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标题: The ionized and hot gas in M17 SW SOFIA/GREAT THz observations of [C II] and (CO)-C-12 J=13-12

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摘要: Aims. With new THz maps that cover an area of similar to  $3.3 \times 2.1$  pc<sup>2</sup> we probe the spatial distribution and association of the ionized, neutral and molecular gas components in the M17 SW nebula.

Methods. We used the dual band receiver GREAT on board the SOFIA airborne telescope to obtain a  $5.7 \times 3.7$  map of the (CO)-C-12 J = 13-12 transition and the [C II] 158  $\mu$  m fine-structure line in M17 SW and compare the spectroscopically resolved maps with corresponding ground-based data for low-and mid-J CO and [C I] emission.

Results. For the first time SOFIA/GREAT allow us to compare velocity-resolved [C II] emission maps with molecular tracers. We see a large part of the [C II] emission, both spatially and in velocity, that is completely non-associated with the other tracers of photon-dominated regions (PDR). Only particular narrow channel maps of the velocity-resolved [C II] spectra show a correlation between the different gas components, which is not seen at all in the integrated intensity maps. These show different morphology in all lines but give hardly any information on the origin of the emission. The [C II] 158  $\mu$  m emission extends for more than 2 pc into the M17 SW molecular cloud and its line profile covers a broader velocity range than the (CO)-C-12 J = 13-12 and [C I] emissions, which we interpret as several clumps and layers of ionized carbon gas within the telescope beam. The high-J (CO)-C-12 emission emerges from a dense region between the ionized and neutral carbon emissions, indicating the presence of high-density clumps that allow the fast formation of hot CO in the irradiated complex structure of M17 SW. The [C II] observations in the southern PDR cannot be explained with stratified or clumpy PDR models.

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