

Shaping Written Knowledge

The Genre and Activity of the Experimental Article in Science

Charles Bazerman

In practice you want longer wavelength light that is contribute to the cell's power, so you choose substances that require less energy to become photoconducting. Silicon, for example, can be made photoconducting by photons of half as much energy (1100 nm wavelength), so the maximum possible voltage you can get from such a solar cell is about 1 volt. In silicon, then, photons with wavelengths less than 1100 nm carry more energy than needed, and the extra energy is wasted as heat. Such losses make it difficult to convert large fractions of the solar energy incident on a photovoltaic cell.

C. Particle waves

Quantum theory not only explains the photoelectric effect, but also the colors in the spectrum of hydrogen.

As you saw in the previous section, the spectrum of hydrogen consists of several lines of light which correspond to different energy levels.

Some colors are more frequent than others in these spectra, but nothing about light itself tells you one color is more frequent than another.

The reason that certain spectral lines are more frequent than others is that matter does not radiate energy continuously, but rather in discrete packets called photons.

Each type of atom emits only sharply defined frequencies, called the atom's line spectrum. For example, when you see that particular type of yellow light (Figure 15.1b) you can be sure that there is some sodium present in the light source.

Earlier we explained these characteristic frequencies as transitions of the atom. We have now learned from the photoelectric effect, that each frequency of light corresponds to photons of one particular energy. Hence, now we can see that when an atom transitions (in response to absorbing some energy), it emits well-defined energy packets.

Practically, it is not so simple to get the atoms to emit light. The atoms are in a gas, and they are constantly colliding with each other. These collisions make it difficult to observe the discrete frequencies of the atom's line spectrum.

Instead, we observe that the light from a gas is a mixture of many frequencies. This is because the atoms are constantly colliding with each other, and the energy is being transferred from one atom to another.

For a more accurate representation of electron wave behavior, we can use electron diffraction.

Which of the two models is more accurate? The answer is that both are, but in different contexts. The particle model is more accurate at the microscopic scale, while the wave model is more accurate at the macroscopic scale.

Both models are necessary to understand the behavior of matter. The particle model is used to describe the behavior of individual particles, while the wave model is used to describe the behavior of large numbers of particles.

The wave model is also used to describe the behavior of light. Light is a wave, and it exhibits wave-like behavior. The particle model is used to describe the behavior of light at the microscopic scale, while the wave model is used to describe the behavior of light at the macroscopic scale.

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But we electrons (and other forms of matter) really a type of wave? At first sight this seems a can see that when an atom transitions (in response to absorbing some energy), it emits well-defined energy packets.

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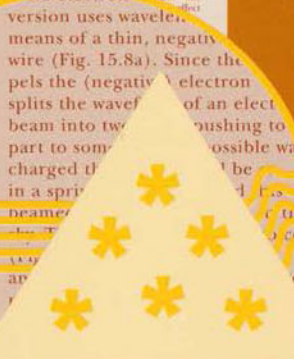
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Shaping Written Knowledge

THE GENRE AND ACTIVITY OF THE

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CHARLES BAZERMAN

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In memory of my parents
Solomon Bazerman (1916–1965)
Miriam Bazerman (1916–1975)

*For Poesy alone can tell her dreams,
With the fine spell of words alone can save
Imagination from the sable charm
And dumb enchantment.*

John Keats, "The Fall of Hyperion"

*Poets survive in fame.
But how can substance trade
The body for a name
Wherewith no soul's arrayed?*

*No form inspires the clay
Now breathless of what was
Save the imputed sway
Of some Pythagoras,*

*Some man so deftly mad
His metamorphosed shade,
Leaving the flesh it had,
Breathes on the words they made.*

J. V. Cunningham

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