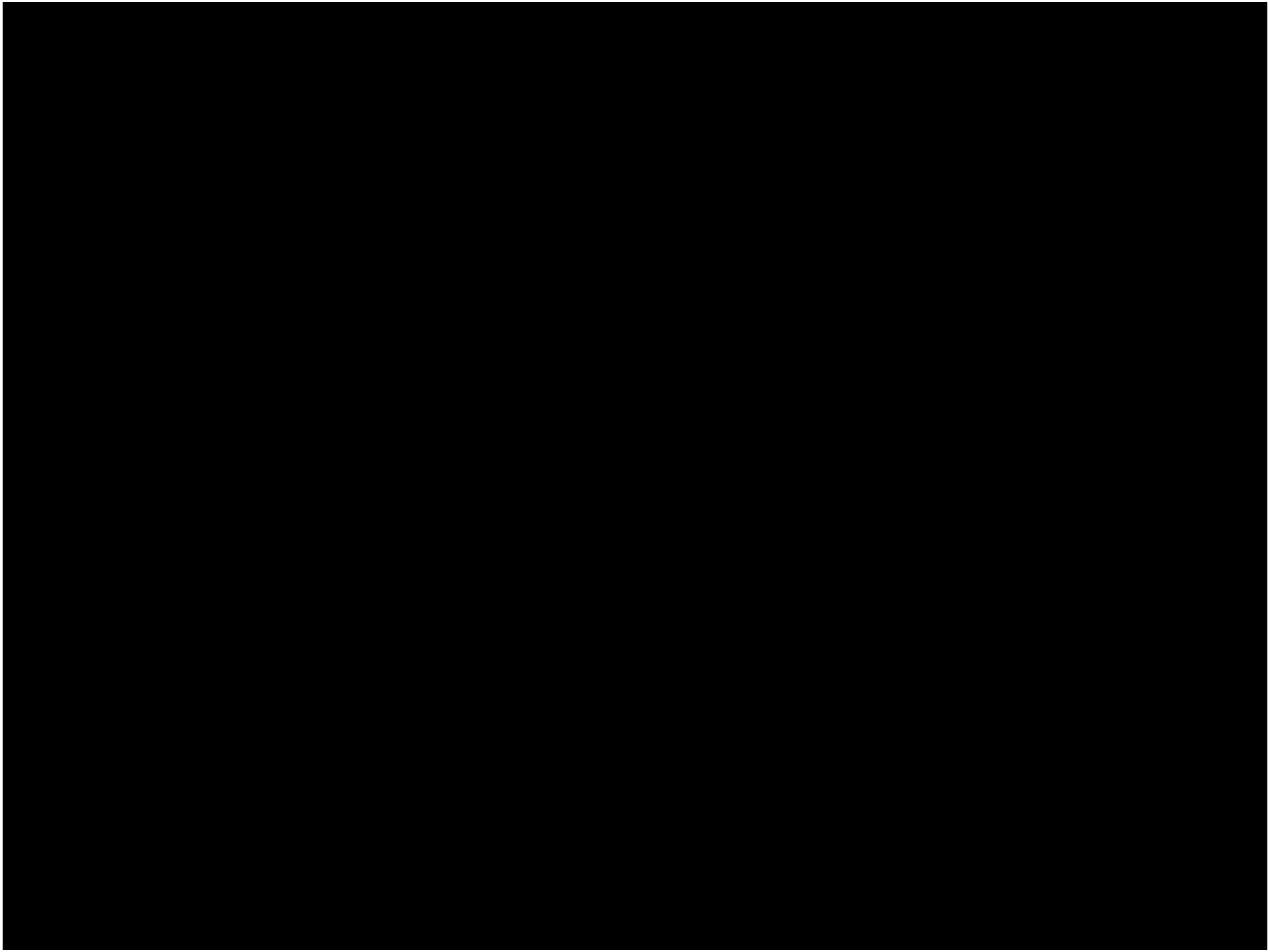
Future EW Technology

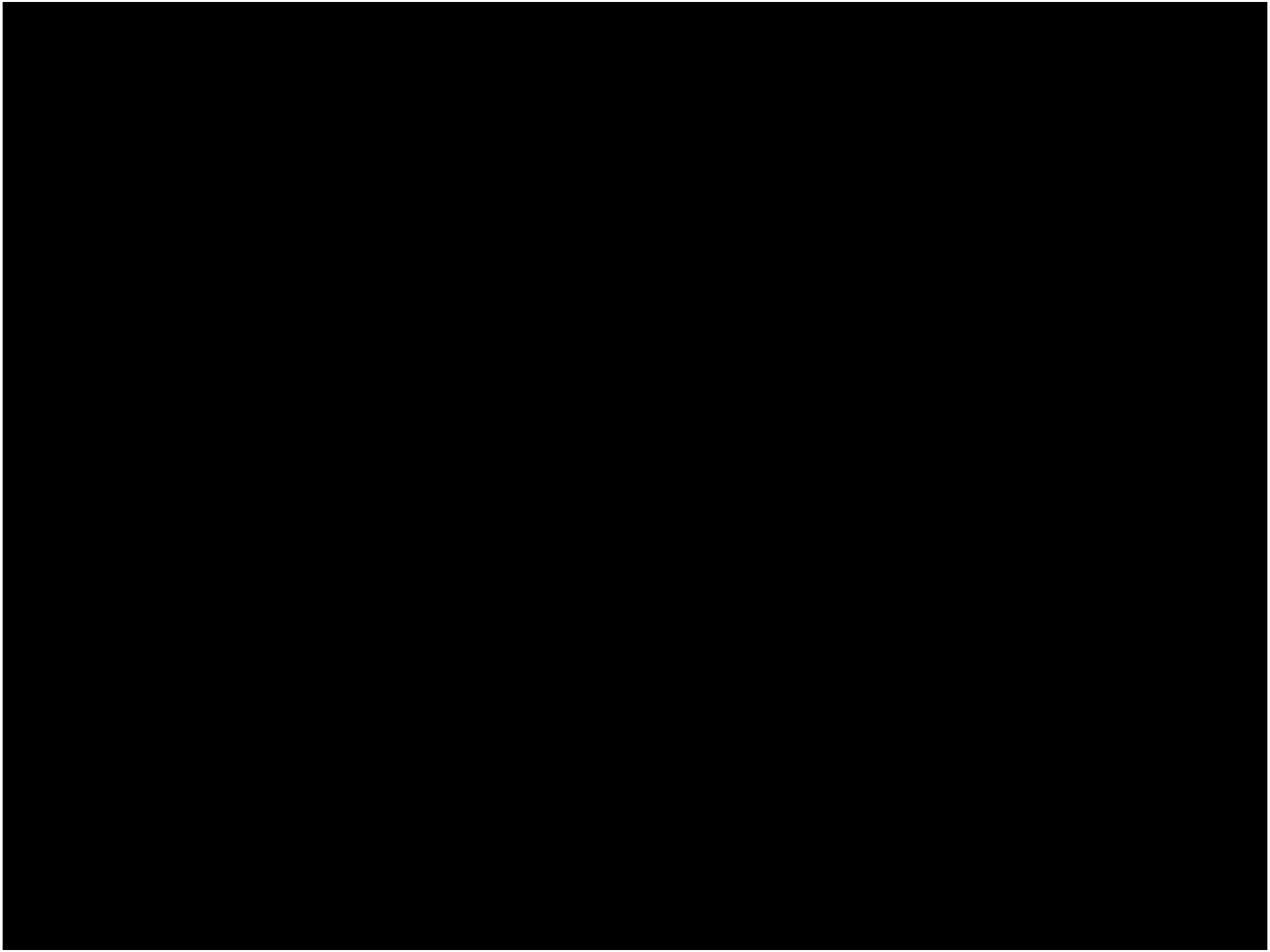
QUO VADIS

Aardvark 2009

“The best way to predict the future is to start with some momentum from the past”



