Clapham Common, Britain, 1797

Henry Cavendish dropped exhausted onto the only chair in his laboratory. He had just finished lifting the second 12-inch, 350-pound lead sphere into place using block and tackle, and needed to rest before he could start the final suspension. He was building an apparatus to weigh the earth. He had seen something like it in the lab of a geologist who recently passed away, John Michell, who had never completed his experiment.

It was a large affair; a support frame ten feet high and ten wide, supporting delicately from its center a balanced six-foot horizontal rod, with two 2-inch lead spheres hanging off either end. And just inside the arc described by the two small lead weights when the beam swung were the two large lead spheres hung on their own rotating suspension. He was going to measure just how much gravitational force was felt by the small moving weights as they were close to the large lead spheres. It was very delicate work, but this is where Henry loved to be, alone in his lab.

Henry Cavendish hated crowds, hated interacting with people; but he loved numbers, measurement and experimenting with chemicals and apparatus. His father, the gregarious Lord Charles Cavendish, politician and scientist, brought young Henry along to his assignments in the British Museum and to the Royal Society to hear reports on the treasures unearthed in foreign lands and in small laboratories alike, to hear tales of discovery in the sciences, in physics, in chemistry, in geology and geography, in archaeology, all the wonders that Henry found so absorbing.

And there in the halls of the Royal Society Henry heard of Newton. Isaac Newton, who had lead the Royal Society for a time and had died just five years before Henry was born. The great physicist and alchemist, it was Newton who came up with a scientific law describing the gravitational attraction of one mass for another. It was a straightforward relationship between the two masses of interest multiplied by each other, divided by the distance between them squared, all multiplied again by a constant. And that constant was Henry’s goal. Big G, the universal gravitational constant, was unknown.

Big G was small, too small to observe in the presence of the Earth, itself a very, very large mass. The apparatus of Michell was just the thing to measure the force of gravity in a different direction from that of Earth’s gravity; it would measure the small force of gravity acting sideways.

It took Henry a week to get the masses positioned and measured as precisely as possible. He had the advantage of access to the best scientific equipment through his father’s wealth and his own connections into the great scientific community around London. His measurements were the rate of rotation when the weights felt that very small gravitational force. Henry set up his apparatus well; he could measure distances and could measure deflections of 0.01 inches.

His plan was simple: measure Big G and use that to find the mass of the earth using Newton’s Law of Gravitation equation. The Universal Gravitational Constant, responsible for keeping the planets in their orbits, and for holding galaxies together, could be known. Big G was a constant. Henry was about to measure the value.

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