

systems. However, the formation mechanism of the multiplicity is poorly understood. Theoretical studies suggest two main mechanisms for the multiplicity: turbulent fragmentation and disk fragmentation. We can testify which mechanism is more plausible by measuring the separation between companions or the alignment of stellar spins. Here we present our ALMA Cycle 2 observational results of a proto-binary system, IRAS 04191+1523, which consists of two Class I sources. We detected disks around both Class I sources, which are located in a common dense filamentary structure traced by C<sup>18</sup>O J=2-1. Two protostellar disks are separated by ~900 AU and their rotational axes are almost perpendicular, which strongly support that this binary system formed by the turbulent fragmentation.

#### [구 AJ-04] Survey for CO Outflow Activities in 68 VeLLOs

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We present a preliminary result of search for CO molecular outflows toward a sample of 68 candidate Very Low Luminosity Objects (VeLLOs:  $L_{\text{int}} \leq 0.1 L_{\odot}$ ) to help to understand their physical properties. The sources have been identified using the data at IR to radio wavelengths by M. Kim et al. 2016 toward nearby star-forming regions in the Gould belt. These sources were observed in rotational transitions 2-1 and 3-2 of <sup>12</sup>CO, <sup>13</sup>CO, and C<sup>18</sup>O molecules with SRAO, CSO, JCMT, and ASTE telescopes. In the beginning of our survey we made a single pointing observation in <sup>12</sup>CO 2-1 or 3-2 lines for our sample, identifying 53 sources as potential outflow candidates from their line wing features. We made full or partial mapping observations for these candidates with the same lines, finding 33 sources with bipolar or one-sided outflow features. Out of these 33 sources, 6 VeLLOs are previously known sources to have their outflows and 27 VeLLOs are found to be new outflow sources identified from this study. We estimated outflow properties with corrections for excitation temperature, optical depth, and inclination. Their outflow forces range from  $8.7 \times 10^{-10}$  to  $6.0 \times 10^{-5} M_{\odot} \text{ km s}^{-1} \text{ yr}^{-1}$  with a median value of  $3.6 \times 10^{-7} M_{\odot} \text{ km s}^{-1} \text{ yr}^{-1}$ , indicating that

most of the VeLLOs are less powerful than those for protostars. Their accretion luminosities vary from  $9.7 \times 10^{-9}$  to  $166 L_{\odot}$  with a median value of  $0.004 L_{\odot}$ , implying that most VeLLOs have larger ratios of the accretion luminosity to the internal luminosity but a significant number of VeLLOs have smaller ratios. This result suggests that many of the VeLLOs can be explained with episodic accretion but a significant number of VeLLOs cannot.

#### [구 AJ-05] BISTRO: B-fields In STar-forming Region Observations

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We introduce a magnetic field survey of the Gould Belt clouds using the James Clerk Maxwell Telescope (JCMT) POL-2: B-fields In STar-forming Region Observations (BISTRO). POL-2 with SCUBA-2 on JCMT is a unique facility, as it is the only facility world-wide that can map the magnetic field within cold dense cores and filaments on scales of ~1000 AU in nearby star-forming regions, such as Taurus and Ophiuchus. It can provide a link between the B-field measured on arc-minute scales by Planck and BLASTPOL and measurements made on arc-second scales by interferometers such as CARMA, SMA, and ALMA. BISTRO was awarded 224 hours toward 16 fields for the next 3 years and started to take data in the 2016A semester.

Note: (PI) D. Ward-Thompson, (co-PIs) P. Bastien, R. Furuya, W. Kwon, S. Lai, and D. Li

### 고천문/태양계

#### [구 HS-01] The Prehistoric Paintings in the Hall of Bulls of the Lascaux Cave are Identified as Arrays of Constellations and Dark Clouds

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프랑스 몽티냐에 위치한 라스코 동굴에는 오늘날까지 발견된 수많은 구석기시대 동굴벽화 가운데 대표적인 그림들을 보존하고 있다. 동굴 벽화는 대략 BC 15,000년 전 것으로 연구되어 왔으며 최근 몇몇 학자들에 의해서 그 가