

If this is done at all thoroughly, the modes of expressing the laws of physical phenomena in technical mathematical language may almost be left to suggest themselves when the requisite progress shall have been made in pure mathematics.

BOOK SHELF

*The Sub-tropical Garden; or Beauty of Form in the Flower-Garden.* By W. Robinson, F.L.S. With Illustrations. (London: Murray, 1871.)

THIS volume is a sequel to the valuable works which Mr. Robinson has already given us—"The Wild Garden," and "Alpine Flowers for English Gardens." The title is a misleading one, and is thus defined by the author:—"Sub-tropical gardening means the culture of plants with large and graceful or remarkable foliage or habit, and the association of them with the usually low-growing and brilliant flowering-plants now so common in our gardens, and which frequently eradicate every trace of beauty of form therein, making the flower-garden a thing of large masses of colour only." It is a pity that Mr. Robinson has assisted to perpetuate so erroneous a designation, which conveys the idea of the culture of tender plants fitted only for our hothouses. The greater part of the volume is occupied with an alphabetical list of plants suitable for the above purpose, with description of the peculiarities of their foliage, mode of cultivation, and propagation, &c. The accompanying cut is intended to suggest the effects to be obtained from young and vigorous specimens of hardy, fine-leaved trees. In all these points Mr. Robinson



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may be safely followed as a guide, combining great practical knowledge of gardening, an extensive acquaintance with the native habits of plants, and an artist's eye to the beauty of form and combination. The following sentence gives his idea of what gardening should be. "Nature, *in parvis naturalibus*, we cannot have in our gardens, but Nature's laws should not be violated; and few human beings have contravened them more than our flower-gardeners during the past twenty years. We should compose them from Nature, as landscape artists do. We may

have in our gardens, and without making wildernesses of them either, all the shade, the relief, the grace, the beauty, and nearly all the irregularity of Nature." A. W. B.

*The Meteoric Theory of Saturn's Rings, considered with Reference to the Solar Motion in Space; also a paper on the Meteoric Theory of the Sun.* By Lieut. A. M. Davies, F.R.A.S. (London: Longmans & Co.)

PROF. CLERK MAXWELL, in his remarkable essay "On the Stability of Saturn's Rings," which gained the Adams Prize in 1856, exhaustively examines the various theories of the constitution of these rings, and decides what are the impossible mechanical conditions for their maintenance and what is the possible one. He shows that they cannot be solid or rigid; he disposes of the possibility of their being continuously fluid, and he concludes that "the only system of rings which can exist is one composed of an indefinite number of unconnected particles revolving round the planets with different velocities according to their respective distances." Lieut. Davies appears not to have seen Prof. Maxwell's work, as he ascribes to the perusal of a derived exposition of it the enlistment of his interest in favour of the Satellite theory of the rings. Having espoused this theory, he has sought an explanation of Saturn's possession of a ring system in the supposition that the planet has picked up streams of meteors in its path through space; this path being a spiral resulting from the planet's orbital motion in conjunction with the proper motion of the solar system. The spirals traversed by the four planets beyond Mars are projected in accordance with Lieut. Davies's assumption of the solar motion, in order to show that Saturn is (excepting Jupiter) more favourably circumstanced than other planets for encountering wandering streams of meteors that are drawn towards the sun; while, from consideration of the masses and the distances of the two planets from the sun, it is argued that Saturn is better circumstanced than Jupiter for attaching such streams permanently to his system in the form of rings. The details of Lieut. Davies's work can only interest those who are closely concerned with cosmical hypotheses. We will merely remark that he appears to place too great faith in figures: he gives the hourly rate of the solar motion in space to a mile, and quotes the solar parallax to four places of decimals! The velocity is a very uncertain element of the solar motion, and a small alteration of the rate assumed by Lieut. Davies would greatly modify his conclusions. The book includes a paper on the meteoric theory of the sun, a theory with which the author is blindly enraptured. He claims that it "accounts for every phenomenon hitherto observed on the solar surface." He holds that the "willow leaves" are meteoric flights just falling into the sun; that the spots are spaces upon which no meteors are raining; that the periodicity of spots is due to the action of the planets in pulling "the meteoric matter outwards from the surface of the sun into larger orbits, thus temporarily delaying its precipitation," and that "the form of the spots bespeaks their origin as extraneous to the solar machinery. Were they cyclones in the atmosphere, they would invariably present a rotatory appearance . . . . This must result were the origin of the spots in a plane parallel to the tangential plane at the sun's surface; but would not do so if their origin lay in the normal to that plane, as it does in the meteoric theory. A careful study of Mr. Carrington's valuable series of observations of solar spots is decidedly unfavourable to the conclusion that they have forms of rotation." Lieut. Davies is either innocently or wilfully ignorant of the palpably cyclonic appearance which spots frequently present, and which has been frequently depicted by observers who have studied the characteristic features of individual spots. This study did not concern Mr. Carrington. The devotees of the meteoric theory of the sun's maintenance will not feel that it has been much advanced by Lieut. Davies's over-straining advocacy.