The OLD CROW : has it come to this?

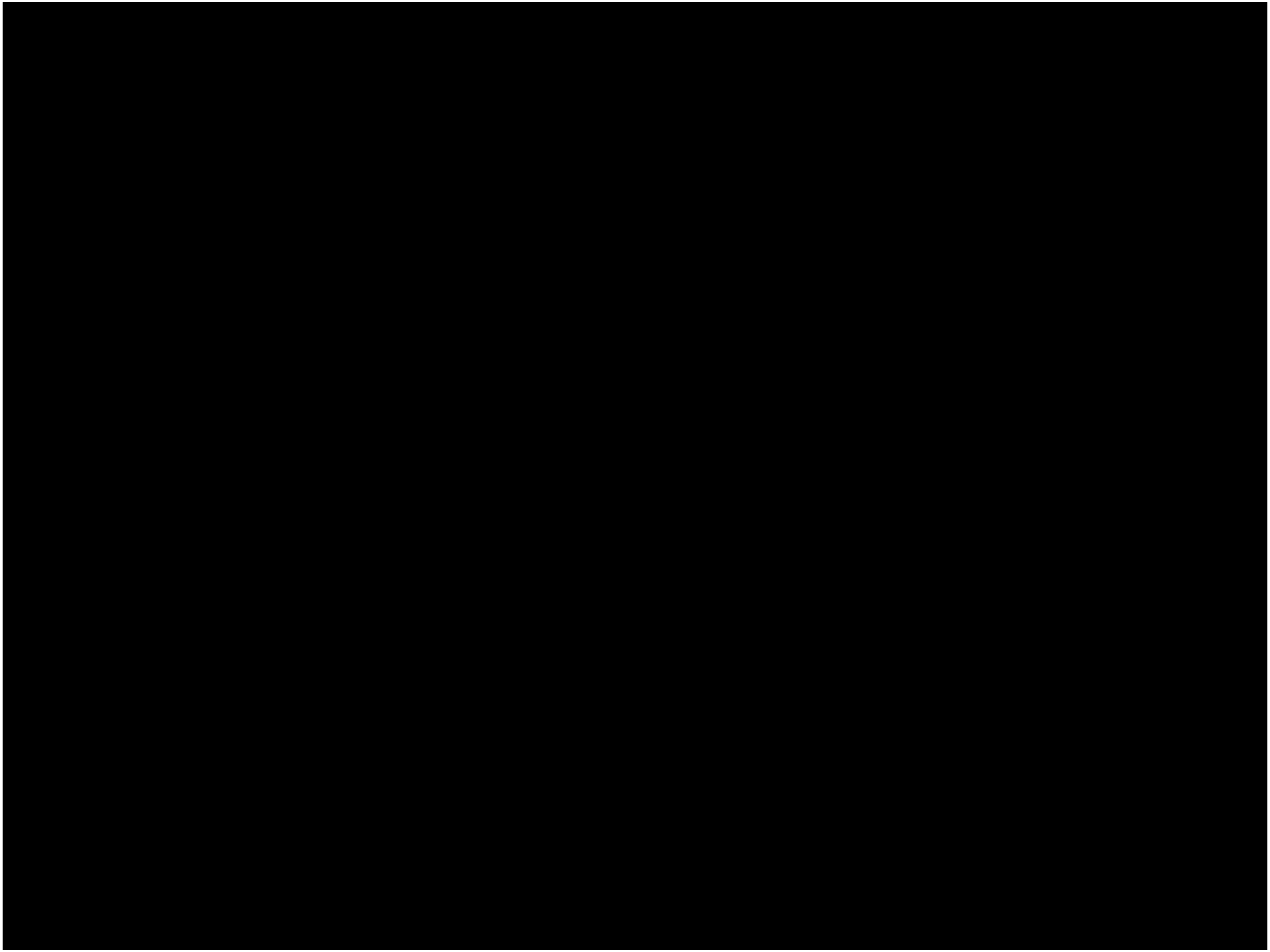


PRESENTATION PLAN

Part 1
The Technology Frontier (as offered by commercial electronics)

