Implementing Relativistic Rotation, Exponential Rest Mass, Exponential Electric Charge and Gravitational Energy into Relativity and Astrophysics

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Einstein's exceptions to general relativity:
Rotation, gravitation, gravitational energy, and more

It is not trivial.

Therefore,

the presentation **skips** cumbersome derivations, equations and chapters, but emphasizes some vital issues

Rotation:

Newtonian: $v = \omega r$

Franklin 1922 relativistic ($v<c$) **rotation:**

$v = \tanh(\omega r / c)$

99% of the mass of quark is
kinetic energy of rotation 2003

Rosen 1946 relativistic ($v<c$) **rotation:**

$v = \omega r / \sqrt{1+(\omega r / c)^2}$

96.5%

Comparing rotations

	Newtonian	Relativistic	Consequences
Linear motion	$V = v1 + v2$	$V = (v1 + v2)/(1 + v1v2/c^2)$	**Special relativity**
Rotation	$V = \omega r$	$V = c \tanh(\omega r/c)$ Franklin 1922 $V = c\,\omega\, r\, /\mathrm{sqrt}[1+(\omega r/c)^2]$ Rosen 1946	99.3% of quark mass is kinetic energy 96.5% " "
Hubble Law	$V = H r$	$V = c \tanh(H r/c)$	6 X (Universe age)

In extreme pressure in the cores of quasars, AGNs and microquasars and in supernovae, quenching Franklin's rotation of quarks supplies the tremendous amount of energy that stabilizes the quasars, AGNs and microquasars but causes exploding supernovae and supplies a significant portion of the explosion energy.

GENERAL RELATIVITY

In his book of 1916, Einstein warned that general relativity is not appropriate for use in all situations. The example that Einstein pointed out is the gravitational field of the entire Earth. This also applies to all celestial bodies like stars, etc.

EXAMPLE

The **principle of equivalence** is not suitable for the **center** of the Earth or a star. The cable of the elevator pulls in **one** direction. The gravitational pull at the center is **equal** in all directions, making the **resultant gravitational force** equal to **zero**. There is **No** equivalence. Instead, a **spherical symmetry** is necessary.

Force in test-particle concept: exponential gravitation

It is used in various approaches by Milne, Yılmaz, Majern´ık and others.

The rest mass m is a function of r $m(r)$

$$c^2\, dm/dr = d(mc^2)/dr = dE/dr = -F = mMG/r^2$$

Solving

$$m(r) = m\infty \exp(-GM/c^2 r)$$

It is called **exponential gravitation**

Exponential gravitation

Increasing *r* increases *m*.

At an infinite distance between *m* and *M* the mass *m* is the maximal *m*∞.

Decreasing *r* decreases *m*.

When *m* approaches zero distance from *M* quasistatically, it's **mass** and the **gravitational force** approaches zero.

Factor 2 is missing because the **test-particle concept** added a wrong constraint dM/dr=0

Solving after removing this constraint gives the factor 2.

The total mass at infinity is:

$M\infty+m\infty$

The total mass at r=0 is:

$M\infty-m\infty$

The solution at any r is:

$$m{+}M = M\infty - m\infty +$$

$$+ 2m\infty \exp(-GM/c\text{^}2r)$$

If $M{=}m$ the solution in not exponential. At $r{=}0$ the total mass results then zero, meaning **annihilation**!

Another solution using **energy** instead **of force** (2008) gives similar results.

The starting point is the pair of equations

$$mc^2 = m\infty c^2 - mMG/r$$

$$Mc^2 = M\infty c^2 - mMG/r$$

Subtracting the two equations gives

$$M - m = M\infty - m\infty$$

The **difference** between the two variable masses remains constant.

