

## Radio view of magnetic fields around relativistic jets

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Active galactic nuclei (AGN) are distant galaxies hosting a supermassive black hole in their center. In these objects, matter is accreting around the black hole, making the nucleus brighter than the combined light from the stars in the surrounding galaxy. In about 10% of AGN, relativistic jets where particles travel near the speed of light are seen. Blazars are a type of AGN where the relativistic jet points towards Earth and shines brightly in all wavebands from radio to very high energy gamma rays.

Despite decades of blazar observations, we do not know how these relativistic jets are launched, but according to simulations and analytic studies, it is believed that magnetic fields play a major role in the jet formation process. Radio observations can be used to observe the magnetic fields around these jets because the emission is synchrotron radiation, which is intrinsically highly polarized. By observing radio polarization, it is possible to infer the magnetic field structure around them. We have used the Very Long Baseline Array to study the magnetic fields around the nearest blazar 3C273 in the 8-15 GHz frequency range. Our observations reveal a large-scale helical magnetic field structure around the jet, which could support the theory of jet formation. However, with this frequency range, we can only see the magnetic fields several parsecs away from the black hole so that directly connecting the observations to simulations of jet formation is challenging.

The solution is to use even higher radio frequencies, which probe the magnetic field near the base of the jet, close to the jet formation region. Atacama Large Millimeter Array (ALMA) has opened a new window for studying the magnetic fields at the base of relativistic jets through millimeter-band polarization observations. We have conducted a pilot study at ALMA where we examine the polarization behavior of 3C273 over the 224-242 GHz frequency range. Our results indicate that the jet is surrounded by magnetized plasma with high magnetic field and/or high electron density.

I will discuss how radio polarization observations using both VLBA and ALMA can reveal the magnetic field structure around relativistic jets, and how these observations can be connected to theory of jet formation.