I used to wonder how it comes about that the electron is negative. Negative - positive; these are perfectly symmetric in physics. There is no reason whatever to prefer one to the other. Then why is the electron negative? I thought about this for a long time and at last all I could think was "It won the fight!"

Albert Einstein

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SES 194

Energy in Everyday Life

Charge

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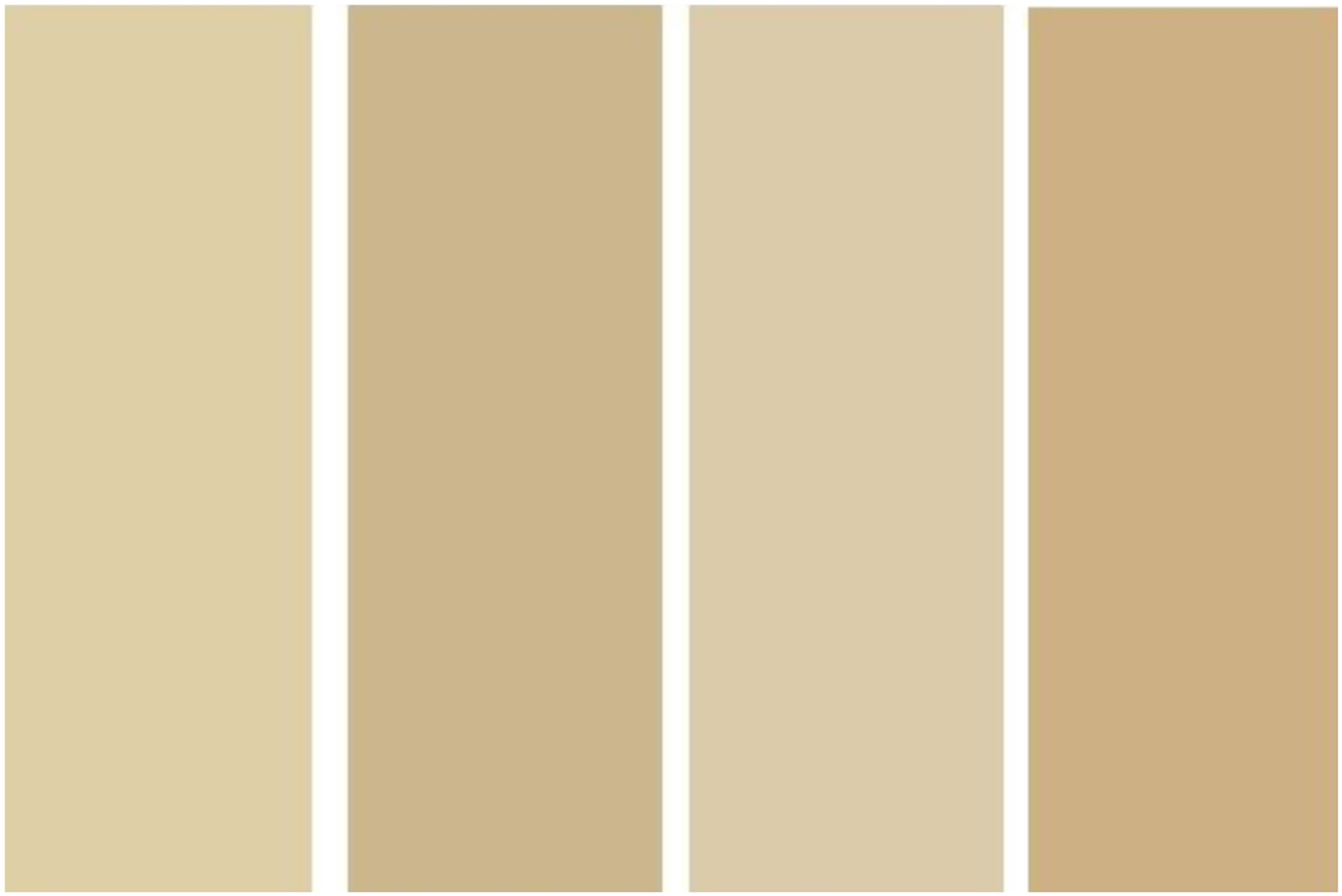
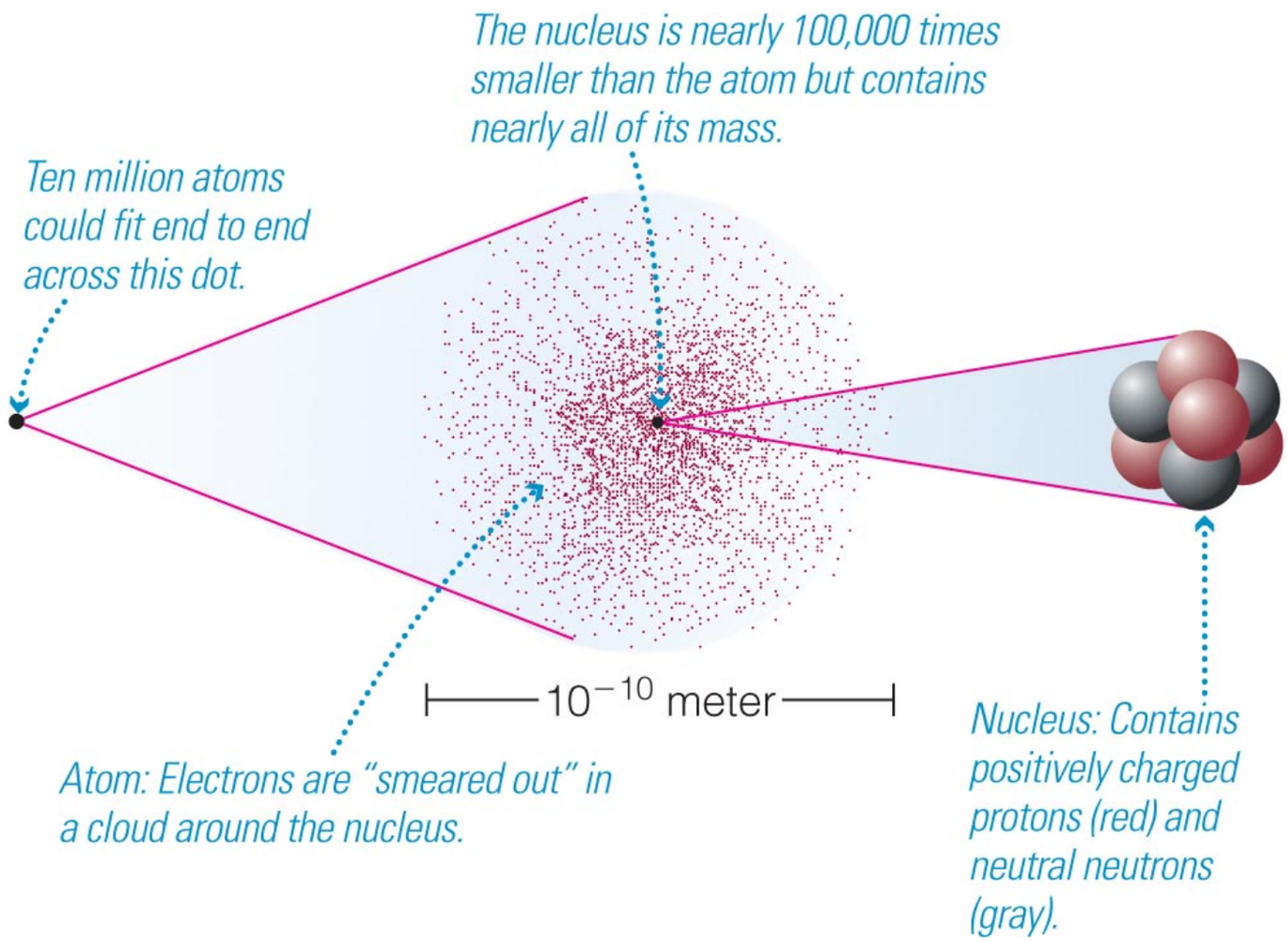
We may not be used to thinking about electric charge since most everything in our everyday life is electrically neutral.



