

out departing from the genuine doctrine of undulation." He then proceeds to suggest the possibility of "a *transverse* vibration, propagated in the direction of the radius, the motions of the particles being in a certain constant direction with respect to that radius; and this," he adds, "is *polarization*." From his further explanation of his views, it appears that he conceived the motions of the particles to be oblique to the direction of the ray, and not perpendicular, as the theory was afterwards framed; but still, here was the essential condition for the explanation of the facts of polarization,—the transverse nature of the vibrations. This idea at once made it possible to conceive how the rays of light could have *sides*; for the direction in which the vibration was transverse to the ray, might be marked by peculiar properties. And after the idea was once started, it was comparatively easy for men like Young and Fresnel to pursue and modify it till it assumed its true and distinct form.

We may judge of the difficulty of taking firmly hold of the conception of transverse vibrations of the ether, as those which constitute light, by observing how long the great philosophers of whom we are speaking lingered within reach of it, before they ventured to grasp it. Fresnel says, in 1821, "When M. Arago and I had remarked (in 1816) that two rays polarized at right angles always give the same quantity of light by their union, I thought this might be explained by supposing the vibrations to be transverse, and to be at right angles when the rays are polarized at right angles. But this supposition was so contrary to the received ideas on the nature of the vibrations of elastic fluids," that Fresnel hesitated to adopt it till he could reconcile it better to his mechanical notions. "Mr. Young, more bold in his conjectures, and less confiding in the views of geometers, published it before me, though perhaps he thought it after me." And M. Arago was afterwards wont to relate¹⁰ that when he and Fresnel had obtained their joint experimental results of the non-interference of oppositely-polarized pencils, and when Fresnel pointed out that transverse vibrations were the only possible translation of this fact into the undulatory theory, he himself protested that he had not courage to publish such a conception; and accordingly, the second part of the Memoir was published in Fresnel's name alone. What renders this more remarkable is, that it occurred when M. Arago had in his possession the very letter of Young, in which he proposed the same suggestion.

¹⁰ I take the liberty of stating this from personal knowledge.