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**Abraham Pais Prize for History of Physics Talk: Henry Cavendish, John Michell, Weighing the**

**Stars**  
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This talk is about an interaction between two 18th-century natural philosophers (physical scientists), Henry Cavendish and John Michell, and its most important outcome, the experiment of weighing the world (their name for it) using a torsion balance (our name for it). Michell was the most inventive of the 18th century English natural philosophers, and Cavendish was the first of his countrymen to possess abilities at all comparable with Newton's. By their interests and skills, they were drawn to one another. Both were universal natural philosophers, equally adept at building scientific instruments, performing experiments, constructing theory, and using mathematics; both had a penchant for exacting, quantitative work. Both also had fitful habits of publication, which did not begin to reveal the range of their work, to the mystification of later scientists and historians. Late in life, Cavendish and Michell turned their attention to the force that Newton had examined most completely, a singular triumph of his natural philosophy, the force of universal gravitation. Over the course of the 18th century, abundant evidence of attraction had been gathered from the motions of the earth, moon, planets, and comets, phenomena which span the intermediate range of masses, sizes, and distances. But in three domains of experience, involving the extreme upper and lower limits of masses and dimensions, the universality of gravitation remained an article of faith. These were the gravity of the "fixed" stars, the mutual attraction of terrestrial bodies, and the gravitation of light and other special substances. Michell took on himself the task of deducing observable consequences from each of these prospective instances of universal gravitation. Cavendish encouraged Michell, and he followed up the resulting observational and experimental questions. The experiment of weighing the world was the last experiment Mitchell planned and the last experiment Cavendish published. The capstone of two distinguished careers, the experiment outlived the world in which it was conceived and carried out. Today gravitation is at the center of the physics of the very small and the very large, and experiments that followed in Michell and Cavendish's footsteps find a place in it. The "most important advance in experiments on gravitation," to quote an authority, "was the introduction of the torsion balance" by Michell and Cavendish and independently by Coulomb; "it has been the basis of all the most significant experiments on gravitation ever since." Another authority traces the "noble tradition of precision measurement to which we are heirs" to Cavendish's experiment, which he calls the "first modern physics experiment."