Magellanic Outflow and Chemistry Survey (MAGOS): the Outflow-Luminosity Scaling Relation in the Magellanic Clouds

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Understanding massive star formation in low-metallicity environments is crucial for constraining the universality of star formation across cosmic evolution. Although Galactic protostellar outflows, one of the fundamental processes in star formation, are known to scale with bolometric luminosity across the mass spectrum, it remains unclear whether this well-established scaling relation holds in low-metallicity environments. We present the first systematic survey of massive protostellar outflows in the Large and Small Magellanic Clouds (LMC and SMC, 0.2-0.5 Zsun), as part of the MAGellanic Outflow and Chemistry Survey (MAGOS). The MAGOS survey targets 40 massive young stellar objects (MYSOs) with luminosities of (1-20)×10^4 Lsun with the Atacama Large Millimeter/submillimeter Array (ALMA) at a resolution of ~0.4” (~0.1 pc) at 0.85~mm. Using CO (3-2), we identify blue- and red-shifted outflows associated with the primary continuum sources towards 29 targets in the LMC and 10 targets in the SMC. Comparing the outflow mass, momentum, energy, and force versus luminosity scaling relations in MAGOS with those in the Galaxy, we find that the LMC CO outflows have a similar slope in the mass scaling relation and steeper slopes in the other three relations. This suggests that CO remains an effective tracer of massive protostellar outflows at ~0.5 Zsun. In contrast, despite the large scatter, the SMC CO outflows have flatter scaling relations than those in both the LMC and the Galaxy for all four properties. This result is consistent with reduced CO abundance due to enhanced photodissociation at ~0.2 Zsun, although the possibility of intrinsically weak outflows in the SMC cannot be ruled out with the current data.