what mode of vibration constituted polarization, that I caught sight of the mechanical causes of double refraction."

Having thus got possession of the principle of the mechanism of polarization, Fresnel proceeded to apply it to the other cases of polarized light, with a rapidity and sagacity which reminds us of the spirit in which Newton traced out the consequences of the principle of universal gravitation. In the execution of his task, indeed, Fresnel was forced upon several precarious assumptions, which make, even yet, a wide difference between the theory of gravitation and that of light. But the mode in which these were confirmed by experiment, compels us to admire the happy apparent boldness of the calculator.

The subject of *polarization by reflection* was one of those which seemed most untractable; but, by means of various artifices and conjectures, it was broken up and subdued. Fresnel began with the simplest case, the reflection of light polarized in the plane of reflection; which he solved by means of the laws of collision of elastic bodies. He then took the reflection of light polarized perpendicularly to this plane; and here, adding to the general mechanical principles a hypothetical assumption, that the communication of the resolved motion parallel to the refracting surface, takes place according to the laws of elastic bodies, he obtains his formula. These results were capable of comparison with experiment; and the comparison, when made by M. Arago, confirmed the formulæ. They accounted, too, for Sir D. Brewster's law concerning the polarizing angle (see Chap. vi.); and this could not but be looked upon as a striking evidence of their having some real foundation. Another artifice which MM. Fresnel and Arago employed, in order to trace the effect of reflection upon common light, was to use a ray polarized in a plane making half a right angle with the plane of reflection; for the quantities of the oppositely[13] polarized light in such an incident ray are equal, as they are in common light; but the relative quantities of the oppositely polarized light in the reflected ray are indicated by the new plane of polarization; and thus these relative quantities become known for the case of common light. The results thus obtained were also confirmed by facts; and in this manner, all that was doubtful in the process of Fresnel's reasoning, seemed to be authorized by its application to real cases.

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[13] It will be recollected all along, that *oppositely* polarized rays are those which are polarized in two planes *perpendicular* to each other. See above, chap. vi.