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Physical conditions in the ISM in elliptical galaxies

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We report ISO observations of three elliptical galaxies, previously detected with IRAS, namely NGC1052, NGC1155 and NGC6958. ISOCAM images of NGC1155 and NGC6958 at 7 and 15 microns of show a central bright source as well as a faint extended component. The extended component has a higher 7/15 micron ratio than is seen in late-type spirals and in the centers of these ellipticals, and is presumably of photospheric and circumstellar origin.

All three galaxies are detected in the [CII](158 micron) line, and NGC1155 is detected in the OI (63 micron) line as well. Previously, only NGC1052 has been detected in HI and none of these galaxies has been detected in CO transitions. The ISO-LWS observations show that [CII] line is a more sensitive measure of ISM than HI and CO. The [CII]/FIR and [CII]/[OI] flux ratios correlate most strongly with the far-infrared colors F60/F100, following the same trends as other galaxies in a sample of 59 galaxies covering a range of morphology, luminosities and star-formation activity levels. This suggests that the [CII] and [OI] line emission are dependent only on the local conditions in the ISM and the physical conditions in FIR emitting regions in elliptical galaxies are not very different from those in spiral galaxies. From the ([CII]+[OI])/FIR and [CII]/[OI] ratios for NGC1155 we derive the density 'n' of the ISM and the local interstellar radiation field (ISRF) G_0. The UV radiation from old stellar populations (PNe, PAGB stars, HB stars) is insufficient by 1-2 orders of magnitude to produce enough gas heating by photoelectrons from dust grains to explain the [CII] and [OI] line emission in NGC1155. Supplementary sources of UV, most likely young stars, are needed. In NGC1052 and NGC6958, the old stellar population produces enough heating radiation to explain the [CII] emission if all of the UV radiation is absorbed by the dust grains, which is unlikely given the geometry and the small amount of ISM in these galaxies.