Comparing line elements

A line element asymptotic to flat one at infinity has the form:

$ds^2 = g00 c^2 dt^2 - (1/g00) dr^2 - r^2 \ldots$

For Newtonian gravitation $g00 = 1$

For general solution

$g00 = 1 - 2GM/c^2 r + K*(2GM/c^2 r)^2$

For Schwarzschild solution $K = 0$

For exponential gravitation $K = 1/2$

For the other solution $K = 1$

Precision

General relativity predicts $\beta_{PPN}-1 = 0$

Precise measurements
of perihelion shift in the solar system
allow for $\beta_{PPN}-1 < 8 \times 10^{-5}$

BepiColombo precision is
$\beta_{PPN}-1 < 3.2 \times 10^{-6}$

Exponential gravitation predicts
$\beta_{PPN}-1 = 0.65 \times 10^{-8}$
well within the measurable tolerance.

Analogy between gravitation and Coulomb electrical forces

Extending exponential gravity forces to electrical forces by assuming analogy with attraction forces between positive and negative electrical forces results in the electric exponential force

$$F = -(Qq/r^2) \exp(-Y\, Q/r)$$

It is well known that two equal electric charges with opposite signs that approach each other are annihilated when they collide. In analogy with exponential gravitation the annihilation is not sudden but gradual during the approach. This is because the electric charges vary depending on the distance between the electric charges.

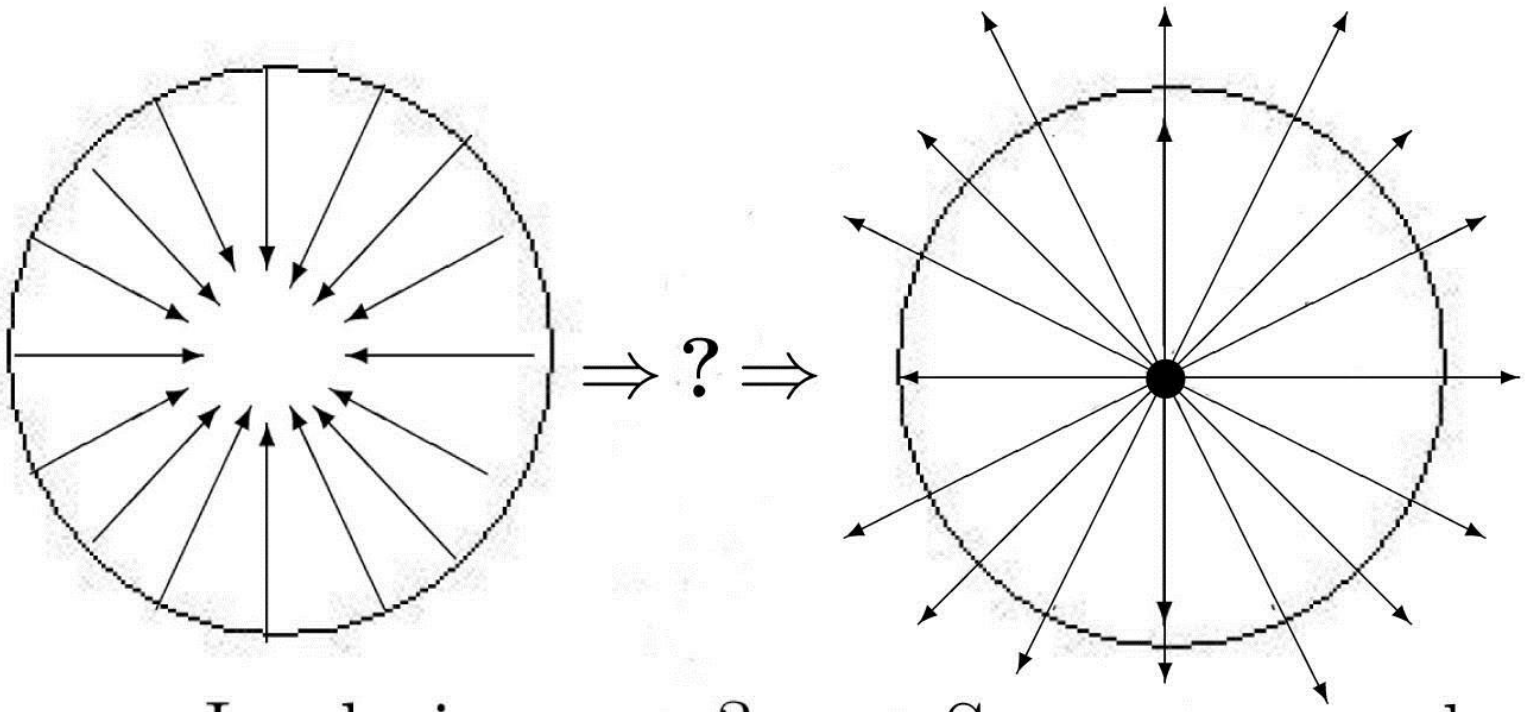
This leads to a second-order quadratic algebraic equation for the distance between an electron surrounding a proton. Its solution resulted in two **sets** of electron orbitals around a proton: The Bohr set of electron orbitals, and an **additional set of orbitals** of an electron around a proton, **very close** to the proton.

