

first theoretical and experimental essays, experiments had already been made by Sir John Herschel at the Cape, and independently by Pouillet in France, with the object of measuring the annual expenditure of heat by the sun. They had found it to be an enormous quantity.¹ They represented it popularly by the thickness of a crust of ice on the surface of the earth, which the heat radiated annually by the sun would be able to melt, and they found this to be about 30 metres or 100 feet. Mayer was the first who seems to have put the question definitely: How is this enormous expenditure of heat defrayed, which would, if not in some way compensated, have resulted, even in historical times, in a great lowering of the temperature of the sun, and hence also of that on the surface of our globe, such as is contradicted by all historical evidence? The answer which Mayer gave to this question was based upon an application of his conception of the equivalence of heat and the energy of mechanical motion. As the sun, according to the cosmogonic hypothesis² of Laplace, was originally formed by

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the sun.

¹ These measurements were made in 1837, and very nearly agreed. The resulting figures can, of course, only be considered as rough approximations: they have been considerably increased by more recent observations. See A. Berry, 'A Short History of Astronomy,' p. 397.

² It does not appear that Mayer brought his "meteoric" hypothesis of the generation and maintenance of the heat of the sun into connection with the nebular hypothesis of Kant and Laplace. In fact, in his first mention of it in his communication to the Paris Academy in 1846 he says simply: "En con-

sidérant le grand nombre que nous voyons, comme bolides ou étoiles tombantes, nous ne pouvons pas douter qu'à tout moment des myriades d'astéroïdes semblables à une grêle épaisse se jettent dans tous les sens sur le soleil où ils perdent la force vive de leur mouvement" (Mayer's 'Schriften und Briefe,' p. 264); and M. Faye remarks that the fact that Mayer's ideas are opposed to Laplace's theory of the origin of the solar system explains how it came about that his theories were never reported on or explicitly mentioned. Leverrier also seems to have ridiculed the meteoric hypothesis, according to