# FIELD GALAXIES: LUMINOSITY, REDSHIFT, AND ABUNDANCE OF TYPES. PART I. THEORY

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## 1. Introduction

The purpose of the present paper is to use the general theory of the spatial distribution of galaxies published earlier [1], [2], [3] in order to deduce formulas representing the observable distributions, joint, marginal and conditional, of the two important characteristics of field galaxies, namely their apparent magnitude and redshift. These formulas, compared with their empirical counterpart represented by the distributions constructed from the data in the catalogues of galaxies, provide means of testing some of the hypotheses underlying the theory and of estimating certain distributions as they exist in space. Specifically, the problems treated include (i) estimates of the luminosity functions of galaxies of specified types, (ii) the luminosity-redshift relation, (iii) the selection probability, and (iv) the relative abundance of various types of galaxies as they exist in space. Some of the formulas deduced here have been published in [4] without proof.

The paper is divided into two parts, theoretical and empirical. In the present theoretical part I an attempt is made to use only assumptions that are of qualitative character and to deduce results that may be of broader validity. Thus, for example, while discussing the luminosity function of field galaxies, our assumptions regarding it are limited only to the condition that certain integrals are convergent, but no specific parametric form of this function is postulated. The only quantitative hypothesis adopted is that the observations refer to relatively nearby galaxies for which the dimming due to redshift may be allowed for.

In the second part of the paper, to be published elsewhere, the theoretical result of part I will be applied to obtain specific information regarding field galaxies. Using the data of the well-known memoir [5] by Humason, Mayall and Sandage, an attempt will be made to obtain actual estimates of the luminosity functions of the several types of galaxies, the abundances of these types in space, and so forth. Here, then, it will be necessary for us to particularize certain

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