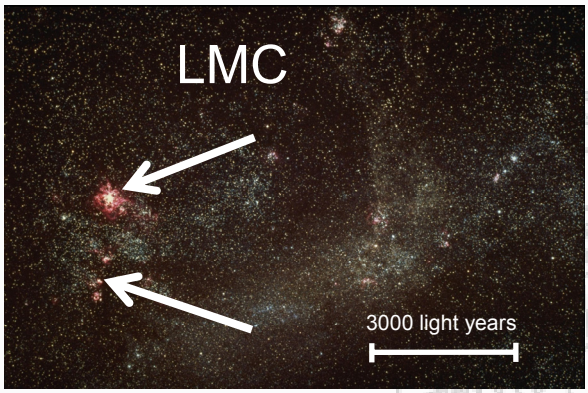
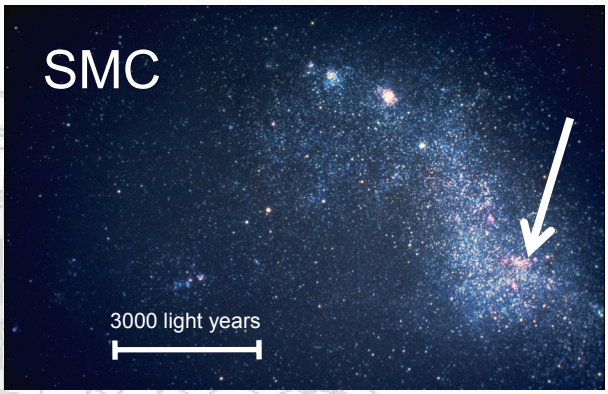
Star formation in the Magellanic Clouds





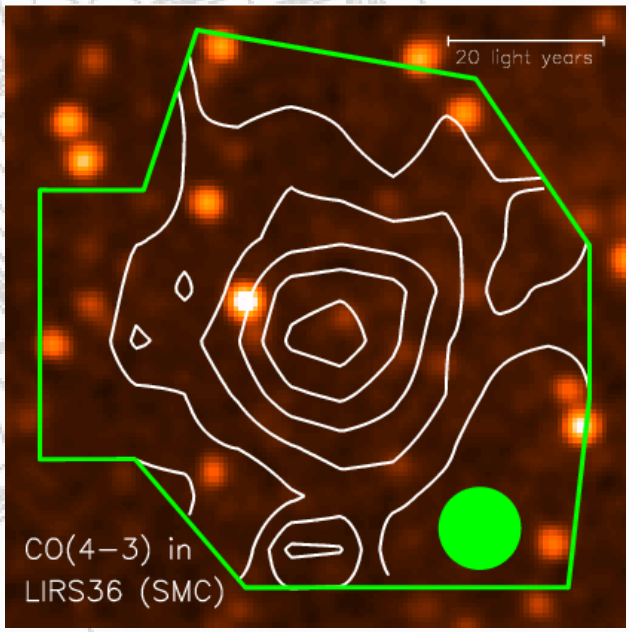
The Large and Small Magellanic Clouds (LMC, SMC) are two of the closest satellite galaxies of the Milky Way, classified as irregular dwarf galaxies. They are clearly visible in the southern sky, and are a prime target for the APEX telescope. The positions so far observed by APEX are indicated on the two optical images above.

The tidal forces caused by gravitational and hydrodynamical interactions with the Milky Way have led to relatively recent and on-going burst of vigorous massive star formation in the Magellanic Clouds. Their evolution is less advanced than that of our own Galaxy, with an abundance of heavy elements only 1/4 (LMC) and 1/10 (SMC) of that in the Milky Way. They therefore resemble primeval galaxies early in the history of the Universe. Observing them so nearby is like zooming in on cosmic structure formation quasi with a time machine!

APEX is able to probe deep into the Magellanic Clouds and observe the dense molecular gas that is the birth place of massive stars. We have observed emission from the J=4-3 rotational transition of the carbon monoxide molecule (CO) in several of such star-forming regions. Our observations trace warmer and denser gas than had been possible in previous investigations of CO lines in these clouds emitted from lower energy levels. We have also begun to observe even higher energy transitions, which will be extended in future APEX observations. This will give detailed information on the physical conditions in the dense parts of the clouds most likely to form the next generation of stars.

