If the observations of meteor-train drifts were reported to one observer or to a specially appointed committee, whether the observations are made casually or from the result of a well organized plan, it would seem probable that in a few years enough drifts could be recorded to bring to light much concerning the movement of the higher atmosphere.

In closing I wish to thank the editorial staff for kindly furnishing me with some valuable data on meteor trains found in the files of the MONTHLY WEATHER REVIEW, and also Miss F. Harpham, of the astronomical computing staff at Columbia University, for assistance rendered on several occasions.

SPECTRAL FORMS IN MIST AND RAIN.

Talla Water is a lake from which Edinburgh derives its water. According to Dr. Hugh Robert Mill, director of the British rainfall organization (see British Rainfall, 1903, p. 49) "Talla is a classic land of rain". Sir Archibald Gilkie refers to it in his Scottish Reminiscences, thus:

> The Talla Valley is narrow and deep, the hills rising steeply from 1,000 to 1,400 feet above the flat alluvial trough at the bottom, which is about 900 feet above the sea. In the days of which I am speaking it was a lonely, sequestered glen, silent save for the bleat of the sheep or the bark of the dogs. In wet weather the wind drove up or down the defile, separating the rain into long vertical shafts, which chased each other like pale spectres. In the narrower tributary gorge of the Games-hope these ghost-like forms are even more marked; hence they are known in the district as the "white men of Games-hope".

STUDIES OF FROST AND ICE CRYSTALS.

BY WILSON A. BENTLEY. Dated Jericho, Vt., May 28, 1906. Revised July, 1907.

(Continued from August Review.)

The extreme difficulty of detaching and securing entire specimens of this type of frost for our purposes has prevented our photographing more than a very few of them. Those that the author succeeded with were, with but one exception, formed around frost nuclei upon windowpanes. For examples of this type of hoarfrost as formed in the open air, see No. 27 A. For additional mention of this type as found indoors on windowpanes, see No. 154 A, type WMD, in section 34, and Nos. 154 B and 161, type WSE, in section 35.

It is of much interest to find within this type of crystal, as within the other similar types heretofore mentioned, systems of air tubes and air inclusions. With the other points of similarity between them this serves to establish still more clearly the probability of the common origin of such air inclusions within both snow and frost crystals.

(17) HTG. Tabular snow crystals with hoarfrost additions.

A most important phase touching both snow and frost study is that relating to changes in habits of growth that may be induced by changes in environment. Very interesting opportunities are occasionally furnished for studying effects of this character, for on rare occasions snow crystals fall at nightfall, and hoarfrost crystal additions form in graft-like fashion upon them before they are modified by evaporation or by melting. This enables the student of crystallography to observe whether such hoarfrost additions as form on and grow outward from such fallen snow crystals conform to their own natural habits of growth, or to those of the fallen snow crystals. It would appear, from what the writer has learned from such few cases as have come under his own observation, that the hoarfrost additions, or grafts, grow and conform to hoarfrost types, rather than to snow-crystal types. Our photographs Nos. 96, 97, 98, and 99 show hoarfrost grafts or additions attached to freshly fallen snow crystals. It is remarkable that all the snow crystals of this series, as well as all the others having hoarfrost additions that have come under the writer's observation, are of a similar branch-like character.

It will be noted by consulting the photographs that in all but one the hoarfrost additions grew in a broad, solid, tabular fashion, in marked contrast to that of the frail, branch-like, snow crystals from which they started. Only in one case, that of No. 99 (which it will be noted portrays but a single segment, or branch-like ray added to the snow crystal), does the hoarfrost addition show a general near resemblance to the snow crystal from which it grew.

COLUMNAR HOARFROST.

Under this title are grouped all hoarfrost crystals that assume the forms of solid or hollow hexagonal columns, hollow hexagonal funnels, combinations of these to form compound crystals, and longitudinally bisected segments of columns and funnels.

(18) Type HCA. Columnar hoarfrost. Hollow columns.

Crystals of this type form in the shape of hollow hexagonal cylinder-like columns. This type of the column is commonly less slender and less elongated in the direction of its main axis than are those of the solid and of the solid fibrous types of the column to be described later. They vary in size from perhaps one-sixteenth to one-sixth of an inch in longer diameter. Many of them taper somewhat toward their bases. When formed in the open, they are essentially mild-weather types. They are most common to early autumn and late spring, and the hoarfrost that collects upon the plants and grasses during the so-called destructive frosts at those dates is almost invariably of this type. Hoarfrost deposits of this character form in the open during calm, clear nights when the surface air temperatures range from 56° to 40° at nightfall, and from 32° to 25° during the latter part of the night or early morning. Sometimes the cold becomes most intense and frost forms most rapidly in the early morning hours between daybreak and sunrise. Crystals of this HCA type rarely or never appear in relatively large numbers in the open simultaneously and associated with tabular hoarfrost crystals. During nights when tabular hoarfrost crystals predominate, this type, HCA, forms in general only on the bare ground and on the under sides of such objects as wood, leaves, straw, etc., that lie directly upon the bare earth, and not insulated from it.

In winter time the shorter and more perfect specimens of this type of frost are of relatively rare occurrence upon the shrubs, grasses, etc., in the open; but they frequently form in winter within relatively warm and inclosed, or partly inclosed, air chambers, as on the sides and roofs of cavities in the snow extending down to moist soil or water, on the under sides of water-trough covers, or of objects such as wood, embedded in the snow. In such confined situations they often grow for a long period of time, and hence attain much greater dimensions than in the open. Many of the individual crystals of this type exhibit but little variety, and a few specimens serve to carry an idea of all. It sometimes happens that they combine with hollow funnel-shaped crystals; funnel-shaped additions grow outward from the apices of the hollow columns and form compound crystals, presumably as a result of a change in atmospheric conditions. (See type HCE.)

Our photographs, Nos. 36 A, 36 B, 36 C, 36 D, and 36 E, quite correctly portray the aspect and general forms of such types of columnar hoarfrost crystals. Nos. 36 A and 36 E show them as collected in autumn and spring during destructive frosts upon grass blades and strawberry-plant leaves, respectively. Nos. 36 B and 36 C show these forms more highly magnified. No. 36 D pictures them as crystallized upon a cedar post.

(19) Type HCB. Columnar hoarfrost. Solid columns.

Hoarfrost crystals of this type grow in the form of the solid column. There are three varieties of the solid column. Some grow in the form of long, slender icy needles, others in a quasi fibroid form. One variety grows in the form of relatively short hexagonal columns, which greatly resemble crystals of type HCA, and in fact differ from them only in this,