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Examining the jet of blazar 3C 273 at low frequencies using the International LOFAR Telescope

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I will present observations of blazar 3C 273 made with the International LOFAR Telescope, which consists of groups of antennas clustered into stations which are spread throughout Europe.

Blazars are active galactic nuclei which have relativistic jets aligned towards Earth. While blazars are known to emit broadband radiation spanning the full electromagnetic spectrum, mapping the low-frequency (< 200 MHz) radio emission has proven challenging in the past due to the resolution and sensitivity which was available with the previous generation of radio telescopes. Advancements are now being made on this front due, in part, to telescopes such as LOFAR.

3C273 is the focus of our research. 3C273 has historical significance (it was the first identified quasar) and it is perhaps the most heavily-researched blazar to date. While the low-frequency emission is likely to be synchrotron radiation, there is still debate over which mechanisms produce the high-energy emission. Some models suggest that the X-ray emission is produced by the inverse-Compton scattering of cosmic microwave background photons (IC/CMB) off relativistic electrons. It is also possible that the high-energy emission is predominantly the result of the synchrotron photons being up-scattered by the relativistic electrons (SSC). By mapping the low-energy electron population and combining our results with multiwavelength data, we can assess the role that the low-energy electron population plays with respect to the production of the high-energy emission. Specifically, our results can test the viability of the IC/CMB and SSC models.

We are conducting high-resolution observations of 3C273 using both the LOFAR High Band Antennas (HBA, 100--240 MHz) and Low Band Antennas (LBA, 10--90 MHz). The observations were made using the international LOFAR stations in order to achieve sub-arcsecond angular resolution. Analysing a bright (67 Jy at 178 MHz) source with the international stations, coupled with the the low declination (+02°) of this source and its proximity to other bright sources (Virgo A) makes the data analysis technically challenging.

We have preliminary results with the HBA data at present and the LBA data reduction is underway.