Massive star feedback in a template galaxy merger, the Antennae

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Super star clusters (SSCs), likely the progenitors of globular clusters, are one of the most extreme forms of star formation. Stellar feedback from such massive clusters is vital to galaxy evolution and star formation history in the Universe, as the intense radiation and stellar winds produced by massive stars are important in unbinding and dispersing large molecular clouds and affecting star formation efficiency and sequential star formation. Nearby galaxy mergers are ideal sites to investigate massive star feedback, and to form local analogous in high-redshift galaxies.
Based on SINFONI and ALMA observations, we have studied one of the most massive (10^7 $M_\odot$) and youngest (3.4 Myr) SSCs in the Antennae merger. It is associated with compact molecular and ionized emission, suggesting it is still embedded in its parent cloud. We found that radiation pressure (P_{rad}) is the dominant stellar feedback mechanism. Comparison with PDR models show that the trapping of IR photons within the internal cavity is negligible and P_{rad} is not enhanced. At present, P_{rad} does not give enough momentum to push away the observed molecular gas from the SSC. The pressure on the hot gas estimated from the X-ray luminosity indicates that the matter surrounding the cluster is clumpy. All of these findings suggest that the SSC is not embedded in its parent cloud after all. We propose that P_{rad} was highly enhanced at the early stages of the SSC formation, early disrupting its parent cloud. The gas observed today surrounding the SSC did not participate on the SSC formation but are nearby clouds and/or gas accreted from the environment. Outflowing gas may be still observed in a broader, high velocity component of the CO gas. Our high-priority Cycle 2 ALMA observations (10 pc angular resolution) are needed to validate this interpretation.