The electrons in the sub-Bohr orbitals have **very high positive energy** because the velocity of the electron in the second set of orbitals is **relativistic**, very close to the velocity of light, just a few km/sec less than the velocity of light.

Celestial bodies use all these in supernovas, quasars and astronomical jets.

SUPERNOVA

A star more massive than eight sun masses collapses before exploding as a supernova. Between the stopping of the collapse and starting of the bounce back, there exists a very short motionless moment. What is the form of the **energy accumulated** at this motionless moment, just before being released and driving a bounce back?



Schematic chain of events in the creation of supernova. The intermediate stage inverting the implosion to explosion is the subject of this paper.

Ordinary electron capture in a proton is a weak process with a characteristic time of 1000 seconds. The characteristic time of the last stage of the collapse is approximately a million times shorter. A free electron lacks the time necessary to be captured in a proton. Its only alternative is to populate a sub-Bohr orbital, where it is an **energy accumulator.**

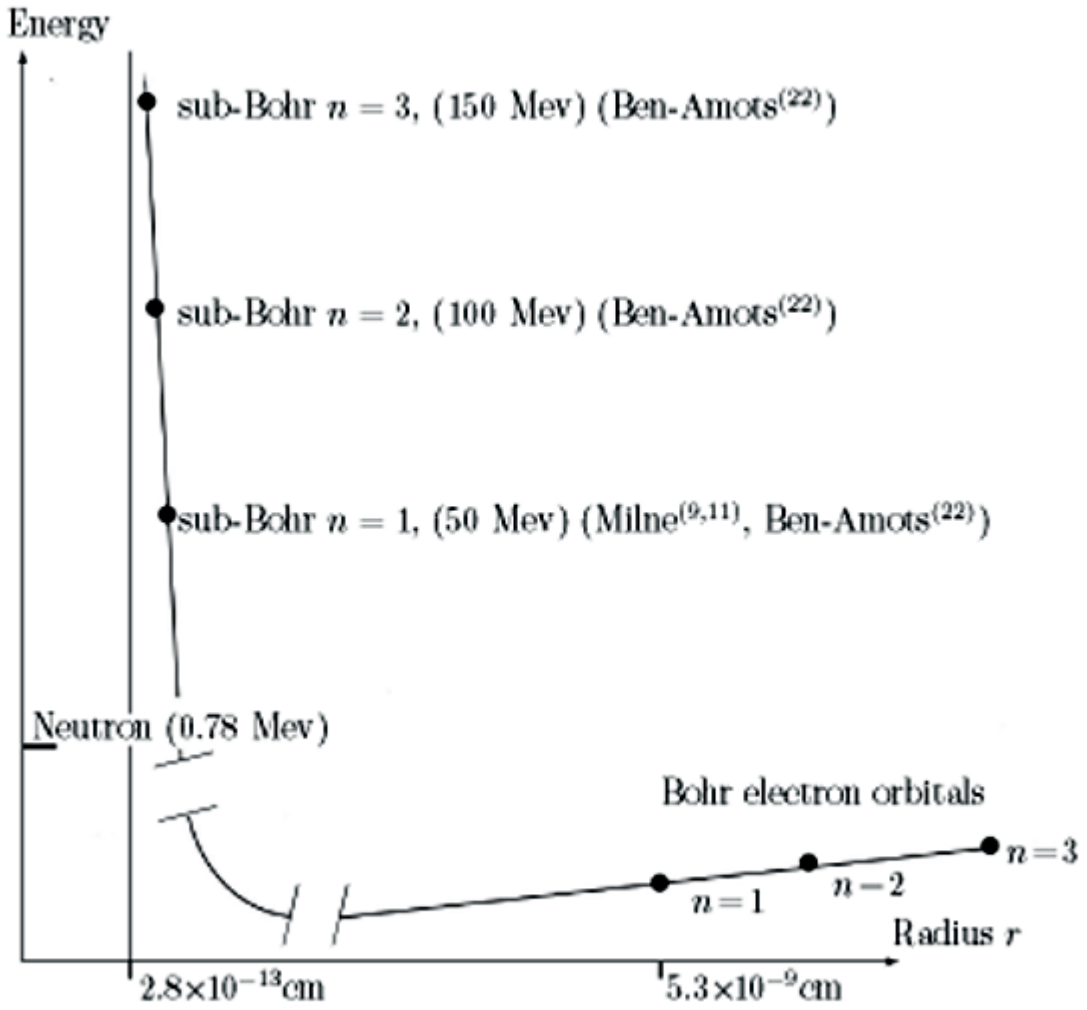


Figure 1: Schematic energy versus the distance r between a proton and an electron circularly orbiting around it, showing sub-Bohr energy levels (changing scale)

A fraction of a second later this energy is reused as kinetic energy of bounce back explosion. However, the sub-Bohr electrons, while being energy accumulators, **do not supply more energy than they accumulate**. Alone, they enable no more kinetic energy than the gravitational energy given by the infalling matter to the sub-Bohr electrons but **not** supernova **explosion**.