Interlude
A “klip in die bos” EW project

Part 2
The Science Frontier (as it was 100 years ago)



All this talk about "stimulus packages" and "bailouts" begs the question :

What does one TRILLION dollars look like?

We'll start with the largest U.S. denomination in general circulation.....a $100 dollar bill. Guaranteed to make friends wherever it goes.

A packet of one hundred $100 bills is less than 1/2" thick and contains $10,000.

Fits in your pocket easily and is more than enough for week or two of shamefully decadent fun.

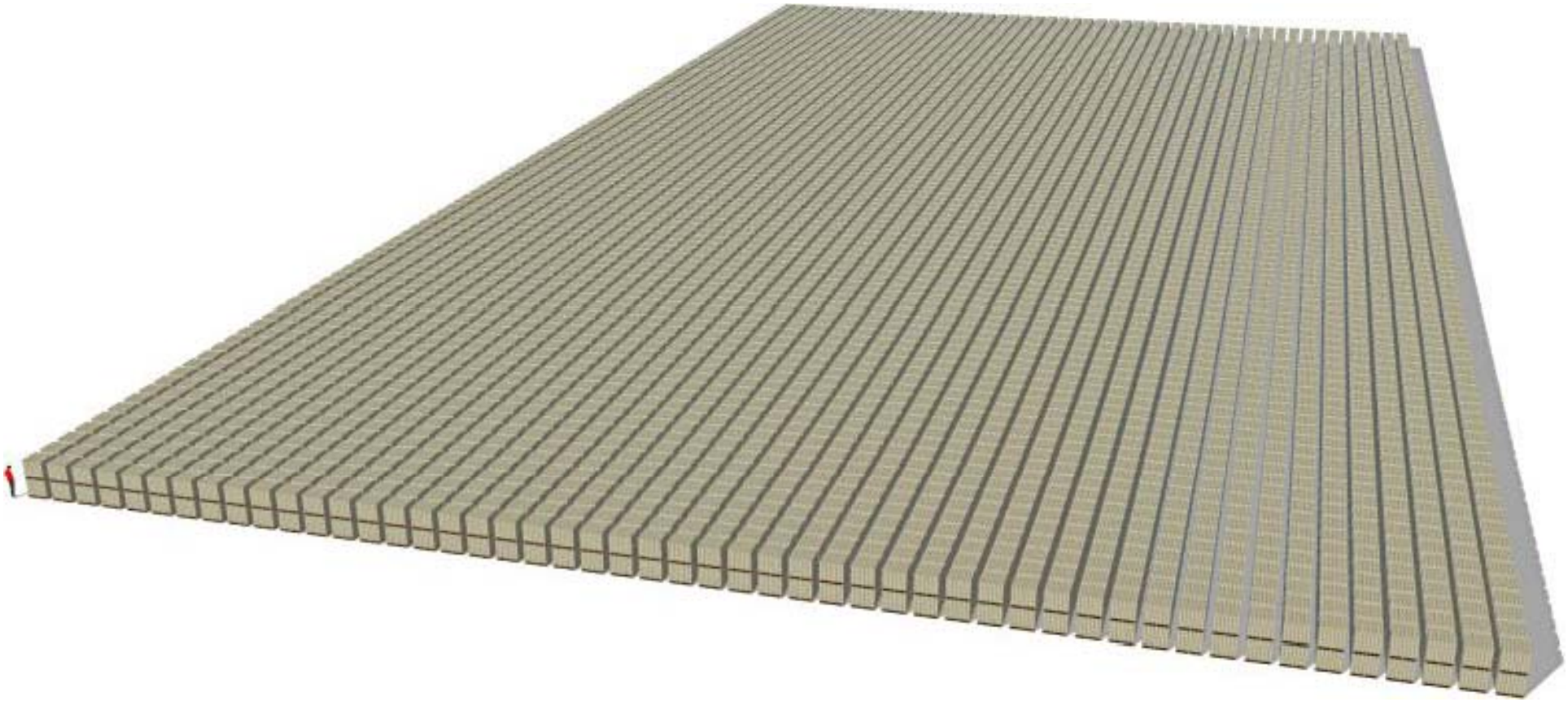
Believe it or not, this next little pile shown below is $1 million dollars (100 packets of $10,000). You could stuff that into a grocery bag and walk around with it.

While a measly $1 million looked a little unimpressive, $100 million is a little more respectable. It fits neatly on a standard pallet...

Now ONE BILLION dollars... now we're really getting somewhere…..10 pallets.

