deviations, in both the original counts and the numbers after reduction to magnitude 18.2. These deviations indicate the conspicuous non-uniformity in the distribution of galaxies throughout the region covered by the survey. The irregularities are so great from field to field that perhaps no conclusion should be drawn concerning the progression of average density with galactic latitude.

The greater richness of the northern galactic hemisphere is as obvious here as in the earlier survey to the thirteenth magnitude. North of latitude +40° the average number per square degree to magnitude 18.2 is 17.8; south of −40° it is 12.6. The difference may be partially the result of our location north of the galactic plane, but the large deviations from region to region show that little trust can be placed in quantitative deductions based on these values.

Figure 2 shows the relation of density to galactic latitude and longitude for the individual regions. An area on the chart is proportional to the corresponding surface area, a result obtained by making the radii of the boundary lines of the various latitude zones proportional to $\sqrt{1 - \sin \beta}$. The densities are the unreduced values, and illustrate again the unevenness in distribution over the sky and the absence of galaxies in regions near the Milky Way.

INFLUENCE OF INTENSIVE DESICCATION ON CERTAIN PHYSICAL PROPERTIES OF BENZENE

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It has been known for over a hundred years that the presence of traces of water may influence the speed, or the occurrence, of chemical reactions. That such traces of water may likewise affect what are called the physical properties of substances is a possibility that has received attention only in more recent times.

Following a private communication in 1910 of the results, published in the next year, obtained by Smith and Menzies1 for intensively desiccated calomel, H. B. Baker² initiated experiments in which a number of different liquids were intensively desiccated by phosphorus pentoxide. After a period of nine years' drying, Baker reported rises in the boiling points of these liquids ranging from 14 to 60 degrees; and rises also in surface tension and in freezing point. These reports were so extraordinary that many critical investigators were attracted into this field of work. Without attempting to enter into details, it may be stated broadly that the
rises in boiling point reported by Baker have been explained away, in their four several laboratories, by Smits, Smith, Lenher and Cohen with Cohen de Meester in terms of accidental superheating, which occurs also with undried liquids. Failure to observe changes in physical properties as a result of intensive desiccation has been reported by Lenher and Daniels; Briscoe, Peel and Robinson; Rodebush and Michalek; Greer; J. W. Smith; and (although not in the earlier) in the more recent investigations of Smits and his collaborators. The results of Mali and of Manley, on the other hand, are not inconsistent with those of Baker. Upon one matter there appears to be no stated disagreement, namely, that intensive desiccation retards speed of distillation.

In returning to this confused subject after a lapse of twenty years, we thought it best to limit ourselves in the first place to the study of a reputedly normal type of liquid which could readily be purified, and thus we selected benzene. It was only later that it was observed by ourselves that liquid benzene exhibits evidence of allotropic change in the neighborhood of 40°. Because of its sensitiveness, we selected vapor pressure as a chief property to study.

Since we felt that the conditions of experiment were all-important, we were at pains to devise for the work a glass apparatus which, while very simple, enabled us to meet the following specifications: (a) superheating cannot occur; (b) time at equilibrium can be protracted at will; (c) every portion of the glass used can be freed from capillaries; (d) all of the completed apparatus can be strongly heated; (e) no tubes of capillary bore form part of the apparatus; (f) no glass septum need be broken within the dry apparatus; (g) no mercury or stopcocks are used; (h) the purified phosphorus pentoxide and purified benzene can be redistilled direct into the apparatus; (i) the mass of desiccant used can be many times that of the substance to be dried; (j) the apparatus can be charged under dust-free conditions; (k) desiccation at elevated temperatures is possible.

The importance of conditions (d) and (j) has been pointed out elsewhere. The apparatus consisted of a simplified isotenisco, with a 2-cc. bulb A, connected as shown in the diagram to a cylindrical bulb B of about 70-cc. volume, which contained the desiccant. During vapor pressure measurements, the latter bulb could be jacketed by water of
known temperature, while the small bulb, containing benzene, was immersed in a stirred oil bath, according to standard isoteniscope technique. The small tubes, shown sealed off, at C, D and E were used for introducing the materials and for currents of dust-free oxygen or nitrogen. The apparatus could finally be sealed off with a content of many grams of phosphorus pentoxide, about one gram of solidified benzene at $-75^\circ$, and nitrogen gas at known temperature and pressure, near that of the room.

The temperature at which the vapor pressure of the liquid benzene was equal to that of the nitrogen, with its partial pressure of benzene vapor, at $18^\circ$ may be called the boiling point of the sample. After expulsion of the nitrogen from bulb $A$ by boiling out, the identity of these two pressures is recognized by the equality of level of the liquid benzene surfaces in the two limbs of the trap $F$. The boiling point determined in this way immediately after sealing coincided with the known boiling point of the sample as previously ascertained by the customary methods. It has been shown elsewhere that the water content of such benzene is insufficient to cause by its removal a boiling point change near $80^\circ$ of over $0.1^\circ$.

For purposes of desiccation, the liquid benzene was transferred to bulb $B$ in contact with the desiccant. When, after a lapse of weeks or months, it was desired to redetermine the boiling point, the benzene was distilled at room temperature into bulb $A$, maintained at a lower temperature. In most of our experiments we permitted the drying process to take place at room temperature. In other experiments, we used temperatures as high as $150^\circ$; in which cases, to minimize danger of bursting the apparatus, we enclosed it completely in an iron tube containing benzene whose vapor pressure at the elevated temperature offset that of the benzene within the glass apparatus.

Some of the experimental results which we obtained by these methods may be summarized as follows:

1. When benzene was dried with ordinary phosphorus pentoxide no change in its vapor pressure was observed.

2. When benzene was dried with purified phosphorus pentoxide but without precautions to exclude dust, no change in its vapor pressure was observed.

3. When benzene was dried with purified phosphorus pentoxide with precautions to exclude or destroy dust, its vapor pressure near $80^\circ$ was
   (a) markedly lowered if the drying process has been carried on at room temperatures, and
   (b) slightly raised if the drying process had been carried on above $80^\circ$.

4. In certain cases, under the conditions of (3), no change was observed, a result attributable, for example, to accidental dust, which likewise is sufficient to explain the negative results obtained by others in desiccation experiments.
5. Interpreted in terms of change of boiling point near atmospheric pressure, desiccation under our conditions at room temperature for two months caused a rise of about 0.4°, for four months about 0.7°, while the maximum rise observed, practically stationary after twenty months, was 2.2°.

6. No evidence was found of "fractionation," even in a sample of benzene whose boiling point had been raised 2.2° by desiccation.

7. When ordinary undried air was slowly admitted by diffusion to benzene whose vapor pressure had been reduced by desiccation to an abnormally low value, the vapor pressure reverted again to the normal value in a few hours.

8. In regard to reversion to normal boiling point while within the sealed apparatus, no sample of benzene showed such reversion after standing at room temperature. Two samples whose boiling points had been raised 0.4° by two months' drying at room temperature showed complete reversion upon heating near 78° out of direct contact with phosphorus pentoxide for at most three days; whereas a sample whose boiling point had been raised 2.2° by eighteen months' drying at room temperature showed no change of boiling point in either direction upon heating for periods of 18, 4 and 9 days at 120°, 135° and 150°, respectively.

9. Samples of desiccated benzene of abnormally high boiling point showed no change from the normal freezing point greater than 0.1°.

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