Alpino, Prospero (1553–1616) botanist, by A. Beguinot.

Amici, Giovanni Battista (1786–1863) physicist. naturalist, by G. B. De Toni.

Anguillara, Luigi (c. 1512–1570) botanist, by G. B. De Toni.

Baranzano, Redento (1590–1622) philosopher, astronomer, by G. Boffito.

Bertini, Anton Francesco (1658–1726), physician, by A. Corsini.

Bertini, Giuseppe (1772–1845) physician, by A. Corsini.

Bertini, Giuseppe Maria Saverio (1694–1756), physician, by A. Corsini.

Biringuccio, Vannoccio (1480–1530?), technician, chemist, by A. Mieli.

Cestoni, Diacinto (1637–1718), naturalist, by G. Stefanini.

Chiarugi, Vincenzo (1759–1820) psychiatrist, physician, by A. Vedrani.

Cocchi, Antonio (1695–1758), physician, by A. Corsini.

Corti, Bonaventura (1729–1813), botanist, by G. B. De Toni.

Cotugno, Domenico (1736–1822), physician, by G. Bilancioni.

De Visiani, Roberto (1800–1878), botanist, by A. Beguinot.

Dini, Ulisse (1845–1918), mathematician, by G. Loria.

Fibonacci, Leonardo (sec. xii–xiii), mathematician, by G. Loria.

Figari, Antonio (1804–1870) traveler, naturalist, by G. Stefanini.

Folli, Francesco (1624–1685), physician, naturalist, by G. Goretti-Miniati.

Ghini, Luca (c. 1490–1556), botanist, by G. B. De Toni.

Guilandino, Melchiorre (c. 1520–1589), botanist, by G. B. De Toni.

Inghirami, Giovanni (1779–1851), astronomer, by G. Giovannozzi.

Magini, Giovanni Antonio (1555-1617), astronomer, geographer, by A. Favaro.

Maranta, Bartolomeo (c. 1500–1511), physician, botanist, by G. B. De Toni.

Moletti, Giuseppe (1531–1588) astronomer, cosmographer, by A. Favaro.

Passerini, Giovanni (1816–1893), botanist, by G. B. De Toni.

Piccone, Antonio (1844–1901), botanist, by G. B. De Toni.

Pontedera, Giulio (1688–1737), botanist, by A. Beguinot.

Riva, Giovanni Guglielmo, (1627–1677), physician, by C. Artom.

Schiaparelli, Giovanni Virginio (1835–1910) astronomer, historian of science, by E. Millosevich.

Silvestri, Francesco (1474–1528), philosopher, by G. Sestili.

Sterzi, Giuseppe (1876–1919), anatomist, by G. Favaro.

Valli, Eusebio (1755–1816), physician, by A. Vedrani.

Zanardini, Giovanni (1804–1878), physician, botanist, by G. B. De Toni.

LOUIS C. KARPINSKI
UNIVERSITY OF MICHIGAN

SPECIAL ARTICLES

THE EINSTEIN SOLAR FIELD AND SPACE OF SIX DIMENSIONS

THE Einstein theory is four-dimensional in the sense that four (general or world) coordinates x_1, x_2, x_3, x_4 are employed. The fundamental quadratic form

$$ds^2 = \Sigma g_{ik} dx_i dx_k,$$

where the ten potentials g_{ik} are functions of the four coordinates, in general has a curvature tensor which does not vanish, and therefore defines a curved manifold M of four dimensions. In fact M is flat or euclidean or homodoidal only when there is no actual gravitation. Excluding this trivial case, the question arises what is the flat space of fewest dimensions n, which can be regarded as containing the curved manifold M?

Abstractly considered the possible values of n are 5, 6, 7, 8, 9, 10; that is, any M can surely be immersed in a flat space of not more than 10 dimensions. But if we take into account Einstein's differential equations of gravitation, $R_{ik} = 0$, or $G_{ik} = 0$, we find that the simplest case, $n = 5$, is actually impossible. That is to say:

An Einstein four-dimensional manifold, defining a permanent gravitational field, can never be regarded as immersed in a flat space of five dimensions.