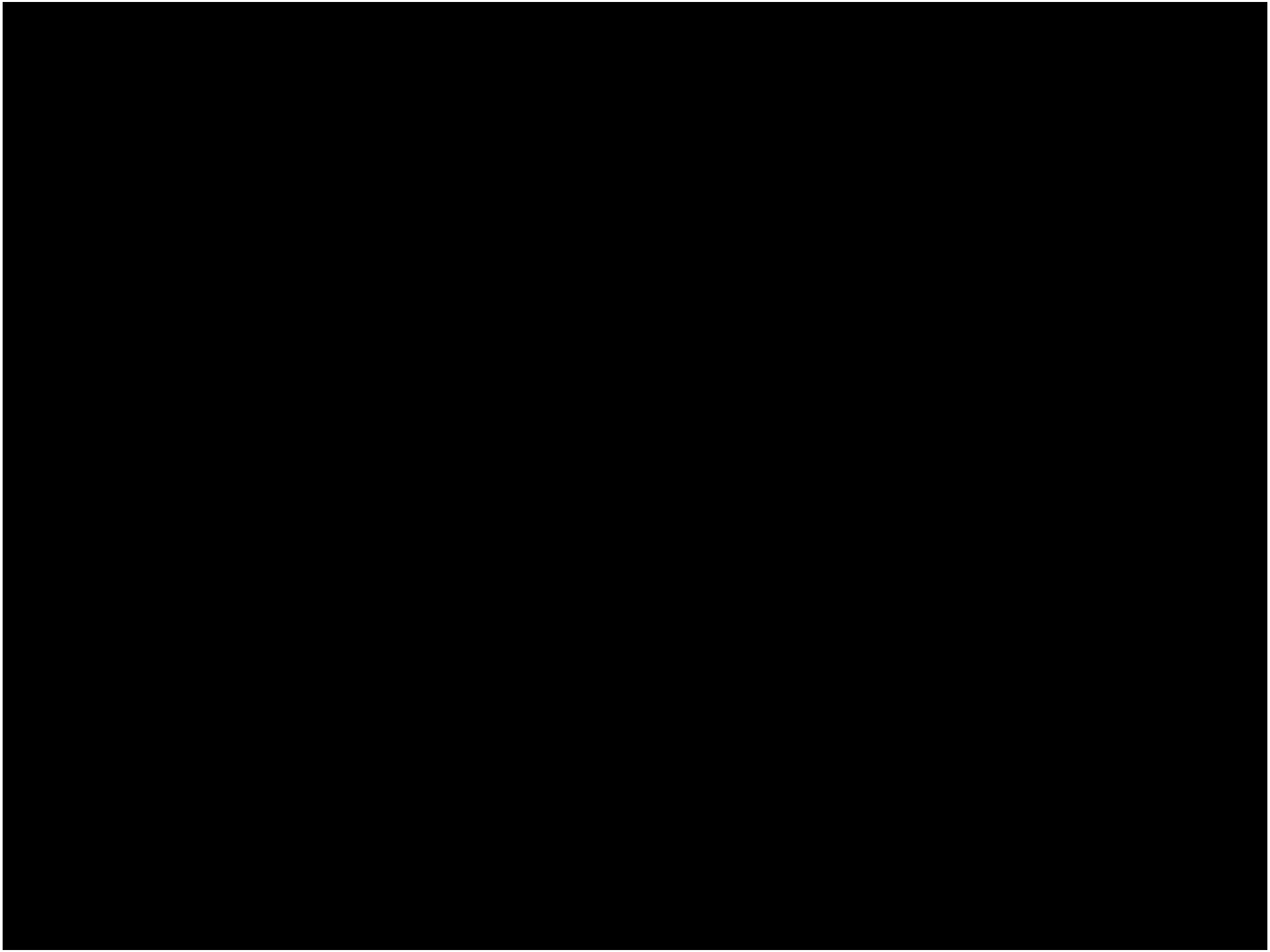
Next we'll look at ONE TRILLION dollars. This is that number we've been hearing about so much. What is a trillion dollars? Well, it's a million million. It's a thousand billion. It's a one followed by 12 zeros.

I give you *$1 trillion dollars*...!!!!!!



<u>Notice those pallets are *double stacked*.</u>

So the next time you hear someone toss around the phrase "trillion dollars"... *that's* what they're talking about.



