cal optician of Munich. He made a great number of experiments on the shadows produced by small holes, and groups of small holes, very near each other. These were published[a] in his *New Modifications of Light*, in 1823. The greater part of this Memoir is employed in tracing the laws of phenomena of the extremely complex and splendid appearances which he obtained; but at the conclusion he observes, "It is remarkable that the laws of the reciprocal influence and of the diffraction of the rays, can be deduced from the principles of the undulatory theory: knowing the conditions, we may, by means of an extremely simple equation, determine the extent of a luminous wave for each of the different colors; and in every case, the calculation corresponds with observation." This mention of "an extremely simple equation," appears to imply that he employed only Young's and Fresnel's earlier mode of calculating interferences, by considering two portions of light, and not the method of integration. Both from the late period at which they were published, and from the absence of mathematical details, Fraunhofer's labors had not any strong influence on the establishment of the undulatory theory; although they are excellent verifications of it, both from the goodness of the observations, and the complexity and beauty of the phenomena.

We have now to consider the progress of the undulatory theory in another of its departments, according to the division already stated.

Sect. 3.—*Explanation of Double Refraction by the Undulatory Theory.*

WE have traced the history of the undulatory theory applied to diffraction, into the period when Young came to have Fresnel for his fellow-laborer. But in the mean time, Young had considered the theory in its reference to other phenomena, and especially to those of *double refraction*.

In this case, indeed, Huyghens's explanation of the facts of Iceland spar, by means of spheroidal undulations, was so complete, and had been so fully confirmed by the measurements of Haüy and Wollaston, that little remained to be done, except to connect the Huyghenian hypothesis with the mechanical views belonging to the theory, and to extend his law to other cases. The former part of this task Young executed, by remarking that we may conceive the *elasticity* of the

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[a] In Schumacher's *Astronomische Abhandlungen*, in French; earlier in German.