



Universität
Basel

Research Project

Probing the structure of neighbouring galaxy groups with newly discovered dwarf galaxies

Third-party funded project

Project title Probing the structure of neighbouring galaxy groups with newly discovered dwarf galaxies

Principal Investigator(s) [Binggeli, Bruno](#) ;

Project Members [Müller, Oliver](#) ;

Organisation / Research unit

Departement Physik

Department

Project start 01.10.2016

Probable end 31.08.2018

Status Completed

Dwarf galaxies play a key role in our understanding of structure formation and the dark matter problem. The unexpected low abundance and disk-like distribution of faint dwarf satellites around the Milky Way and Andromeda galaxies observed in recent years pose a challenge to the LCDM standard scenario of structure formation. Much hinges upon the question of how unique or normal the dwarf galaxy population of the Local Group is. Other nearby groups of galaxies are therefore being observed now to look for similar phenomena beyond the Local Group. To provide a basis for such studies we have in the previous SNF-supported project embarked on a survey of the southern Centaurus and Sculptor groups of galaxies to find new very faint and low surface brightness dwarfs. In an extended search based on dedicated imaging with the wide-field Dark Energy Survey Camera (DECam) at CTIO covering the whole Centaurus group (ca. 500 square degs) we have discovered, and carried out surface photometry for, more than 50 new dwarf candidates (two discovery papers are published). This is essentially doubling the number of known members of the group if the candidates are confirmed. We have used ESO's VLT to determine the distances of three dwarf candidates and thereby successfully test the feasibility of that instrument to measure the distances of faint Centaurus dwarfs by the 'Red Giant Branch' method. More VLT observation time for further candidates was unfortunately only granted late; the data analysis and the results thereof fall outside the timeframe of this project. Instead, the search for new, faint dwarf galaxies was extended to the northern M101 and Leo-I groups. Using the public database of the Sloan Digital Sky Survey (SDSS) covering ca. 300 square degs, 50 additional dwarf candidates were found in these groups. The existence of a disk-like distribution of dwarf satellites in the Centaurus group was known before and confirmed by our new candidates. Whether it is an analogous structure to the local satellite planes remained unclear. However, the observed velocities of the already known dwarf satellites show a distinct rotation pattern, just like the local disks. Through in-depth statistical analysis, and comparison with cosmological simulations, we were able to demonstrate that the formation of such a coherent structure is very unlikely (the probability is less than 1%). Since this is the third time, after the Milky Way and Andromeda, that we have encountered such a structure thanks to our work, the standard model of the structure formation with DM, and the existence of DM itself, is seriously challenged now. This result was published in the magazine SCIENCE and found a large echo in the scientific community and in the press world-wide.

Keywords galaxies: dwarf; cosmology; dark matter

Financed by

Swiss National Science Foundation (SNSF)

Add publication

Published results

4492285, Müller, Oliver; Pawlowski, Marcel; Jerjen, Helmut; Lelli, Federico, A whirling plane of satellite galaxies around Centaurus A challenges cold dark matter cosmology, 0036-8075 ; 1095-9203, Science, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

4492282, Müller, Oliver; Rejkuba, Marina; Jerjen, Helmut, Distances from the tip of the red giant branch to the dwarf galaxies dw1335-29 and dw1340-30 in the Centaurus group, 0004-6361 ; 1432-0746, Astronomy & Astrophysics, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

4492283, Müller, Oliver; Jerjen, Helmut; Binggeli, Bruno, The Leo-I group: new dwarf galaxy and ultra diffuse galaxy candidates, 0004-6361 ; 1432-0746, Astronomy and Astrophysics, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

4235495, Müller, Oliver; Scalera, Roberto; Binggeli, Bruno; Jerjen, Helmut, The M101 group complex: new dwarf galaxy candidates and spatial structure, 0004-6361 ; 1432-0746, Astronomy and Astrophysics, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

Add documents

Specify cooperation partners