Super Crunchers

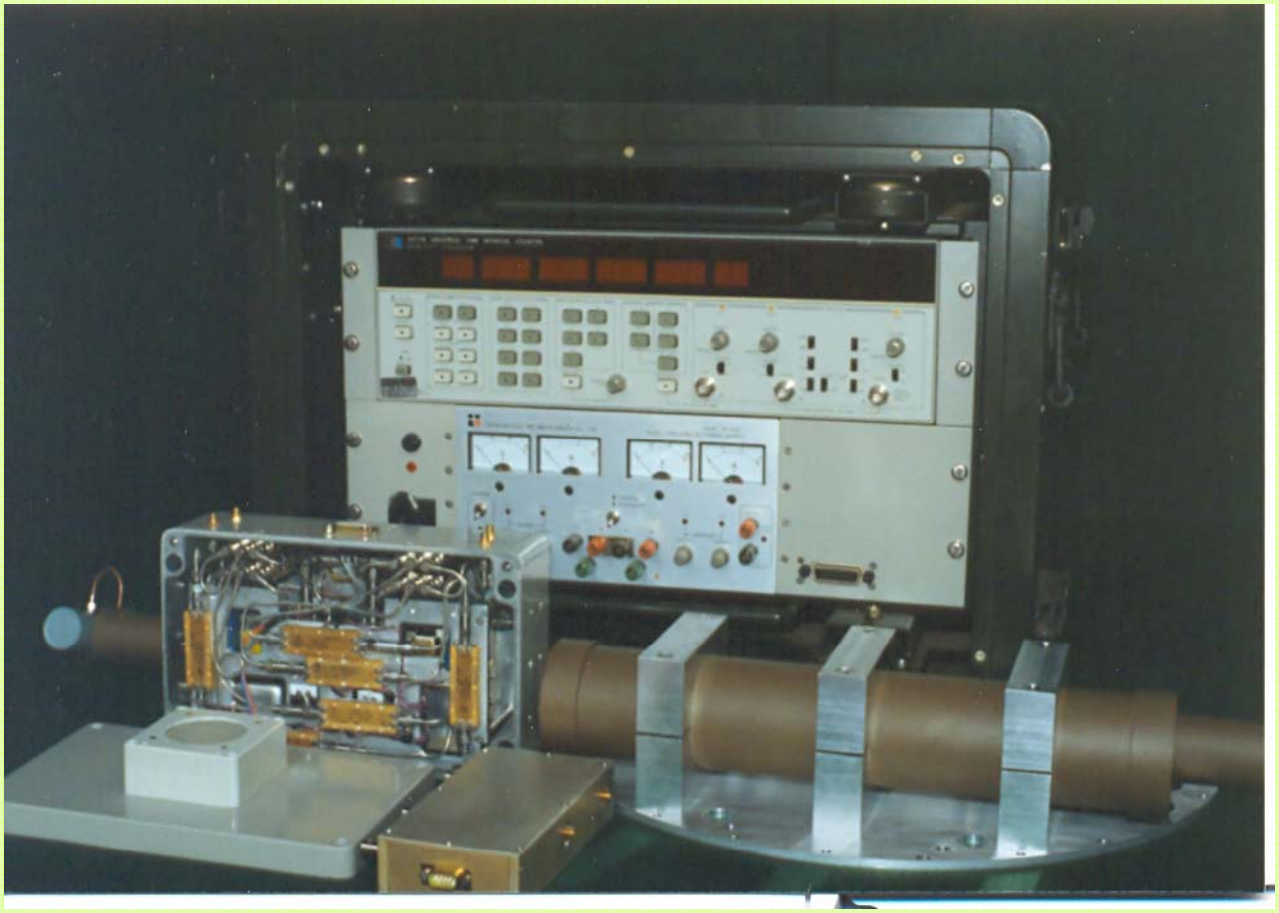
Ian Ayres

Freakonomics

Levitt & Lubner

SHORT BASELINE TIME DELAY DF

SHORT BASELINE TIME DELAY DF



Einstein’s 1905 papers :

1) Concerning a Heuristic Point of View about the Creation and Transformation of Light

2) On the Motion of Particles Suspended in Liquids at Rest Required by the Kinetic Theory of Heat

3) On the Electrodynamics of Moving Bodies

Confluence

SCIENCE

Classical mechanics

Cons. Mass, energy

Newton

Joule

Lavoiser

Electricity, Magnetism

1790 Volta – first cell

1820 Oersted – magnet. from current

1931 Faraday – current induced by moving mag.

