X55a Outflows of Low-Mass Galaxies with $M_* = 10^4 - 10^7\ M_\odot$

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In the galaxy formation framework, galaxies with low masses experience energy-driven outflows powered by thermal energy of supernova explosions. Here we have carried out very deep medium-high resolution optical spectroscopy for 21 nearby low-mass ($M_* = 10^4 - 10^7\ M_\odot$) galaxies with Magellan/MagE. These low-mass galaxies are actively star-forming systems with high specific star-formation rates of $100 - 1000$ Gyr^{-1} that are well above the star-formation main sequence and its extrapolation. We identify broad-line components of Hα and [OIII]λ5007 emission in 14 out of the 21 galaxies that cannot be explained by physical Voigt profiles broadened by the MagE instrumental profile. We conduct double Gaussian profile fitting to the emission of the 14 galaxies, and find that the broad-line components have line widths of ~ 100 km s^{-1} indicative of galaxy outflows, which are detected due to our spectra whose resolution and S/N ratios are sufficiently high. We estimate the maximum velocities $v_{\rm max}$, most of which are comparable to or slightly larger than the escape velocities, while these $v_{\rm max}$ values are small, $\sim 60 - 200$ km s^{-1}. Down to this low mass regime, there extend positive correlations of $v_{\rm max}$ with star-formation rates, stellar masses, and circular velocities. We also measure broad- to narrow-line ratios BNRs that are generally smaller than those of massive galaxies. Due to the small $v_{\rm max}$ and BNR, the mass loading factors eta are as small as $0.1 - 1$ or below, suggesting that there may not exist a largely excessive eta of energy driven outflows that are predicted by numerical simulations.