The figures shown here are APEX contour maps of CO (4-3) emission (observed within the areas outlined in green) overlaid on near infrared images. The infrared images trace the stars and interstellar dust heated to high temperatures, whereas the APEX maps reveal the dense gas shielded from the ultraviolet radiation field.

Star Formation in the SMC



*The conditions in the SMC are more primitive than in both the LMC and our own Galaxy, with lower abundances of heavy elements and less dust compared to gas. This means it allows us to study star formation under conditions far removed from what we know in the Milky Way. The source presented here is the brightest molecular cloud in the active south-western part of the SMC and is currently forming massive stars. This particular cloud is labeled **LIRS36**. The filled green disk in the lower right corner shows the spatial resolution of the APEX telescope.*

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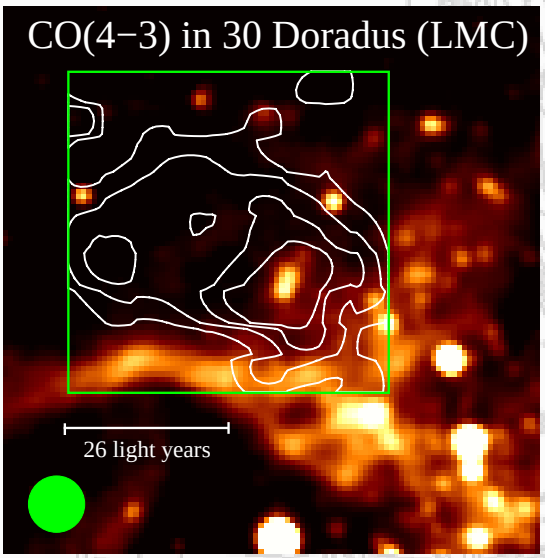
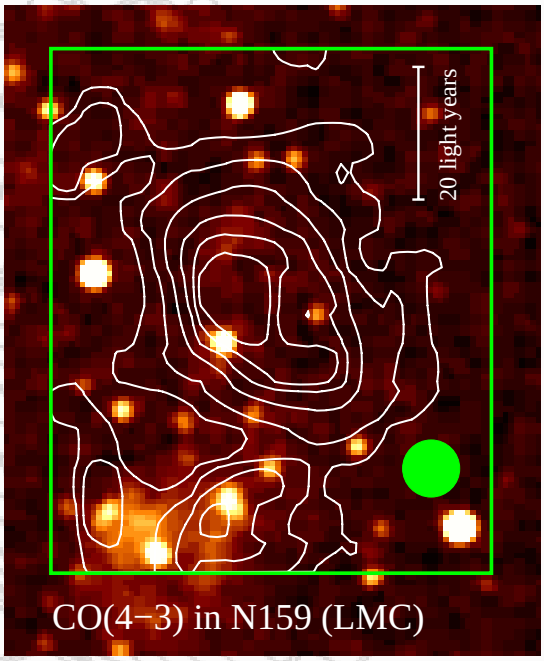
Violent and spectacular star formation in the LMC

The environmental conditions in the LMC lie between those of the advanced Milky Way and the more primitive SMC. Comparison of observations in the three locations gives us detailed insights into the physical processes that are necessary for massive star formation to proceed.



*The figure above shows the brightest molecular peak in the extreme **30 Doradus** region of the LMC. It is an extreme and violent environment where the rapid formation of clusters of massive stars produce an intense UV radiation field and strong stellar winds. Only a few molecular clouds still exist in this gigantic star formation factory, and most of the surplus gas that enshrouded the region in the past has already been blown away. Our source represents one of the remaining giant molecular clouds that still contain material to form yet more stars.*

*Our second source in the LMC is located to the south of 30 Doradus in a region labeled **N159**. It is currently undergoing active star formation but is still wrapped in its natal molecular gas. The APEX contour map shown here is the brightest CO condensation in this region.*



Credit for Figures:

LMC/SMC: Optical image (NOAO/AURA/NSF)
Background for APEX contours: 2MASS J band atlas image (courtesy U. Mass/IPAC)

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