1857 Maxwell – electo-magnetic field & propagation

1884 Hertz – em transmission & reception

TECHNOLOGY

Henry – elec magnets

Morse – telegraph

Bell - telephone

Tesla, Edison, Swan

Electric motors, generators, light

Tesla, Marconi

Radio transmission

Radar

EW

Speed of light

Galileo

Cassini vs Roemer

Michelson-Morley

Riccioli, Herschel, de Sitter

Confluence of scientific developments

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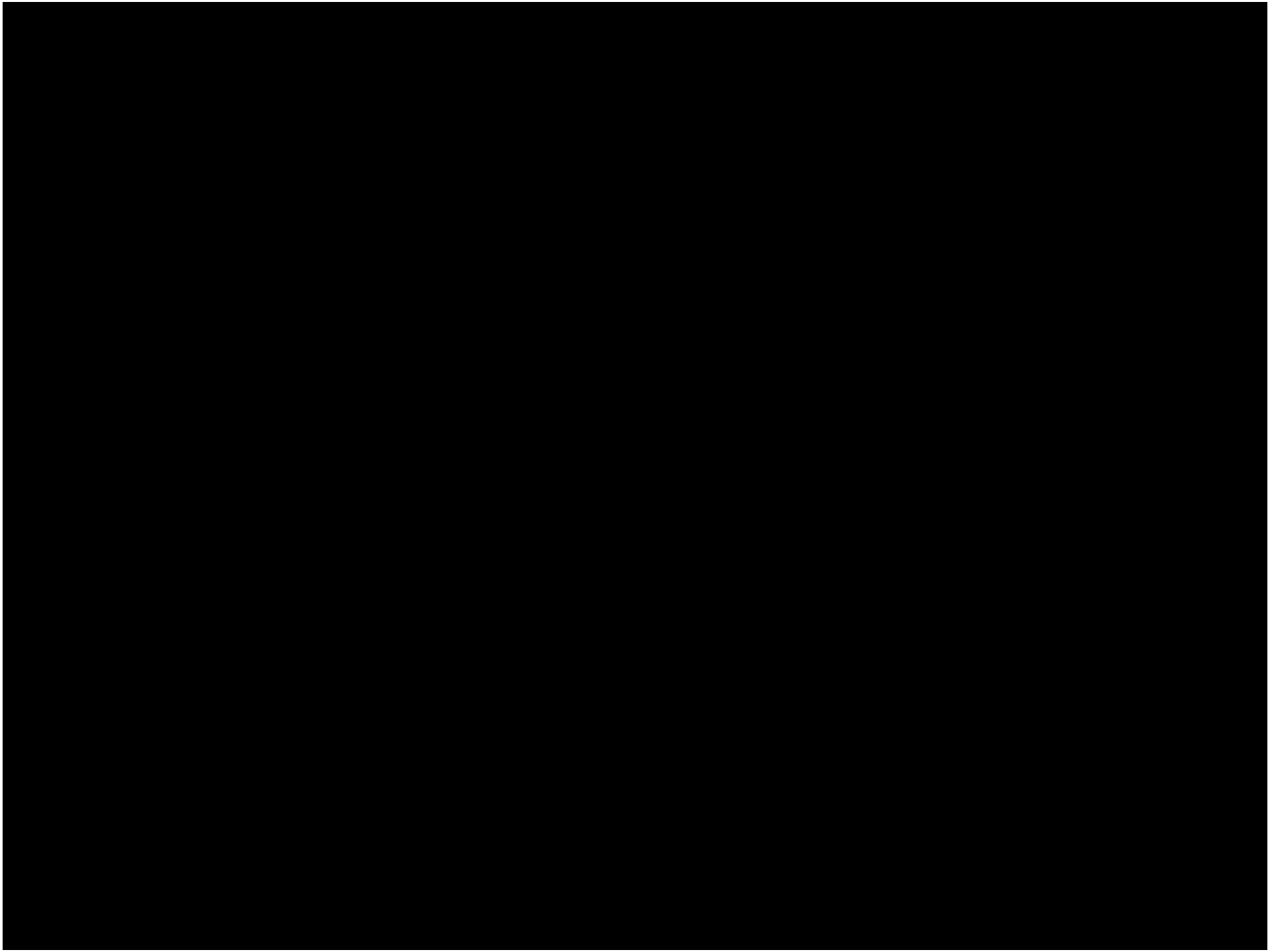
Chaim Weizmann – chemist and first president of Israel - after trans-Atlantic ship journey with Albert Einstein :