What process supplies the additional energy that results in such a strong explosion that increases the velocity of the ejected matter of the entire star up to thousands km/sec?

The high pressure in the collapsed core of the star produced by sudden stopping of the fast collapse causes sudden close contact between the spinning quarks of neighbor nucleons.

The friction between these close contact quarks causes fast quenching of their rotation. The energy needed for explosion is taken from the kinetic energy of the rotation of the quarks. The rotation energy of the quark spinning with Franklin's relativistic rotation constitutes more than 99% of the quark mass.

Quenching of the rotation energy of the quarks of a few percents of the mass of the star is sufficient for all the forms of energy of supernova explosion. Together with the energy accumulated in the sub-Bohr orbitals it may stop the implosion of a star and reverse it to an explosion with energy beyond the gravitational energy gained during the implosion.

QUASARS and **JETS**

The fusion of elements supplies energy and builds "onion" layers of heavier elements within the star. Iron is the inner and the heaviest element close to the center of the star. At higher temperatures at the center of the massive star iron nuclei decompose to helium and hydrogen nuclei.

In order to sustain stability of a supermassive body an energy source at its center supplies energy **also** to **decompose iron nuclei** to helium and hydrogen nuclei. The energy needed is taken from the kinetic energy of the rotation of the quarks. The rotation energy of the quark spinning with Franklin's relativistic rotation is about 99% of the quark mass.

Variable luminosity

By buoyancy, the hot helium and hydrogen nuclei flow outward **continuously** or accumulate in huge bubbles that burst outward. These bubbles were observed.

