Quantom test of prime numbers

Chaib Edderraa Abdallah

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Abstract

we give a new method to for testing whether any positive integer is prime or not using real experiment by throwing neutron into a Plutonium.

1 Introduction

before BCE Euclid prove that there are infinitely many prime number and from that moment many celebrated mathematicians try to find some formula to understand the distribution of the prime numbers before looking to that we need to know how to know that if any number is prime not but until now there is no standard formula except few method which are not work all the time or have some error first of them is the Euclidian Algorithm which is testing all the prime less than or equal $\sqrt{c}$ where c is the number that you want to test it this method is work but for a large numbers this method is take a long time even by computer.in the 17 century Fermat come up with a new test which said that if any number p is prime if he satisfy the following

$$a^p - a \equiv 0 \; mod \; p$$

where a is an integer in which $1 < a \leq p$ unfortunately this method is fail with some prime 341,561, 1729, .. which they pass the test but they are composite .there is also similar test called Lucas primality test which says let n be a positive integers if there exists an integer a $1 < a < n$ such that

$$a^{n-1} \equiv (mod \; n)$$

and for every prime factor q of $n-1$

$$a^{\frac{(n-1)}{q}} \not\equiv (mod \; n)$$

then n is prime if no such prime exists then n is composite . in 2002 Agrawal ,Kayal,and Saxana come up with a new test called AKS-test of prime[1] which said that if all the coefficients of the polynomial

$$(x-1)^p - (x^p - 1)$$

are divisible by p then p is prime ,if there exist a least one coefficient does not divisible by p then p is not prime ,for example let test 4 then we have $(x-1)^4 - (x^4-1) = 4x^3+6x^2-4x$ we have $4 \nmid 6$ so 4 is not prime ,this method is work effectively but it is not easy to compute the coefficients of the polynomials for a large value .
[1]

[1]Key Words .Prime number.lattice points.
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2 the mean tesult

.in this paper we give an experiment test for prime numbers in which we can do it in lab . unfortunately we can't deduce a formula from the experiment but we well talk about it in section 3,so before that let try to look at the problem from other angle if we have an postive integer let called N and we want to know if it is prime or not we search if there exist a divisor of N except one and it self by other word is to looking the solution of the equation

$$xy = N \tag{1}$$

where $x, y \in \mathbb{N} \setminus \{1, N\}$ and $x, y \leqslant \sqrt{N}$

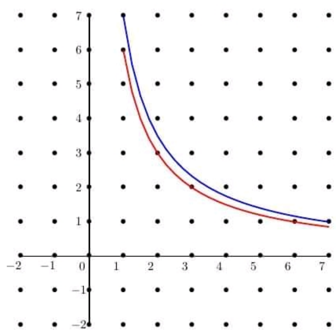

Figure 1: this figure show the graph of the function $\frac{6}{x}$ and $\frac{7}{x}$

if we plot equation (1) as function of x and take $N = 6$ (red line) when we look for the integers solution in the graph are represented by the intersection of the curve with the black points which is intersects with point $(3, 2)$ which is exactly the solution to the equation $xy = 6$(we ignore the point $(1, 6)$ because it is the trivial solution) and 3.2 are the divisors of 6 see Fig.1.now if we take $N = 7$ then we well see no intersection (except $(1, 7)$ for the same reason as before) with the black point so 7 is prime. where the black points represent the lattice points(a lattice point is point with integer coordinate) ,so we transform the problem from searching integers solution to the equation (1) to look the intersection of the curve with the black points our idea is to try to find thing in real live to be our new plane in which it has the some property of lattice of points and try to represent the graph of the curve by other way and test if there is intersection or not fortunately we find that the atoms arrange them self same as lattice points the specially in solid matter (see[2]chapter 1) in which they have the same distance between each other and with infinity of symmetry called the crystals see Fig.2 and there is many type of them bcc,fcc,..,and the only one that we need it is the simple cubic lattice see Fig.2 and there is only one element in nature which have this arrangement of atoms is the plutonium so if we imagine that the nuclei of the atom are the black point since we can ignore the electron cloud(we well see after why) then we well have equivalent between the lattice points of the plan and the lattice points of atoms and the only difference between them is the unit we take it to be equal $270 \times 10^{-12}m$(m is the unit of measuring unit metre) in our experiment since the radius of the atom of Po is $135 \times 10^{-12}m$. now we find our new plane and we need to find some thing to represent the curve to do that we need to imagine a nother way to plot a curve for example if we put a screen with a length L and we make on it a slit like the graph of the function $y = \frac{N}{x}$ and behind we put a gun of beam then we well see exactly in the front of view the graph of the curve and this is the way that we well use .now we are ready to state our method .
first come up with a gun of neutrons and put in the front of it a screen as we explain

before with length $L = [\sqrt{N}] \times 270 \times 10^{-12} m$ and we make on it a slit like the graph of the function $y = \frac{N}{x}$(with respect the unit that we talk about before) and N is the number that you want to test it and put a quantities of Po which has the shape of the square with length $L = [\sqrt{N}] \times 270 \times 10^{-12} m$ see Fig.3

