X16a   The *ISO* 170 μm Luminosity Function of Galaxies

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We constructed a local luminosity function (LF) of galaxies using a flux-limited sample ($S_{170} \geq 0.195$ Jy) of 55 galaxies at $z < 0.3$ taken from the *ISO* FIRBACK survey at 170 μm. The overall shape of the 170-μm LF is found to be different from that of the total 60-μm LF (Takeuchi, Yoshikawa, & Ishii 2003): the bright end of the LF declines more steeply than that of the 60-μm LF. This behavior is quantitatively similar to the LF of the cool subsample of the *IRAS* PSCz galaxies. We also estimated the strength of the evolution of the LF by assuming the pure luminosity evolution (PLE): $L(z) \propto (1+z)^Q$. We obtained $Q = 5.0^{+2.5}_{-0.5}$ which is similar to the value obtained by recent *Spitzer* observations, in spite of the limited sample size. Then, integrating over the 170-μm LF, we obtained the local luminosity density at 170 μm, $\rho_L(170\mu\mathrm{m})$. A direct integration of the LF gives $\rho_L(170\mu\mathrm{m}) = 1.1 \times 10^8 h\ L_\odot \mathrm{Mpc}^{-3}$, whilst if we assume a strong PLE with $Q = 5$, the value is $5.2 \times 10^7 h\ L_\odot \mathrm{Mpc}^{-3}$. This is a considerable contribution to the local FIR luminosity density. By summing up with other available infrared data, we obtained the total dust luminosity density in the Local Universe, $\rho_L(\mathrm{dust}) = 1.1 \times 10^8 h\ L_\odot \mathrm{Mpc}^{-3}$. Using this value, we estimated the cosmic star formation rate (SFR) density hidden by dust in the Local Universe. We obtained $\rho_{\mathrm{SFR}}(\mathrm{dust}) \simeq 1.1\text{--}1.2\, h \times 10^{-2}\ M_\odot \mathrm{yr}^{-1} \mathrm{Mpc}^{-3}$, which means that 60 % of the star formation is obscured by dust in the Local Universe. We also discuss the cosmic spectrum (the spectral energy distribution of the luminosity density) in the Local Universe.