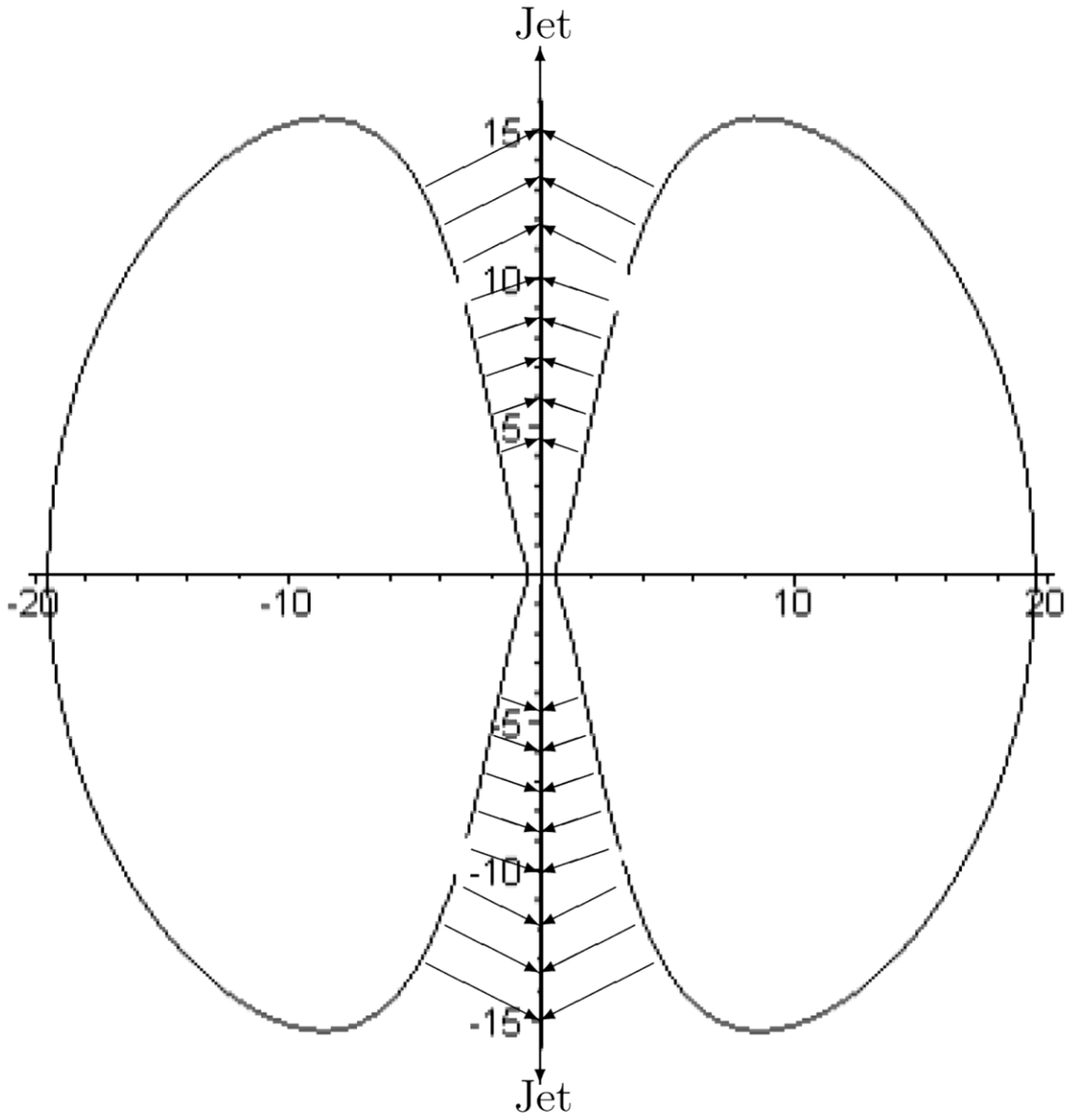
Huge bubbles explain the variable luminosity of quasars.

