

A Method to Count the Number of Petals of Cherry Blossom

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Abstract

We present a method to calculate the number of petals of a cherry blossom using the radiative transfer by observing the optical depth of the blossom against the sky. For a cherry tree of height ~ 10 m, we estimate the number of petals to be $\mathcal{N} \sim 3 \times 10^7$. The method can be applied to count the number of leaves and/or petals of any tree.

1 Radiative Transfer of Cherry Blossom to Count the Number of Petals

The brightness of the sky B through the cherry blossom is related to the intrinsic brightness B_0 by

$$B = B_0 e^{-\tau}, \quad (1)$$

where τ is the optical depth and is related to the absorption coefficient κ along the line of sight distance x by

$$\tau = \int \kappa dx. \quad (2)$$

The absorption coefficient is given by the density, n , and cross section, $\sigma \sin i$, through

$$\kappa = n\sigma \sin i, \quad (3)$$

where i is the mean inclination of petals, and $\sigma = \pi(d/2)^2$ is the area of a petal with d being the diameter of a petal. We thus obtain

$$\tau = \int n\sigma \sin i dx = N\sigma \sin i, \quad (4)$$

where $N = \int n dx$ is the column density.

The total number of petals, \mathcal{N} , is calculated by

$$\mathcal{N} \sim 2\pi r^2 N = \frac{2\pi r^2 \tau}{\sigma \sin i} = \frac{8r^2}{d^2 \sin i} \left(-\ln \frac{B}{B_0} \right), \quad (5)$$

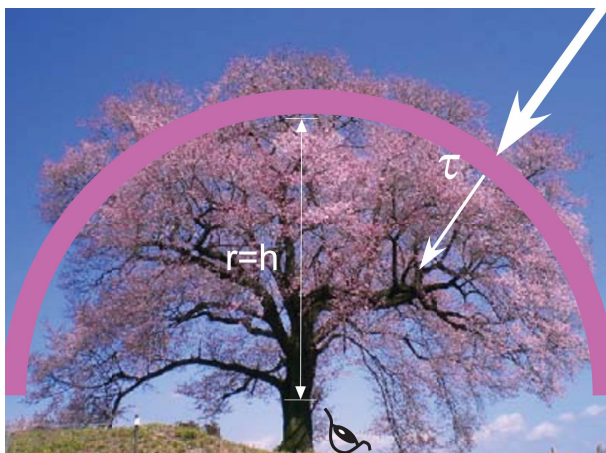


Figure 1: Cherry blossom. The blue sky with B_0 is transmitted to the observer to yield B .

Here, r is the radius of a half spherical surface of the blossom and is approximated by the height of a cherry tree, h . The mean diameter of the petals is measured to be $d \sim 1$ cm, and the mean inclination is estimated to be $i \sim 45^\circ$ for the random distribution of the direction of the flowers.

Observing the ratio of transmitted and intrinsic skys, we obtain $B/B_0 \sim 0.1 - 0.05$ (figure 1), or $\tau = -\ln(B/B_0) \sim 2.3 - 3.0$. Thus, we estimate that the number of cherry petals in a medium-sized tree of height $h \sim r \sim 10$ m is $\mathcal{N} \sim 2.6 - 3.4 \times 10^7$. We finally propose a relation to calculate the petal number for a cherry tree of height h as

$$\mathcal{N} \sim 3 \times 10^7 \left(\frac{h}{10 \text{ m}} \right)^2. \quad (6)$$

References

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