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# IDEALITY

IN THE

## PHYSICAL SCIENCES

BY

BENJAMIN PEIRCE

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### IDEALITY IN THE PHYSICAL SCIENCES.

ers, have passed away; and the ripe harvest of suns and planets is maturing.

The two *Magellanic Clouds* are conspicuous displays of stellar light, which are unseen by the northern astronomer. They resemble portions of the Milky Way in their general aspect and brightness. When examined through the telescope, their constitution is found to be astonishingly complex. According to Sir John Herschel, they combine patches of nebulosity of every degree of resolvability "nebulae in abundance, both regular and irregular; globular clusters in every state of condensation; and objects of a nebulous character quite peculiar, and which have no analogue in any other region of the heavens." They are celestial museums, in which examples of all sidereal forms are collected. Not only do they contain every variety of nebula and cluster, but even the monsters have their representatives.

The *Annular Nebulae* are sidereal rings, which exhibit a peculiar mode of development. Unlike the ordinary nebulae, they manifest a centrifugal rather than a centri-

petal class of aggregation; they indicate statical, but dynamic equilibrium. They suggest an approach to organic constitution.

The ring furnishes an ideal connection between the most immense and the smallest phenomena of the physical world. It is found among the stars and planets, as well as with the nebulae. It adorns Saturn, making it the most beautiful of the stars; and Laplace saw in it the remnant of the process by which the solar system was developed. It is quite probable, as indicated by Mr. Charles S. Peirce of the Coast Survey, that our galaxy should be classed as a stellar ring. The ring is conspicuous among the typical forms of the animal kingdom, and is essential to the elemental vortex theory. In the intellectual world it is not restricted to geometry; it has wound its way into art as the type of infinity, into law as the symbol of authority, and into religion as the pledge of faith. The geometric idea does not expand with the magnitude of the circle, nor diminish with its contraction. It is equally perfect in the molecule and in the sidereal cluster, and no

complication of appearance can obscure the simplicity of the conception.

The annular nebula demands careful study on account of the variety of aspect under which it may be presented. Its circular form may be foreshortened into an ellipse, or an elliptical form into a circle. When viewed from the side, it may be undistinguishable from a dumb-bell nebula; and since it cannot be taken in the hand, and turned around for inspection, the actual figure can be recognized only by refined and thoughtful observation.

The *Spiral Nebula*, first exhibited by the telescope of Lord Rosse, is the visible representative of a peculiar process of evolution. It tells of mighty explosions, of a rotating mass, and of a resisting medium. Behold it, and wonder if geometry will ever penetrate its mystery and explore the secret of its formation! Its suggestions are obvious to the simplest understanding; but the profoundest philosopher may exhaust his wisdom in exploring its ideality. There is evidence of similar action in the streaming outskirts of a large number of nebulae and of the galaxy itself.

I have attempted to give a simple description of the various classes of nebulae. Typical forms can be selected, but they are never sharply isolated from other forms. We have always a continuous series, and an uninterrupted succession of apparent transformations. There are not distinct species and genera and families and classes, as in the organic world; but each division seems to be a temporary and transitional stage.

When you enter a grove of oak, and see trees of every size surrounding you, you do not hesitate to arrange them in a mental series, according to their seeming age; and you read, in the succession, the history of each individual, as correctly as if you had seen it grow. When the botanist inspects his herbarium, with its specimens of seed, germ, early shoot, and plant in flower, in fruit, and in seed, he is enabled to study each growth, without awaiting the long course of development. In the same spirit of philosophy, Sir William Herschel interpreted the unbroken law of succession in the celestial forms. They constitute an illustrated history. If he could have prolonged his

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