Averaged over some distance, each positive charge has a corresponding negative charge.

We've seen that atoms, which ultimately make up all material objects, have positively charged protons and charge neutral neutrons in the tiny nucleus.

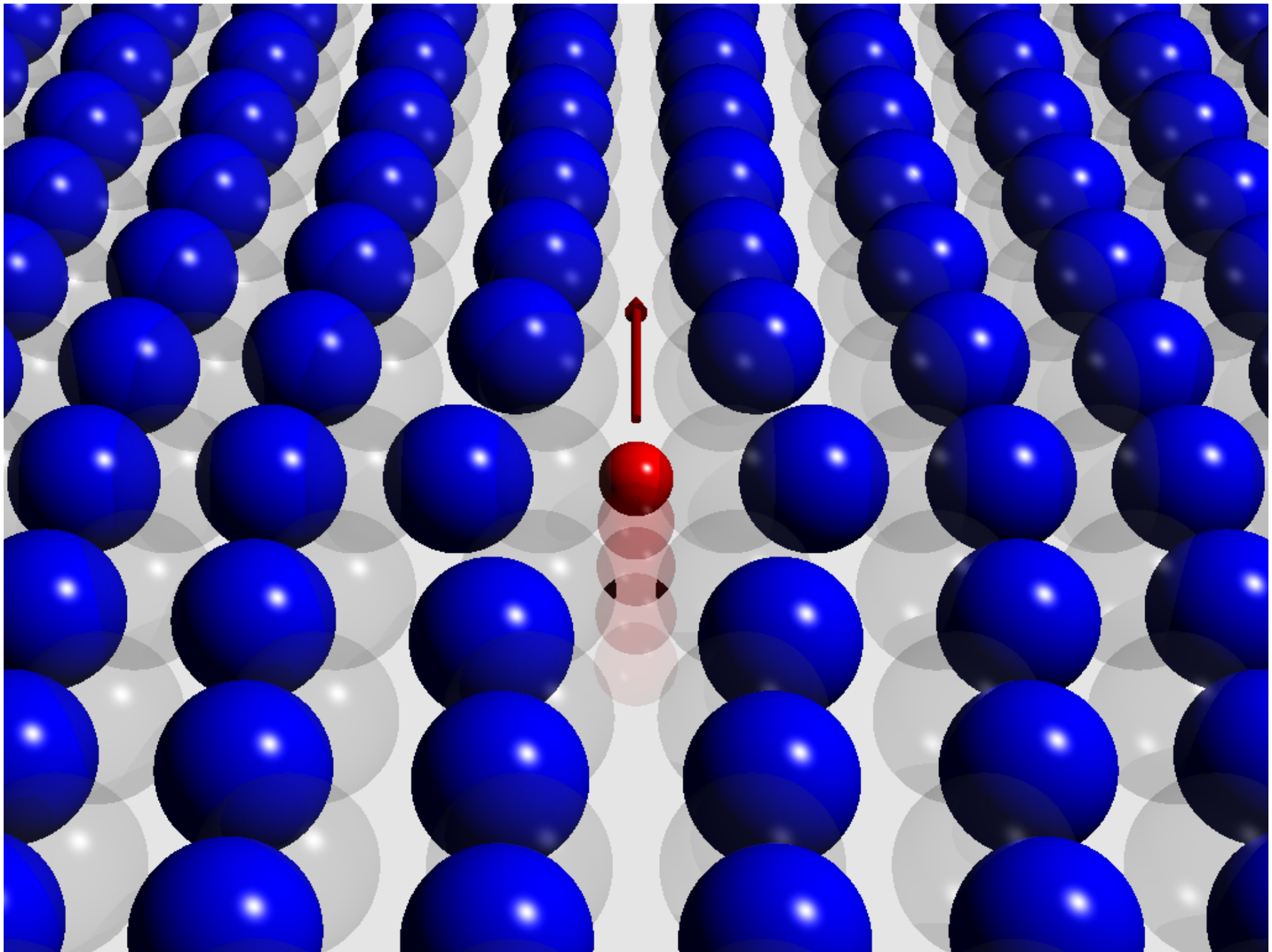


Outside the nucleus of the atom is the "sheath" of negatively charged electrons, which happen to have exactly the same "size" as the proton's unit of positive charge.