“Einstein explained his theory to me every day, and on my arrival I was fully convinced that he understood it”

“ Never run after a bus, a pretty woman or a cosmological model because there will be another in a few minutes “

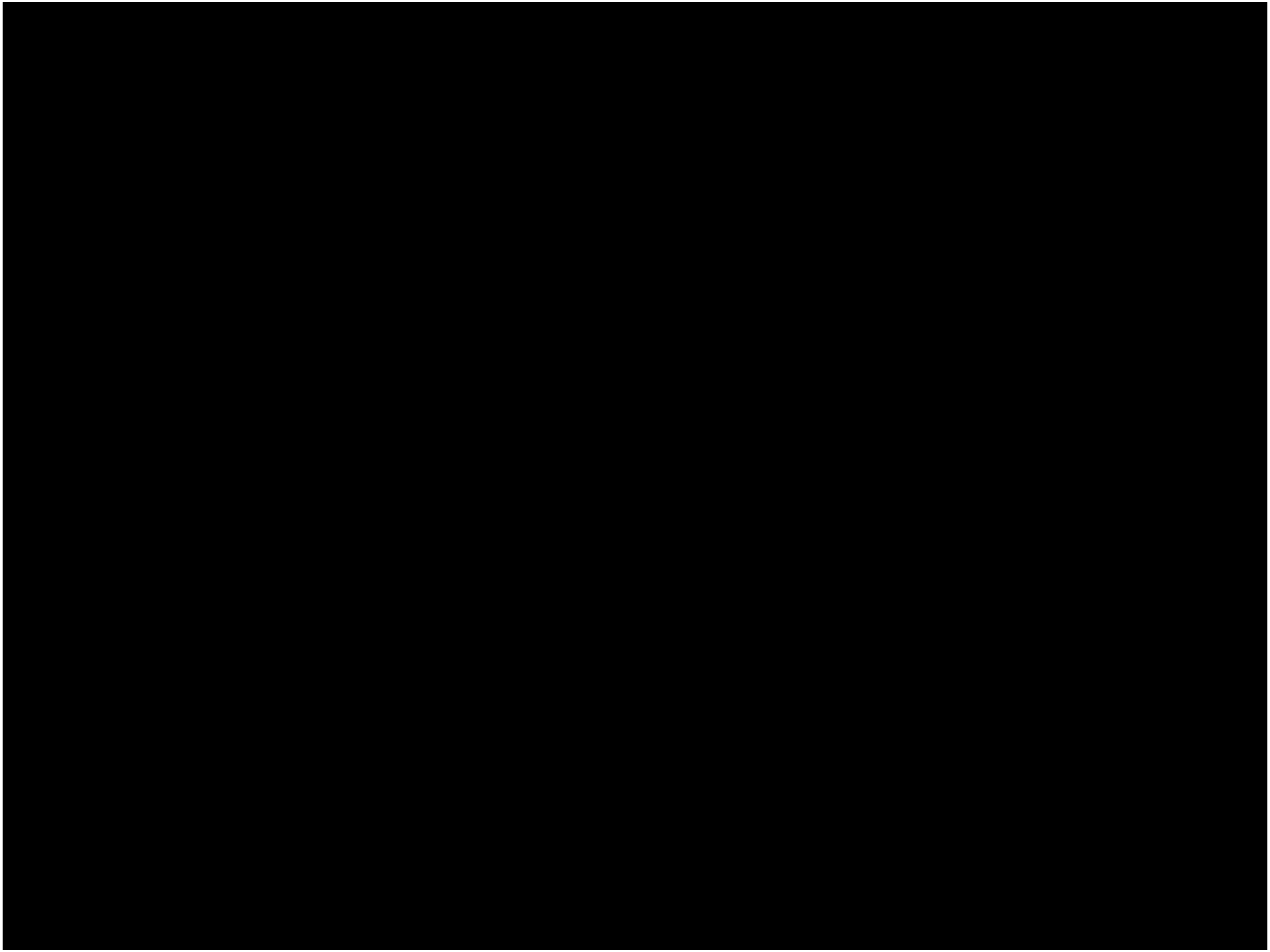
John Wheeler



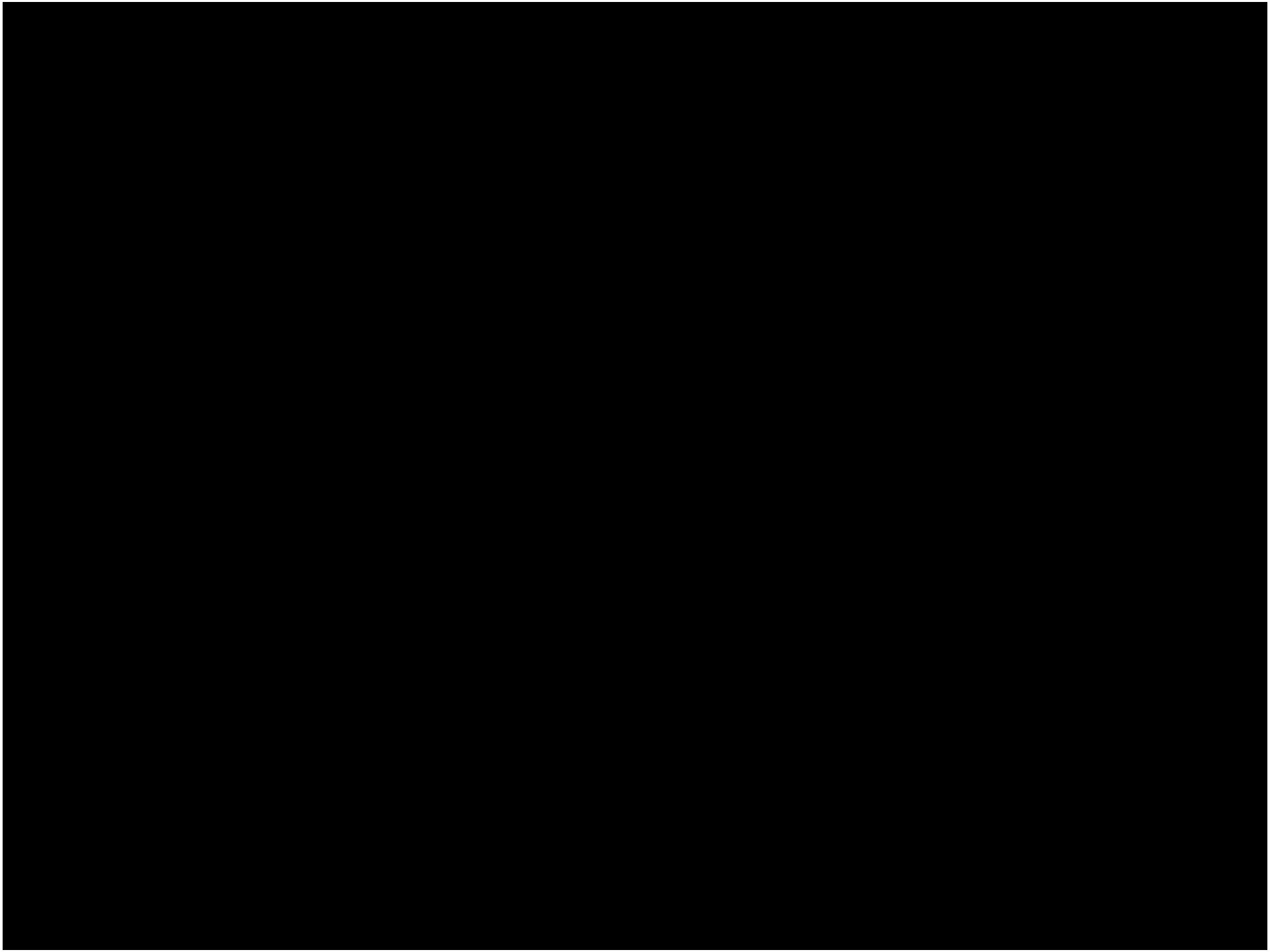
We are not thinking big enough

(and don't worry – you won't reach the limits of physics, much less the limits of nature)

We are not acting fast enough



Dominant characteristic of the cosmos is emptiness



1895 Wilhelm Roentgen discovers X-rays (Nobel 1901)

1896 Henri Becquerel discovers radio-activity (Nobel 1903)

1896 Wilhelm Wien. Laws of heat radiation (Nobel 1911)

1897 JJ Thompson, Discovery of electron (Nobel 1906)

1898 Marie and Pierre Curie. Radioactivity research (Nobel 1903)
1898 Marie Curie. Discovery of radium and polonium (Nobel 1911)

