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Protostellar Jets as Particle Accelerators. The case of HH 80-81.

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Massive stars are capable to accelerate particles due to their powerful winds ejected during the main sequence and post-main sequence evolutionary stages. However, recent studies on massive young stellar objects with *Fermi*-LAT have demonstrated that collimated jets, created by the protostars while they are still accreting mass, can produce a significant amount of accelerated particles even though during the pre-main sequence stages.

In this context, we have studied the particle acceleration in IRAS 18162-2048, a massive protostar with ~20 $M_\odot$ that powers the longest collimated jet in our galaxy. The jet is located in a very dense environment, surrounded by a recently reported protostellar cluster with many medium and low-mass protostars. The main knots of the jet (HH 80, HH 81, and HH 80N) have been detected in radio and X-ray wavelengths, emitting non-thermal emission. In this work, we have associated a *Fermi*-LAT 4FGL source with the protostellar jet based on positional arguments.

The study of the high-energy spectrum of the source, spanning from 300 MeV to ~1 GeV, suggests a soft particle distribution consistent with diffusive shock acceleration. We test both leptonic and hadronic models, finding them consistent with the kinetic energy of the outflow jet. We also perform a morphological analysis, finding interesting correlations between the emission and the molecular clouds in the region.

In our poster, we will present the detection of gamma-ray emission originated by a protostar in a star-forming region. The proven capability of massive stellar objects for accelerating particles since their forming stages is an interesting starting point for analyzing cosmic ray production within massive star-forming clusters, as we expect many of these protostars in the densest regions of the active forming clusters.

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