



These circular disk antennas, each 25 m in diameter, are pointed to receive radio waves from out in space. Radio waves are electromagnetic (EM) waves that have frequencies from a few hundred Hz to about 100 MHz. These antennas are connected together electronically to achieve better detail, and are a part of the Very Large Array in New Mexico searching the heavens for information about the Cosmos.

Maxwell predicted the existence of EM waves from his famous equations, which are a magnificent summary of electromagnetism.

## CHAPTER 22

# Electromagnetic Waves

The culmination of electromagnetic theory in the nineteenth century was the prediction, and the experimental verification, that waves of electromagnetic fields could travel through space. This achievement opened a whole new world of communication: first the wireless telegraph, then radio and television, and more recently cell phones and remote-control devices. And it yielded the spectacular prediction that light is an electromagnetic wave.

The theoretical prediction of electromagnetic waves was the work of the Scottish physicist James Clerk Maxwell (1831–1879; Fig. 22–1), who unified, in one magnificent theory, all the phenomena of electricity and magnetism.

FIGURE 22–1 James Clerk Maxwell.

