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CONTENTS

ABSTRACT

Cross-matching of catalogues of astronomical objects has become an important resource for scientific discovery. Using this technique on optical and radio catalogues we have found a number of bright (V<11 mag) stars with apparent double radio-lobes. In this thesis we aim to study competing explanations for these objects and other (mostly fainter) examples found in the literature, proposing these to be either genuine radio-emitting stellar systems or chance alignments of a star and a background radio galaxy. We use various kinds of information to test the evidence for the two opposing explanations: the characteristics of the radio emission as drawn from the FIRST and NVSS surveys, as well as radio fluxes from the literature (drawn from the CATS service); their location on the "Black Hole Fundamental Plane" assuming a real association; the characteristics of the stars in terms of evolutionary state, age, rotational velocity and radial velocity, based on our high-resolution spectra from the TIGRE telescope; possible proper motions of the radio structures compared to known proper motions of the stars; an estimate of the number of such associations expected at random; the stars' infrared colors from the AllWISE catalogue; the radio continuum spectral indices, and an analysis of additional radio observations taken from the archive of the Very Large Array interferometer.

Most of these tests turn out to be inconclusive, and several of them lend support to the hypothesis of these radio-optical coincidences to be consistent with random. By contrast, our spectroscopic results strongly suggest that the stars in question are not randomly sampled, as would be expected in the case of chance alignments with background galaxies. This is backed up by our quantitative estimate of the number of objects (stars and double radio lobes) expected to be aligned by chance, which for the six bright stars of the TIGRE sample is about half the observed number. Forthcoming observations, especially currently ongoing VLA Sky Survey (VLASS) should be able to provide more detailed radio images and constrain the proper motions of the radio components.