GEORGE GREEN

1793 - 1841

MILLER AND MATHEMATICAL PHYSICIST

George Green was born in Nottingham in 1793. His father was a baker. He had a fine tower mill built in Sneinton, overlooking the Trent valley. When George was fourteen, milling became Mr Green's main business, as it later was for George.

As far as we know, George Green had only fourteen months of formal schooling. He left Mr Goodacre's Academy at the age of nine to work in his father's bakery. However, it seems that even at that early age he was showing a remarkable aptitude for mathematics. He was later to become an outstanding mathematician and physicist whose significance to science and technology continues to grow. Yet as a busy miller, much of his studying was done, as he put it, "in the hours stolen from my sleep".

In 1828, at the age of only thirty-five, he published his first and greatest work, entitled "An Essay on the Application of Mathematical Analysis to the Theories of Electricity and Magnetism". In it he presented a whole new field of mathematics, including what are still known as Green's Functions and Green's Theorem. Green's Functions are very widely used in all branches of modern physical sciences: They are used to solve problems in areas as diverse as nuclear physics, superconductivity, satellite communications, radar, electrical circuit theory and even the new mathematics of fractals and chaos theory!

$$\oint_C (L\,dx + M\,dy) = \iint_D \left(\frac{\partial M}{\partial x} - \frac{\partial L}{\partial y}\right) dx\,dy$$

Green's essay came to the attention of a man called Sir Edward Bromhead, who became Green's patron. Recognising his genius, Bromhead encouraged Green to publish further papers and sponsored him as an undergraduate student at Caius College, Cambridge. Green was now a wealthy man and employed a manager to run his milling business. This left him free to study at Caius College, where he received a degree and later became a Fellow of the college. However, his health failed him and he returned to Nottingham where he died in 1841 at the age of forty-eight.

In all, Green published ten papers. They investigated such subjects as electric charge and magnetic fields, the behaviour of fluids, wave motion, the elasticity of materials and the behaviour of light and sound. In his work he introduced the concept of conservation of

energy and, for the first time, introduced the term `potential' in respect of electrical charge. Several of the papers dealt with the reflection of light and Green's analysis of these phenomena was a great step forward in this field. He gave the first mathematical explanation of total internal reflection of light, thus providing the basis for optic fibre technology.

When Green died his work was largely unrecognized, but since then, the application of his mathematics has been of great importance. Although Green in his time was concerned with very specific problems, the techniques he devised now have enormous general application: Today physicists and engineers in many different fields use his mathematics to help them solve problems.

Green's importance has now been recognised and he has received a specific honour in recent years: The grave of Sir Isaac Newton (the eighteenth century physicist and mathematician) can be found in Westminster Abbey. Arranged around three corners of the grave were memorial plaques to three of the nineteenth century's most famous and influential physicists - Michael Faraday, William Thomson (Lord Kelvin) and Clerk-Maxwell. In 1993 a plaque was placed at the fourth corner of Newton's grave, dedicated to George Green. In his bicentennial year this honoured him in his rightful place amongst the greatest scientists of his, and indeed of any, age.

The George Green Library at the University of Nottingham is named after him, and houses the majority of the University's Science and Engineering Collection. In 1986, Green's mill was restored to working order. It now serves both as a working example of a 19th century mill and as a museum and science centre dedicated to George Green.