ON CORRELATIONS BETWEEN BRIGHTNESS, VELOCITY, AND MAGNETIC FIELDS IN THE SOLAR PHOTOSPHERE

W. C. LIVINGSTON
KITT PEAK NATIONAL OBSERVATORY

1. Introduction

Modern observations indicate that the solar atmosphere is a region of confluence for many kinds of gas motions, both radial and transverse, some oscillatory, possessing a wide range in amplitude and physical size. The basic driving force behind these motions is the escape of energy from the sun's interior. Therefore, associated with the above velocity field (V) may be expected a brightness field (I) because the last free path of outward energy flux takes the form of radiation. The constraints on the motions near the surface include gravity and magnetic fields (H). Magnetism can be expected to play a role because solar material is highly ionized and therefore a good electrical conductor. Induction currents tend to oppose gas motion across existing magnetic lines of force. Ultimately the desire is to understand the structure and dynamics of the solar atmosphere.

Toward this end, accurate and properly analyzed observations are needed. The apparent stochastic nature of the VIH fields, together with the inadequacy of even the best optical image resolution, requires that the data receive a statistical treatment. Thus, the appropriateness of this subject for this symposium.

In this paper we shall outline the available observational data on velocity and brightness fields. We shall restrict ourselves to the lowest atmospheric level, the "photosphere," and also to aspects of the normal or "quiet" sun. Additional new, and preliminary, observations on the relation of (longitudinal) magnetic fields to the V and I structure are given. We emphasize the preliminary nature of this new data because our effective image resolution is uncertain, and it is difficult to say how the fine detail is attenuated. The fine detail is most important because the scale height of the photosphere is the order of 100 km, or about 0.15 arc seconds viewed from the earth.

1.1. *Methods of observation.* Wide band direct photographs, high dispersion

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