1900 Max Planck. Quantum law (Nobel 1918)

1902 Ernest Rutherford. Transmutation of elements (Nobel 1908)

1905 Albert Einstein. Photoelectric effect (Nobel 1921)

1909 Robert Millikan. Measurement of electron charge and photoelectric effect (Nobel 1923)

1911 Victor Hess, Discovery of cosmic rays (Nobel 1936)

1913 Niels Bohr Quantum theory of the atom (Nobel 1922)

1913 Frederich Soddy. Discovery of radioactive isotopes (Nobel 1913)

1923 Louis de Broglie. Wave nature of electron (Nobel 1929)

1925 Werner Heisenberg Quantum mechanics. Uncertainty principle (Nobel 1932)

1925 Wolfgang Pauli. Exclusion principle. (Nobel 1945)

1926 Erwin Schrodinger. Wave mechanics (Nobel 1933)

1926 Paul Dirac. Quantum theory (Nobel 1933)

1926 Max Born. Statistical interpretation of quantum theory (Nobel 1954)

1927 Clinton Davisson, George Thomson.
Proof of wave property of electron (Noble 1937)

1927 Arthur Compton. Experimental proof of light as particle (Nobel 1927)

1928 Linus Pauling. Quantum chemical bonding theory. (Nobel 1954)

1932 James Chadwick. Discovery of the neutron (Nobel 1935)

1932 Carl Anderson. Discovery of antielectron (positron) (Nobel 1936)

1933 Enrico Fermi. Postulates beta decay, weak force in nucleus
1934 Enrico Fermi. “Slow” neutron nuclear reactions

1935 Yukawa. Strong force in nucleus (meson) (Nobel 1949)

1936 Carl Anderson. Discovers meson
Niles Bohr. Liquid drop model of nucleus

1938 Hans Bethe. Explanation of nuclear reactions in stars (Nobel 1967)
(Cecilia Payne)

1939 Otto Hahn. Theory of fission of heavy nuclei. (Nobel 1944)
(Lise Meitner)

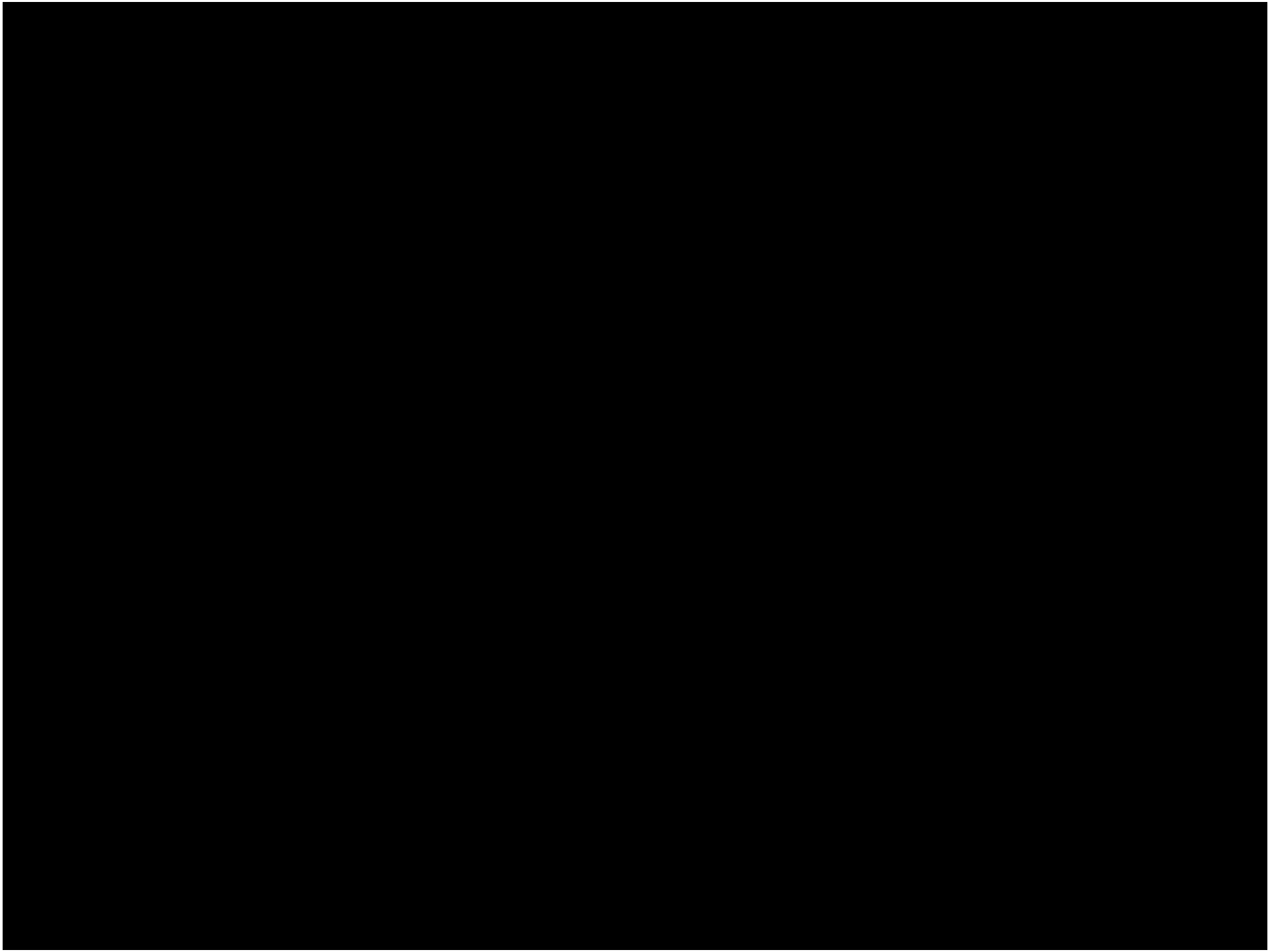
AGE WHEN DOING NOBEL LEVEL WORK

Einstein 26
Heiseberg 24 ,
Pauli 25
Dirac 23
Watson (double helix) 25
Bragg 25

Schroedinger 37

Age is, of course, a fever chill
That every physicist must fear,
He‘s better dead than living still
When once he‘s past his thirtieth year

Attributed to Dirac



WE, AND ALL MATERIAL, ARE MERELY SLIGHT DISTURBANCES IN SPACE-TIME

“ I don’t like it and I am sorry I had anything to do with it “

Schroedinger

“ God does not play dice “

Einstein

“ Einstein stop telling God what to do “

Bohr

“ Nothing is more central than this :

Empty space is not empty. It is the domain of the most violent physics ”

J A Wheeler

“ Nothing is too fantastic to be true “

Michael Faraday

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