SPACE DISTRIBUTION OF SMALL DARK NEBULAE

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1. Introduction

The National Geographic Society—Palomar Observatory Sky Atlas has been used to compile a catalogue of dark nebulae [4]. In this catalogue the galactic coordinates, projected surface areas (in square degrees), and estimates of the opacities of the clouds are listed. The most opaque clouds are designated by opacity 6. These objects were selected on the condition that no stars were visible within the measured surface area of the cloud. This paper deals only with the distribution of the opacity 6 clouds, and attempts to reproduce the observed distribution of apparent sizes of those objects by a simple model.

2. Model I

Model I is based on the following idealized conditions of the region surrounding the sun.

(1) Stars are assumed to be distributed at random in space with a mean density of S_0 stars/pc^3.

(2) It is assumed that we are able to detect all stars not obscured by the opacity 6 clouds.

(3) The opacity 6 clouds are assumed to be spherical, and completely opaque so that no stars can be seen through the nebulae.

(4) There is assumed to be no lower limit to the measurable size of a nebula.

(5) It is assumed that no nebulae eclipse each other.

(6) All opacity 6 nebulae are assumed to have the same area Ω pc^2 of their orthogonal projection on a plane perpendicular to the line of sight.

(7) The opacity 6 clouds are assumed to be distributed at random in space, with a mean density of C_0 clouds/pc^3.

On these assumptions we want to calculate the probability of observing a nebula of measured surface area of ω' square degrees and classify this object as an opacity 6 cloud. This probability is given by

$$P = \pi^*(0)\pi^c(0)\pi'(1), \tag{2.1}$$

where

$\pi^*(0)$ is the probability that there are no stars in the volume element subtended by the cloud,