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标题: Microwave and radio emission of dusty star-forming galaxies: implication for the cosmic radio background
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摘要: We use the most up-to-date cosmological evolution models of dusty star-forming galaxies and radio sources to compute the extragalactic number counts and the cosmic background from 408 MHz to 12 THz (or 24 mu m). The evolution model of star-forming galaxies reproduces the recent constraints obtained by Spitzer, Herschel, and ground-based submm and mm experiments: number counts, redshift distribution of galaxies, cosmic background intensity and anisotropies. The template spectral energy distributions used in this model are extrapolated to the radio domain adding three emission components: synchrotron, free-free, and spinning dust. To fix the synchrotron intensity, we use the well-known IR/radio flux ratio, q(70), and a constant spectral index beta(S) = -3, consistent with measurements made in local galaxies taking account the spinning dust emission. For a constant q(70), our model added to the active galactic nucleus (AGN) contribution provides a good fit to the extragalactic number counts from 24 mu m to 408 MHz, and to the cosmic background intensity in the far- and mid-IR. The spinning dust emission accounts for up to 20% of the cosmic microwave background produced by star-forming galaxies, but for only less than 10% of the total background when AGN are included. The star-forming galaxies account for 77.5% of the number counts at 1.4 GHz for a flux of 100 mu Jy. However, the model falls short of reproducing the cosmic radio background measured with the ARCADE2 balloon-borne experiment. Considering the case when q(70) decreases strongly with redshift, this still does not explain the ARCADE2 measurements. It also yields to an overestimate of the low-flux number counts in the radio. As a result, we rule out a steep variation of q(70) with the redshift at least for z <= 3.5. Then, adding a population of faint star-forming galaxies at high redshift (L-IR <= 10(11) L-circle dot and 4 <= z <= 6), which would be able to reproduce the ARCADE2 measurements, leads to predictions of the cosmic IR background much higher than what is currently observed, ruling out this as the explanation for the ARCADE2 results. Considering our findings and previous studies of the diffuse extragalactic radio emission, we conclude that if the radio emission measured by ARCADE2 is astrophysical in origin, it has to originate in the Galaxy or to originate in a new kind of radio sources (with no mid- to far-IR counterparts) or emission mechanism still to be discovered.
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