Individual External Collaborator Project Proposal

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WG(s) involved in the project: Nearby Galaxies, Diffuse Emission/SNRs

Scientific Project description (up to two pages, all included):

Complementary optical study of the source populations and the ISM in the Magellanic Clouds

The Large and the Small Magellanic Clouds (LMC, SMC) at distances of only 50 and 60 kpc, are the largest satellite galaxies of the Milky Way and are ideal targets to study the entire source populations and the interstellar medium in a galaxy. The proximity enables spatially resolved studies of the objects, and the accurately known distance allows for analysis of the energetics of each of them. Furthermore, the stellar populations of both MCs are well studied, and thus allow to determine crucial conditions like the initial mass function of stars and their energy and mass inputs at any location in the galaxies.

We have been performing multi-wavelength studies of different sources (incl. interstellar bubbles and supernova remnants) using radio, optical, and X-ray data since the early 2010s. The radio data mainly taken at ATCA and Parkes Observatory reveal the distribution of the cold atomic gas, HII regions, and synchrotron sources (like pulsar-wind nebulae or supernova remnants). Accreting compact objects in X-ray binaries as well as the hot thin plasma in interstellar bubbles or supernova remnants can be well detected and studied in X-rays. The radio data have been taken by the group of Prof. Miroslav Filipovic (Western Sydney University), while the X-ray data for our studies have been provided by Dr. Frank Haberl (MPE) and Prof. Manami Sasaki (University of Erlangen-Nürnberg). I contribute to these comprehensive studies by providing optical continuum and emission-line data (Halpha, [S II], and [O III]) of the Magellanic Cloud Emission Line Survey (MCELS) carried out at CTIO. Optical data give information about the stellar populations, planetary nebulae, HII regions,

supernova remnants, and other interstellar structures which are excited by the radiation or shocks of hot stars.

While MCELS (as well as the improved data of MCELS2) provide optical data of the entire Magellanic Clouds, X-ray data which had been available so far, only cover parts of these galaxies. With eRASS, we will be able to study the galaxies entirely in these three wavelength ranges for the first time and to study different source populations, various structures in the ISM, correlations of the populations with the ISM, and the implication for the evolution and thus the star-formation history of the Magellanic Clouds.

Required data, supporting datasets and/or tools:

eRASS data (will be analysed by F. Haberl, M. Sasaki, C. Maitra and collaborators within the eROSITA_DE consortium)

Complementary optical photometry data of MCELS will be provided.

List of Potential Collaborators within eROSITA_DE

F. Haberl (MPE), M. Sasaki (ECAP/FAU), C. Maitra (MPE)

Expected Outcome

Papers on the study of SNRs and ISM in the Magellanic Clouds:

First studies of the diffuse X-ray emission in the Large Magellanic Cloud with eROSITA (M. Sasaki, J. Knies, F. Haberl, et al. 2022, A&A, 661, A37)

Projects in progress:

LMC HII region N11 (Kisetsu Tsuge at al.)
LMC HII region N44 (Kisetsu Tsuge et al.)
LMC SNRs (Federico Zangrandi et al.)

Expected duration of the project

First results are expected after eRASS1, but improved data of eRASS1-8 will also require complementary optical data. Therefore, it is expected that a further extension of the external collaborator status will be useful.