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Voices in the sky

"This velocity is so nearly that of light, that it seems we have strong reasons to conclude that light itself is an electromagnetic disturbance in the form of waves propagated through the electromagnetic field according to electromagnetic laws."

James Clerk Maxwell, 1865

"From a long view of the history of mankind – seen from, say 10,000 years from now – there can be little doubt that the most significant event of the 19th century will be judged as Maxwell's discovery of the laws of electrodynamics."

Richard Feynman

London, 30 October 1862:

When he left King's College, James Clerk Maxwell felt like dancing on air. The October rain had stopped and the sun had come out, and he halted opposite the church St Mary le Strand, for a while utterly transfixed by the light sparkling off the surface of a fresh puddle in the road. An hour ago, it was only a suspicion in his mind. But now, having consulted a reference book in the King's College library and plugged some numbers into his theory, it was a fact. He knew something that nobody in history of the world had known before.

He knew what light was – a ripple in the electromagnetic fields that filled space.

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Maxwell hurried along the footpath beside the expanse of the Serpentine. To the south of the lake lay the former site of the 1851 Great Exhibition, one of the wonders of the century. Among the visitors to the great glass-and-iron pavilion, so enormous it had enclosed even some of the park's tallest trees, had been Charles Darwin, Charlotte Brontë, Charles Dickens and Alfred Tennyson. It had been dis-assembled bit by bit and re-assembled at Penge Place Estate in Sydenham, South London. To the southwest of its former site was "Albertopolis", the district nicknamed in honour of Queen Victoria's Prince Albert, who had died only the previous December and whose plan was that the Great Exhibition would leave a lasting cultural legacy in the form of museums and galleries. Maxwell, on numerous occasions, had been with Katherine to the newly opened South Kensington Museum.

A ferry was chugging across the water from near the boat house on the far bank of the Serpentine. Swans and ducks and seagulls bobbed around it. But Maxwell paid them no attention. He was captivated instead by a rapidly fading rainbow, low in the sky to the north. How appropriate. Ever since Piccadilly, a single thought had occupied his mind: his cog-and-bead model of the electromagnetic field set no restriction

whatsoever on how fast or how slow it might be jiggled. And that could mean only that the colours of the rainbow represented only a tiny range of possible frequencies. Beyond this visible "spectrum", stretching away in both directions, there must exist undulations of the electromagnetic fields that were both more sluggish and more rapid than those of visible light. By convention, the rainbow contained seven colours. But, in addition to these, he now realised, there must be other "colours", utterly invisible to the naked eye. Millions upon millions of them.

It was an extraordinary, mind-expanding thought.

For a moment, standing on the path by the Serpentine amid squabbling seagulls, he was overwhelmed by a Faraday-esque vision of reality. All about him, stretching out to the very fringes of the known universe, was the electromagnetic field, like a vast invisible ocean of energy. And that ocean was in constant upheaval, its multitudinous vibrations filling the air all around him. And he, James Clerk Maxwell, was the first person in the history of the human race to realise this.

It is not easy to convey, unless one has experienced it, the dramatic feeling of sudden enlightenment that floods the mind when the right idea finally clicks into place. One immediately sees how many previously puzzling facts are neatly explained by the new hypothesis. Maxwell could kick himself for not having the idea earlier, it now seemed so obvious. Yet before, everything had been in a fog.

Now his mind was racing. Might it be possible to artificially vibrate the electromagnetic fields? Was it conceivable that, by means of some as-yet-uninvented technology, it might be possible to create invisible electromagnetic waves? He could see no reason why not. So it must therefore be possible! But the sun to the south was now low in the sky. He could not afford to daydream any longer. Quickening his pace, he hurried along the bank of the Serpentine and crossed the road into Kensington Gardens. Ahead, in the vestibule of 8 Palace Gardens, Katherine would already be dressed for her horse ride and waiting impatiently.

Karlsruhe, Germany, 12 December 1887:

Hertz made another adjustment, stood for a while stroking his neat beard while the thought went through his mind: is this really going to work? But A subtle change in the sound in the laboratory stopped him in mid-stroke. Frowning, Heinrich Hertz crouched next to his receiver.

There was a spark in the air gap! The gap, which was only a few hundredths of a millimetre wide, was tiny, and the spark was easier to hear than it was to see. But there was no doubt about it. It was definitely there.

He switched off the oscillator. The spark at the receiver died. He switched it on again. The spark reappeared.

Something invisible was travelling through the air from his transmitter to his receiver! Although he could not prove it yet, he was sure he knew what it was. It had been predicted 15 years earlier by a brilliant Scottish physicist who had died years before his time…