This applies in particular to the solar field (defined say by the Schwarzschild form), in which the earth and the other planets are moving. The appropriate value of n must therefore be greater than 5 and less than 11. A brief discussion shows that actually $n = 6$. Therefore:

The solar gravitational field can be represented by a curved manifold of four dimensions situated in a flat space of six dimensions.

This manifold can be written in finite form and gives what may be called a *geometric model* of the field in which we are living.

The proofs of these theorems and the actual equation of this model are appearing in current numbers of the *American Journal of Mathematics,* together with the full discussion of the general results connecting light rays and orbits in any field stated in SCIENCE, October 29, 1920, pp. 413–414.

EDWARD KASNER

COLUMBIA UNIVERSITY

THE AMERICAN CHEMICAL SOCIETY

(*Continued*)

FERTILIZER DIVISION

F. B. Carpenter, *chairman*
H. C. Moore, *secretary*

Kelp as a basis of an American potash industry: J. W. TURRENTINE.

Relationships of chemistry and the fertilizer industry: C. H. MACDOWELL.

A perfect fertilizer law: E. G. PROULX.

Boron in relation to the fertilizer industry: J. E. BRECKENRIDGE.

The quantitative estimation of borax in mixed fertilizers: J. M. BARTLETT.

Note on the determination of nitrogen in fertilizers containing both organic and nitric nitrogen: F. B. CARPENTER. Notwithstanding the fact that the modified Kjeldahl and Gunning methods have been in use for a number of years, the results obtained by these methods in the hands of different analysts on samples containing mixtures of organic and nitric nitrogen are far from satisfactory. This is probably largely due to a wrong interpretation of the official method. From the standpoint of the manufacturer this is quite a serious matter and it seems desirable that the Association of Official Agricultural Chemists should take such action as is necessary to modify or at least change the reading of the modified methods so that there may be no misunderstanding of how they should be carried out.

Dicyanodiamide. A rapid, direct method for its determination in cyanamid and mixed fertilizers: ROLLA N. HARGER, presented by Oswald Schreiner. The method depends upon the fact that when a solution of silver picrate is added to a solution of dicyanodiamide, the latter is quantitatively precipitated as a double compound of silver picrate and dicyanodiamide, $C_6H_2(NO_2)_3OAG$, $C_2H_4N_4$. This new double compound we have named silver picrate-mono-cyanoguanidine. It forms in small crystals which quickly settle out of the solution and can be separated upon a Gooch crucible very rapidly, so that the analysis can be carried out in a very short time. Neither cyanide nor urea give any precipitate when their solutions are treated with silver picrate, and determinations of dicyanodiamide carried out in the presence of these compounds showed that they have no effect upon the analysis. The molar weight of the compound is 420.22, five (4.991) times that of dicyanodiamide, a fact which greatly enhances the accuracy of the method, since an error of 1 mg. in the precipitate weighed will mean an error of only 0.2 mg. of dicyanodiamide or 0.13 + mg. of nitrogen.

The changes taking place in cyanamid when used in mixed fertilizers: ROLLA N. HARGER, presented by Oswald Schreiner. (1) When cyanamid is placed in a mixed fertilizer containing acid phosphate and 5–10 per cent. of moisture, the cyanamide content decreases with great rapidity. (2) This change is represented principally by, and in many cases quantitatively by, the formation of dicyanodiamide. (3) A given quantity of moist acid phosphate is able to transform a limited amount of calcium cyanamid. (4) Cyanamid is not affected by dry acid phosphate. (5) Moisture alone is able to cause the conversion of cyanamid to dicyanodiamid, but the change is much slower than when acid phosphate is present. Since it has been repeatedly shown that dicyanodiamid is valueless as a fertilizer material and, moreover, is toxic to many plants, the formation of this compound in fertilizer materials seems undesirable. From the results of this study it would seem that