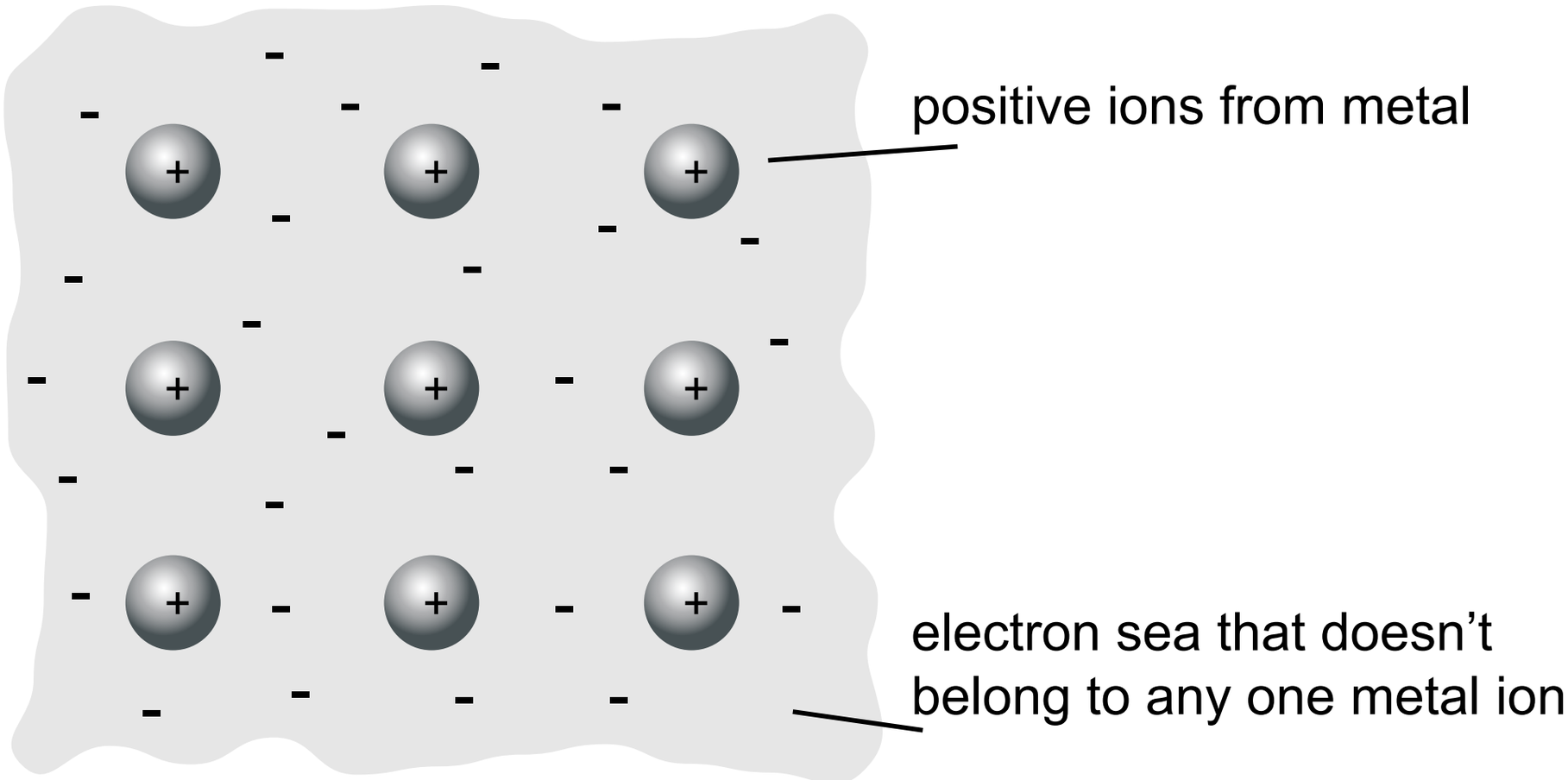
Since the electrons are on the outside, and the nucleus so small, electrons may be easily removed from the atom.

These electrons may even be removed by rubbing, as we feel in the case of a spark between us and a door handle.

Since the electrons may be removed relatively easily and they have a much smaller mass than the protons, electrons move more freely within and between materials.



For example, the atoms in a metal bind together into a lattice by letting one or two of their electrons wander throughout the interior of the metal.



In a copper wire there is a sea of mobile electrons (recall Ben Franklin's "fluid").

You may correctly gather that electric charge only comes in bundles of a specific size, either positive or negative.

The size of this bundle, or quantum, is given the symbol“*e*”. A proton has charge of *e*, a neutron has a charge of 0 and an electron has a charge of -*e*.

All observable charge comes in integer multiples of e. One can have -5*e* or 27,500 *e*, but never 1/2 *e* or 2.1 *e*.