BASIC INFORMATION ON SUB-PROJECT

NAME OF PROGRAMME/FUND	Scholarship Fund - Sciex NMS^{ch}
RESEARCH FIELD AND OTHER RESEARCH FIELDS INVOLVED (if applicable)	Astronomy, Astrophysics and Spatial Sciences
TITLE OF THE SUB-PROJECT	Understanding the origin of Lyman-alpha emission and absorption in galaxies (LyaGals)
REGION OF THE CZECH REPUBLIC (according to the location of the home institution)	Central Bohemian Region
GRANT AMOUNT SPENT	101 350,91 CHF
INTERMEDIATE BODY	Swissuniversities
HOME INSTITUTION	Academy of Sciences of the Czech Republic, Astronomical Institute
HOST INSTITUTION	Geneva University, Department of Astronomy
NAME OF THE FELLOW	Ivana Orlitová/Stoklasová

ABSTRACT OF THE SUB-PROJECT	Exploration of the early Universe is one of the fundamental science drivers for astronomical observations as well as simulations nowadays, with the aim to understand the cosmological structure formation and the reionization of Universe by the first stars. Detections of high-redshift galaxies and determining their properties have largely been possible thanks to the Lyman- alpha emission line. However, the resonant nature of this crucial line, with strong radiative transfer effects makes the interpretation of observations complex. Therefore, detailed studies of local galaxies are necessary to understand the physics of Lyman-alpha emission and its transport through the interstellar gas and dust. We propose to perform such a study on a unique sample of twenty nearby galaxies, currently observed by the group of Prof. Schaerer and co-workers with the Hubble Space Telescope, and with other spectroscopic facilities on large ground-based telescopes. We will probe the effects of the dust content and distribution, interstellar-medium geometry and kinematics, galaxy morphology, orientation effects and possible outflows, and assess the Lyman-alpha visibility and line profiles. We will interpret the spatially resolved as well as integrated data by modelling the Lyman-alpha line profiles with the use of the 3D state-of-the-art radiation transfer codes developed in Geneva. The results will have direct consequences not only for understanding the local, evolved galaxies, but also for the derivation of properties of the most distant, early galaxies, which had a significant impact on the Universe as we know it today.

MAIN RESULTS	We have used the radiation transfer code to interpret Lyman alpha spectra of 30 galaxies in the nearby Universe. We have found that neutral gas kinematics plays a decisive role for Lyman alpha escape from gas-rich systems. In parallel, we searched for systems where the amount of neutral gas would be the determining factor: we have found them among the recently discovered compact dwarf galaxies commonly called Green Peas. We made a prediction based on the study of Lyman alpha spectra that the amount of neutral gas in the Green Peas is so low that not only Lyman alpha but also ionising radiation can escape from these galaxies. We successfully proposed new observations with the Hubble Space Telescope to test this hypothesis. We have recently obtained the data which confirm our prediction. These results have large impact on our understanding on the evolution of the Universe since its early stages: our detection of ionising radiation leaking from a galaxy proves the crucial role that dwarf galaxies played for the reionisation of the Universe after its Dark Ages. The results have been presented at conferences (Stockholm 2013, 2014, Geneva 2014, Groningen 2015), seminars (Grenoble 2013, Minneapolis 2015, Amherst 2015) and published in international high-impact journals (e.g. Verhamme, Orlitova, Schaerer & Hayes 2015, Astronomy & Astrophysics 578, A7). The work that was started at the Sciex project has its direct follow-up, the Fellow obtained a post-doctoral grant from Czech Science Foundation, and continues active work on Lyman alpha physics in collaboration with University of Geneva and other universities within a large international team. The Fellow has recently obtained observational time at the Hubble Space Telescope for two projects as Principal Investigator, and participates at five other projects as Co-Investigator. The observations have led to major discoveries accepted for publication in prestigious journals such as Nature (Izotov, Orlitova, Schaerer et al., Nature, in press). In total, the Fellow co-authored ten high-impact papers resulting from the Sciex project and its follow-up.
DATE OF REALISATION OF THE FELLOWSHIP	1.10.2012 - 30.9.2013

MORE INFORMATION ON THE PROGRAMME	**www.sciex.ch**