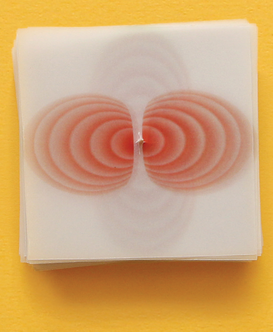
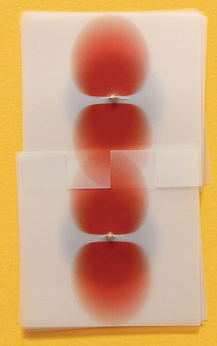
CREATE THE UNIVERSE

A FOUR-STEP METHOD

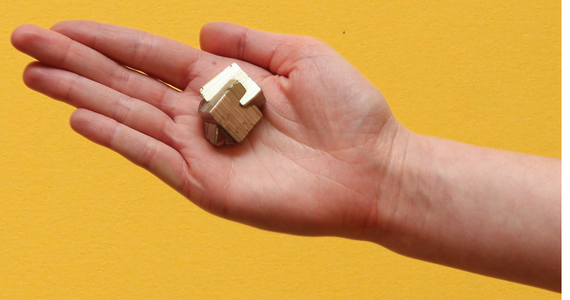
ELECTRONS



ATOMS



BONDS



SOLID MATTER

DISCOVER THE VIDEOS AT WWW.PHYSICSREIMAGINED.COM !

CREATED AND DIRECTED BY COLINE AUBERT FROM THE HAUTE ÉCOLE DES ARTS DU RHIN

IN COLLABORATION WITH JULIEN BOBROFF FROM THE "PHYSICS REIMAGINED" TEAM - UNIVERSITÉ PARIS-SUD AND CNRS

$$-\frac{h^2}{2m}\nabla^2\psi - \frac{1}{4\pi\varepsilon_0}.\frac{e^2}{r}\psi = E\psi(r)$$

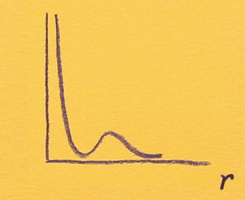
$$\psi(r) = \psi(r,\theta,\phi)$$

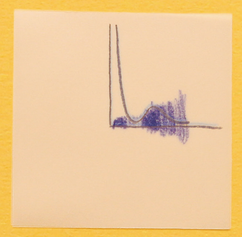
$$\nabla^2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}$$

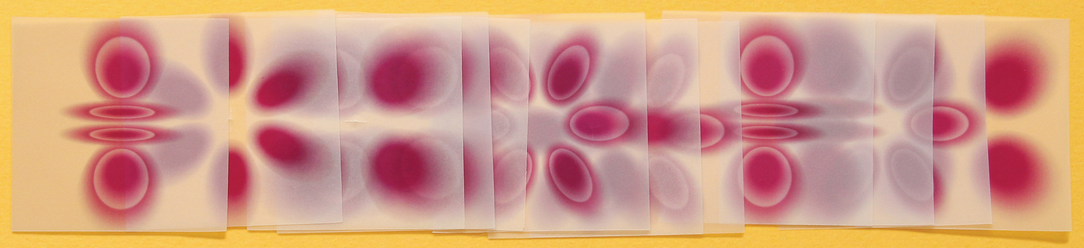
$$\nabla^2 = \frac{1}{r^2}\frac{\partial^2}{\partial r}\left(r^2\frac{\partial}{\partial r}\right) + \frac{1}{r^2 sin\theta}\frac{\partial}{\partial\theta}\left(sin\theta\frac{\partial}{\partial\theta}\right) + \frac{1}{r^2 sin^2\theta}\frac{\partial^2}{\partial\phi^2}$$

