

## **ExHaLe-jet: Modeling blazar jets with an extended hadro-leptonic radiation code**

Blazars emit across all electromagnetic wavelengths. While the so-called one-zone model has described well both quiescent and flaring states, it cannot explain the radio emission and fails in more complex data sets, such as AP Librae. In order to self-consistently describe the entire electromagnetic spectrum emitted by the jet, extended radiation models are necessary. Notably, kinetic descriptions of extended jets can provide the temporal and spatial evolution of the particle species and the full electromagnetic output. Here, we present the initial results of a newly developed hadro-leptonic extended-jet code: ExHaLe-jet. As protons take much longer than electrons to lose their energy, they can transport energy over much larger distances than electrons and are therefore essential for the energy transport in the jet. Furthermore, protons induce injection of additional pairs through pion and Bethe-Heitler pair production, which can explain a dominant leptonic radiation signal while still producing neutrinos. In this talk, we discuss the differences between leptonic and hadronic dominated SED solutions, the SED shapes, evolution along the jet flow, and jet powers. We also highlight the important role of external photon fields, such as the accretion disk and the BLR.

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