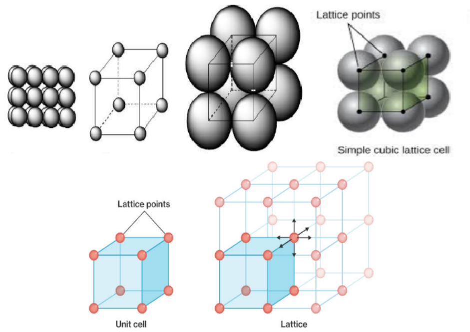

Figure 2: this figure explains the arrangement of atoms in simple cubic lattice

.and put between the screen and the quantities a detector to make the incident neutrons behave like particles not a wave as happen in the double slit experiment

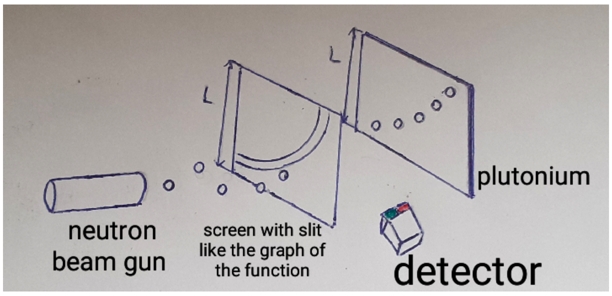

Figure 3: this figure show how the experiment occur

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Lemma 1 *now our test is the following if we the throw neutrons from the gun and we make sure that we don't leave any empty space in the slit of the screen that we don't throw on it (except the point in the corner which represents point* $(1, N)$ *then*
if happen an explosion then this number N *is not prime*
if there no explosion happen then N *is prime .*

Proof since the nuclei in the quantities of the plutonium represents the lattice points and the throwing of the neutrons is represents the graph of the function since the only neutrons which pass are pass through the slit of the screen (it is like draw a curve by put point near than other and the whole points represents the complete graph) and because the neutron is an uncharge particle so it does not interact with electron cloud so if he collision with one the nucleus of the PO will happen an explosion because plutonium is an unstable element .and in sense of plan the curve intersects with one the lattice points .and if no explosion happen that mean all the neutrons pass through the space in the atom and in sence of the original plan the curve does not intersects with the black points so it is prime .

to make the experiment able to do it in the life the number that we can test it is a least bigger than $6,022 \times 10^{23}$ because this number mean that the quantities of the plutonium is $1g$ which is visible and we can deal with that quantities in fact we can check prime less than $6,022 \times 10^{23}$ but it depends on the technologies that we have .the benefit of our method is that it is very fast if the gun send many neutron in second and also we can know the divisor of the number if the technologies is sufficient to determine the place of explosion because he represente the point of intersection with the lattice point . inversely what happen to the methods that we talk about it in the introduction our method does't fail or be complicated when we deal with a bigger numbers because the quantities of the plutonium becomes more visible when we test large numbers .

3 test from Mathematical eyes

in this section we discuss the test from mathematical way unfortunately the rule of the quantum mechanic does't give as certain information about the motion of particles is just give as a probability of the location of the particle by the wave function this follow from the uncertainty principle of Heisenberg..

the probabilaty of a incident particles interacts with a nucleus at distance l is given by(see [3])

$$p(l) = 1 - e^{\frac{l}{\lambda}} \tag{2}$$

where $\lambda = \frac{1}{\Sigma}\ cm$

such that the macroscopic cross-section Σ is define by$\Sigma = N\sigma$ is the product of the cross-section σ which represents the area of collision and expressed in terms of barns($1b = 10^{-24}\ cm^2$) with N which is the atom density given by

$N = \frac{\rho}{M} A_\nu$

ρ is the material density, M is the molar mass ,and A_ν Avogadro constant (6.022045×10^{23}) now let use this formula to compute the probability of an incident neutron collision with nucleus of Po

first we start to compute the cross-section

$\sigma = \pi r_0^2 A^{\frac{2}{3}}$

$= \pi(1.35 \times 10^{-13})^2 (209)^{\frac{2}{3}}$

$= 2.015 * 10^{-24}\ cm = 2.015 \quad barn$

now we compute the atom density N

$N = \frac{\rho}{M} A_\nu = \frac{9196 \times 10^{-3}}{208.9824} 6.02204 \times 10^{23}$

$N = 206499 \times 10^{28} \quad \frac{atoms}{cm^3}$

so we get

$\Sigma = N\sigma = 2.6499 \times 10^{28} 2.015 \times 10^{-24}$

$\Sigma = 5339.485 \quad cm^{-1}$

let take the distance of traveling neutron inside the Po is $l = 10^{-6} m$.now we are ready to compute the probability by relation(1)

$p(l) = 1 - e^{-\frac{10^{-6}}{5339.485^{-1}}}$

$p(l) = 0.05$ it follows from this expression that 5 % of all particles will have a collision up to a path $l = 10^{-6} m$.

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Abdallah Chaib Edderraa
Universty of Hassiba Ben Bouali Chlef
Email:a.chaibedderraa@univ-chlef.dz