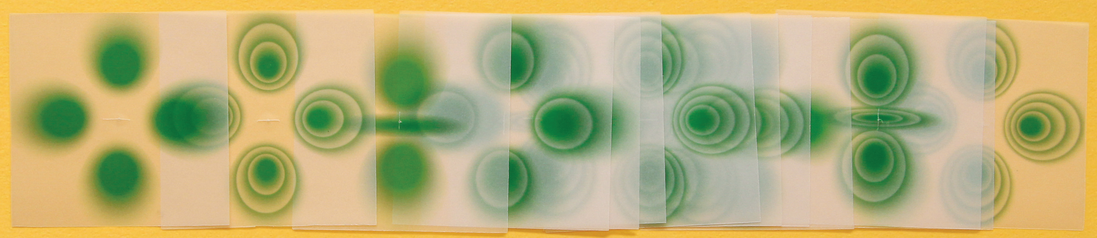
$$-\frac{h^2}{2m_e}\frac{1}{r^2 sin\theta}\left[\frac{1}{r^2}\frac{\partial^2}{\partial r}\left(r^2\frac{\partial\psi}{\partial r}\right) + \frac{1}{r^2 sin\theta}\frac{\partial}{\partial\theta}\left(sin\theta\frac{\partial\psi}{\partial\theta}\right) + \frac{1}{r^2 sin^2\theta}\frac{\partial^2\psi}{\partial\phi^2}\right] - \frac{1}{4\pi\varepsilon_0}.\frac{e^2}{r}\psi = E\psi$$

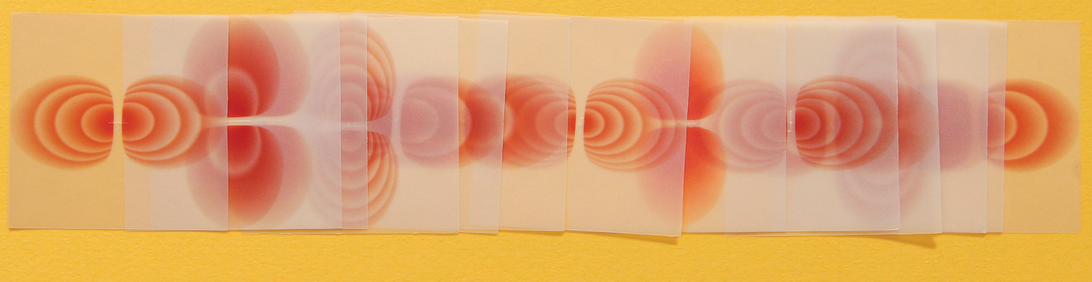
$$\psi_{n,l,m_l}(r,\theta,\phi) = R_{n,l}(r).Y_{l,m_l}(\theta,\phi)$$

