

Large Synoptic Survey Telescope Galaxies, Dark-Matter and Black Holes: Extragalactic Roadmap

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Abstract.

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1 Introduction

The Large Synoptic Survey Telescope (LSST) is a wide-field, ground-based telescope, designed to image a substantial fraction of the sky in six optical bands every few nights. It is planned to operate for a decade allowing the stacked images to detect galaxies to redshifts well beyond unity. The LSST and the survey are designed to meet the requirements (Ivezic & the LSST Science Collaboration 2011) of a broad range of science goals in astronomy, astrophysics and cosmology. The LSST was the top-ranked large ground-based initiative in the 2010 National Academy of Sciences decadal survey in astronomy and astrophysics, and is on track to begin the survey early in the next decade.

In 2008, eleven separate quasi-independent science collaborations were formed to focus on a broad range of topics in astronomy and cosmology that the LSST could address. Members of these collaborations have been instrumental in helping to develop the science case for LSST (encapsulated in the LSST Science Book), to refine the concepts for the survey and for the data processing, and to educate other scientists and the public about the promise of this unique observatory.

The Dark Energy Science Collaboration (DESC) has taken the next logical step beyond the science book. They identified the most critical challenges that will need to be overcome to realize LSST's potential for measuring the effects of Dark Energy. They looked at five complementary techniques for tackling dark energy, and outlined high-priority tasks for the science collaboration during construction. They designated sixteen working groups (some of which already existed) to coordinate the work. This roadmap has been documented in a 133-page white paper (arxiv.org/abs/1211.0310). The white paper provides a guide for investigators looking for ways to contribute to the overall investigation. It may help in efforts to obtain funding, because it provides clear indication of the importance of the advance work and how the pieces fit together.

The investigation of Dark Energy is only one topic for LSST. It is important to develop similarly concrete roadmaps for work in other areas. After some discussion among the collaborations, it appears useful in some cases for different science collaborations to join forces on a single whitepaper. This is particularly true for topics that involve observations of distant galaxies. With the advent of the DESC, some of the science goals of the large-scale-structure, weak-lensing, and strong-lensing collaborations have found a new home. The remaining science goals of those collaborations tend to be focused on galaxy evolution and dark matter. Two other collaborations: AGN and Galaxies, also have those topics as major themes. This roadmap identifies the major high-level science themes of these investigations, outlines how complementary techniques will contribute, and identifies areas where advance work is essential. For this advance work, the emphasis is on areas that are not adequately covered in the DESC roadmap. As convenient shorthand, we use the acronym GALLA (Galaxies, AGN, Lensing Large-scale Structure and Astro-informatics) joint roadmap of the overlapping science collaborations.

Chapter 2 gives a brief summary of the science background. Many of the themes and projects are already set out in the Science Book, where more detail is provided for many of the science investigations. Chapter 3 sets out the highest priority preparatory work to enable these investigations. These tasks are laid out on the assumption that the work plan of the DESC will be carried out and that software and data products resulting from that work will be available to other science collaborations. The Appendix 4 organizes the tasks by science topic and describes them in more detail.

2 Science Background

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2.1 Overview

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3 The Roadmap

4 Task Lists by Science Area

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