가 알루미늄 자유곡면 반