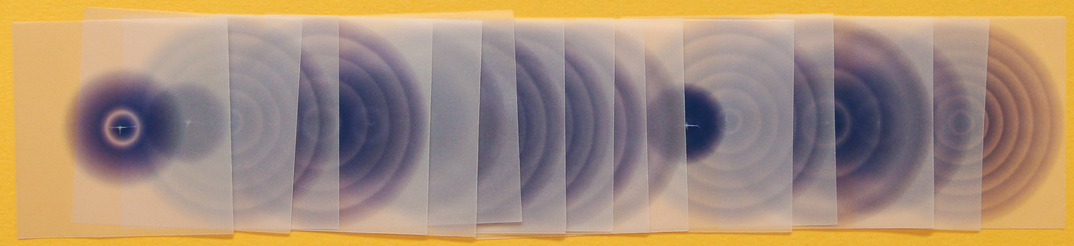












COMPUTE
THE WAVE FUNCTION

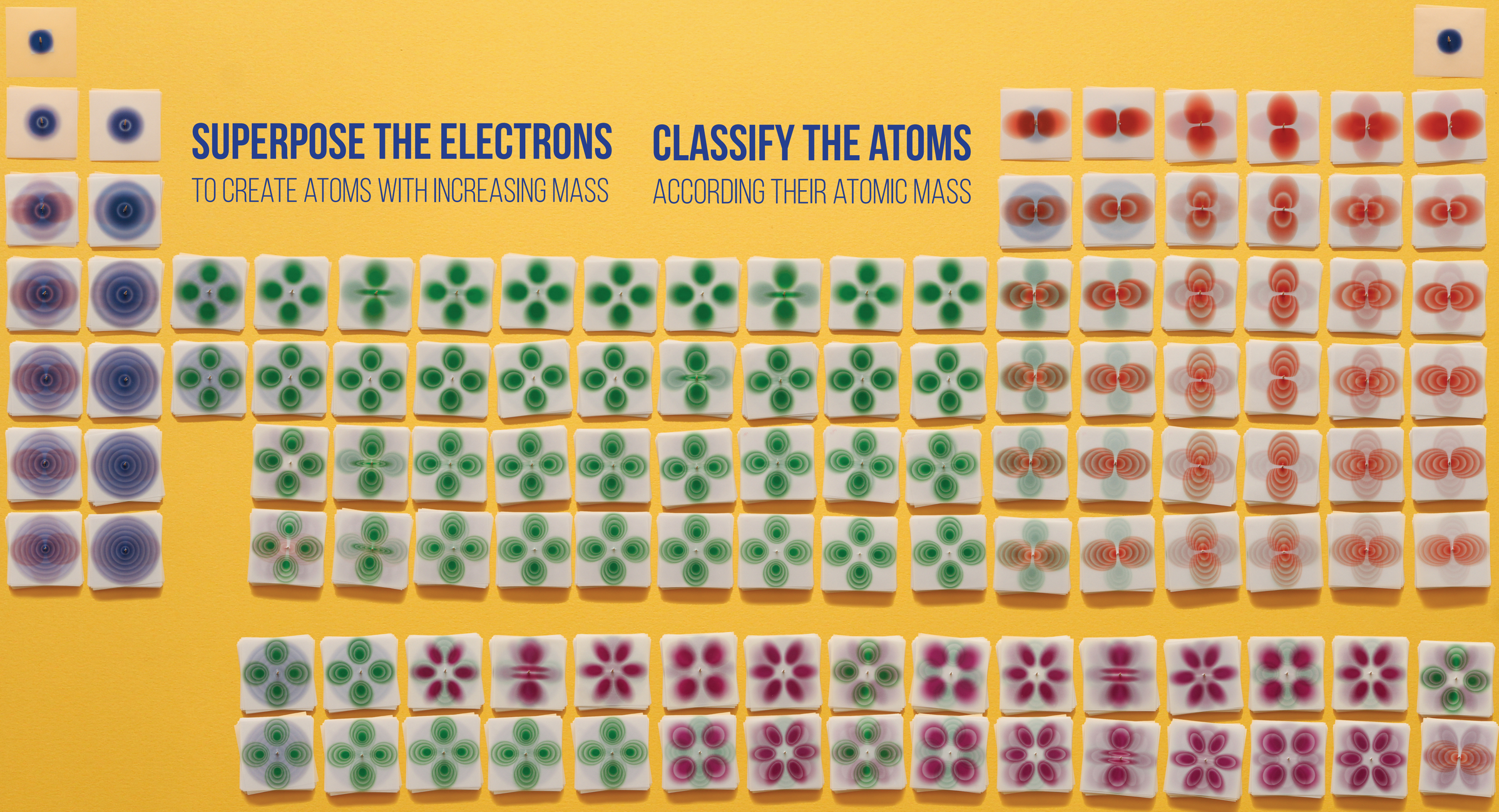
DRAW
THE SOLUTIONS

CLASSIFY
THE ELECTRONS YOU HAVE JUST OBTAINED

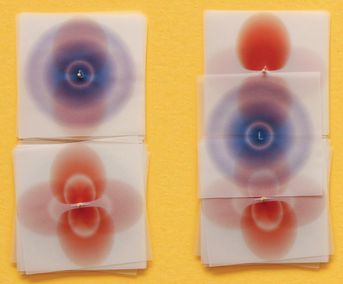
1. SHAPE THE ELECTRONS

SUPERPOSE THE ELECTRONS
TO CREATE ATOMS WITH INCREASING MASS

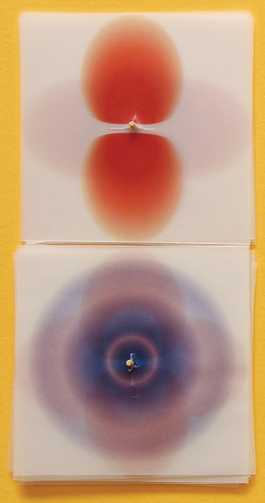
CLASSIFY THE ATOMS
ACCORDING THEIR ATOMIC MASS



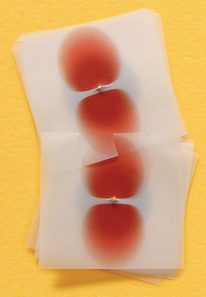
2. BUILD THE ATOMS



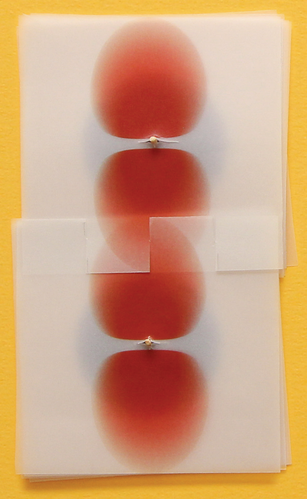
ONE ATOM GIVES
AN ELECTRON TO THE OTHER.



