X48a Discovery of an Extremely Luminous Dust-obscured Galaxy Observed with SDSS, WISE, JCMT, and SMA

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We present the discovery of an extremely luminous dust-obscured galaxy (DOG) at $z_{\rm spec} = 3.703$, WISE J101326.25+611220.1. This DOG is selected as a candidate of extremely luminous infrared (IR) galaxies based on the photometry from the SDSS and WISE. In order to derive its accurate IR luminosity, we perform follow-up observations at 450 and 850 μm using the SCUBA2 on the JCMT, and at 870 and 1300 μm using the SMA, which enable us to pin down its IR Spectral Energy Distribution (SED). We perform SED fitting using 14 photometric data (0.4–1300 μm) and estimate its IR luminosity, $L_{\rm IR}$ (8–1000 μm), to be $2.2^{+1.5}_{-1.0} \times 10^{14}$ $L_\odot$, making it one of the most luminous IR galaxies in the universe. The energy contribution from an active galactic nucleus (AGN) to the IR luminosity is 94^{+6}_{-20}%, which indicates that it is an AGN-dominated DOG. On the other hand, its stellar mass (M_*) and star formation rate (SFR) are $\log(M_*/M_\odot) = 11.2^{+0.6}_{-0.2}$ and $\log({\rm SFR}/M_\odot\,{\rm yr}^{-1}) = 3.1^{+0.2}_{-0.1}$, respectively, which means that this DOG can be considered a starburst galaxy in the M_*–SFR plane. This extremely luminous DOG shows significant AGN and star-forming activity that provides us with an important laboratory to probe the maximum phase of the coevolution of galaxies and supermassive black holes (Toba et al. 2018, ApJ, 857, 31).