ABSTRACT OF THESIS

submitted by

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"A Study on the Detection of 'Winged' Radio Sources, an Exotic Subclass"

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For many years, astronomers have been perplexed by a subclass of extra-galactic radio sources known as "winged" radio galaxies. The "winged" radio source, is a small number of exotic radio sources that exhibit a peculiar radio morphology, where an additional pair of low-surface-brightness, diffuse lobes are observed along a secondary axis of symmetry in addition to the pair of high-surface-brightness, collimated primary lobes. The pair of secondary lobes are found to be aligned at a certain angle to the primary jet axis and are known as "wings". Depending on the position of the wings with respect to the main lobe axis, the winged sources are classified into two categories, 'X'-shaped radio galaxy (XRG) and 'Z'-shaped radio galaxy (ZRG). The winged radio source is a cosmic wonder. However, the origin of such sources is still elusive. Though there are several proposed models, none of them are yet to be established. To date, no proper statistical study has been done either on the general characteristics of wings or on the global attributes of the sources as a population. The primary reason is the low number of such sources, the low sample size restricts us from exploring this field.

In this thesis, I present the identification of new winged radio sources and the study of the global properties of this class of radio sources. The identification of winged sources is done from both the high and low-frequency data surveys. In order to study the morphology of the winged radio sources and their fine details, we chose the best available high-resolution data surveys, namely the VLA Faint Images of the Radio Sky at Twenty-Centimeters (FIRST) data at 1400 MHz for the high-frequency range and the LOFAR Two-meter Sky Survey First Data Release (LoTSS DR1) at 144 MHz for the low-frequency range. Through a systematic search, a total of 458 winged sources from the VLA FIRST data and 40 winged sources from the LoTSS DR1 are identified. Out of the total 498 winged sources, 322 sources are newly discovered. This discovery significantly increased and nearly doubles the number of existing winged sources. By accumulating the newly identified source with all the previous identifications, several statistical studies on their radio and morphological properties are done. The studies give an insight into the global parameters and properties of winged radio sources. An outlook on the origin of such sources is also given.

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