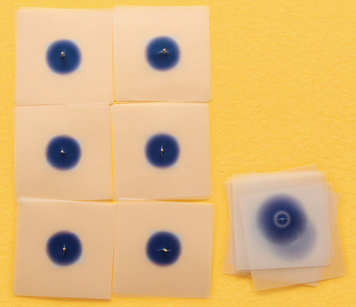
IONIC
BOND



TWO ATOMS
SHARE ONE OF THEIR ELECTRONS.

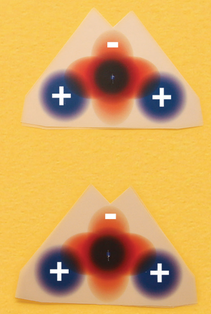


COVALENT
BOND

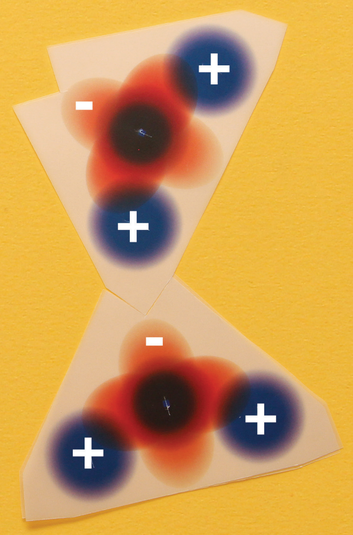


ALL THE ATOMS LET
ONE OF THEIR ELECTRON DELOCALIZE.

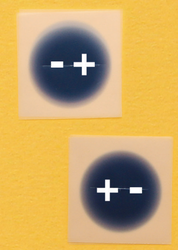
METALLIC
BOND



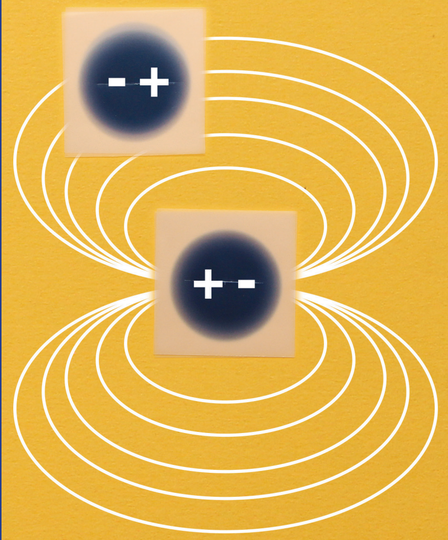
PLUS AND MINUS
HANG EACH OTHER.



HYDROGEN
BOND



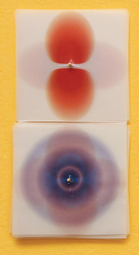
ATOMS INTERACT WITH EACH
OTHERS AS ELECTRIC DIPOLES.



VAN DER WAALS
BOND

3. CREATE THE BONDS

ONE SODIUM ATOM,
ONE CHLORINE ATOM
ANS THEIR IONIC BOND

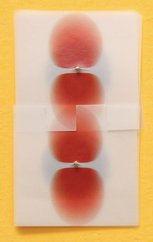


$\times 10^{22}$

=

SALT

TWO CARBON ATOMS
AND THEIR COVALENT BOND



$\times 10^{22}$

=

DIAMOND

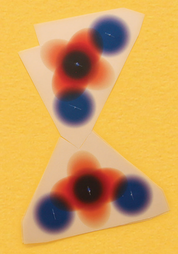
LITHIUM ATOMS
AND THEIR METALLIC BOND

$\times 10^{22}$

=

METAL

TWO MOLECULES OF WATER
AND THEIR HYDROGEN BOND

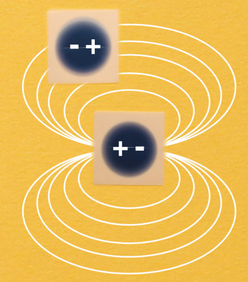


$\times 10^{22}$

=

ICE

TWO HELIUM ATOMS
AND THEIR VAN DER WAALS BOND



$\times 10^{22}$

=

GAS

4. CREATE SOLIDS