JETS

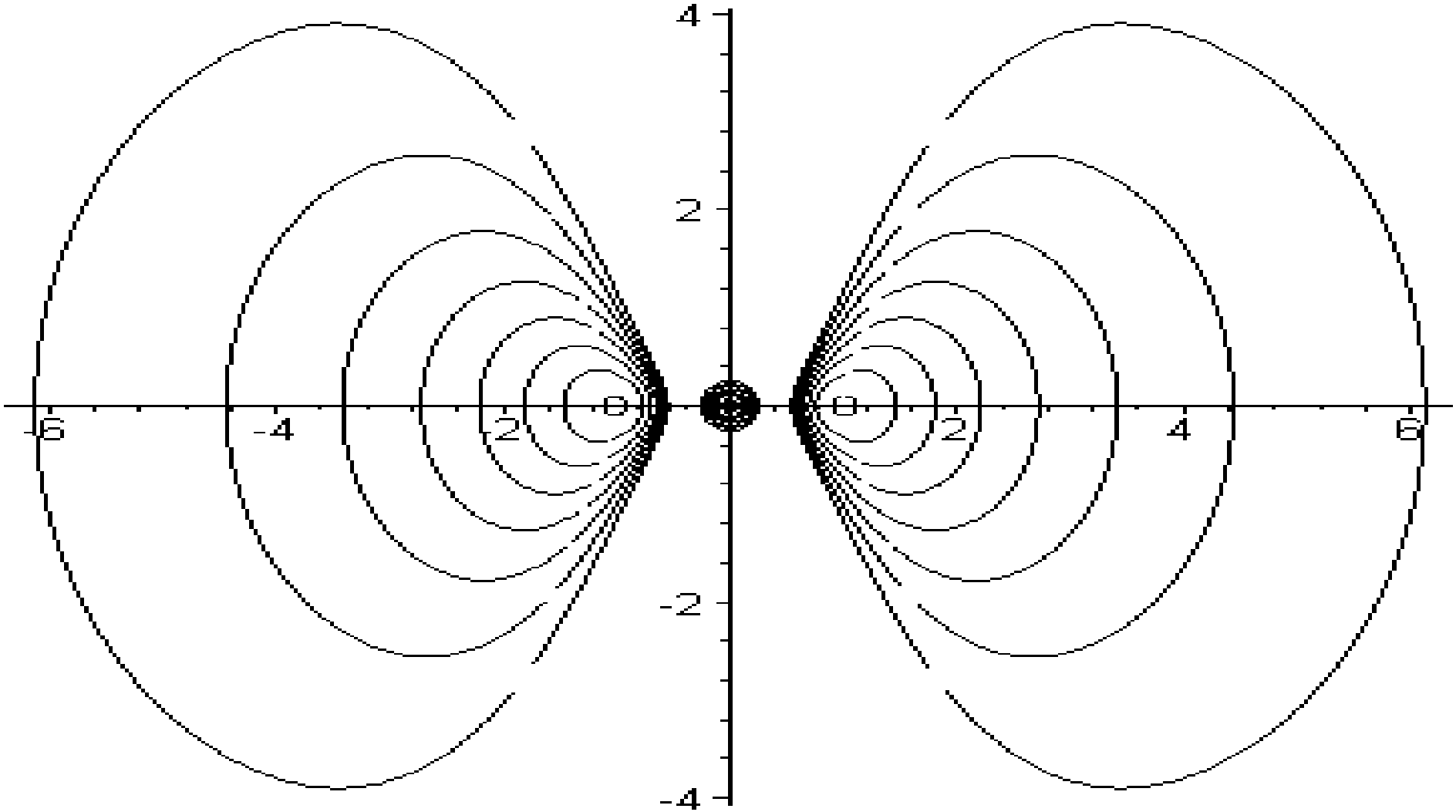
Centrifugal force push heavier matter to the equatorial bulge, but the super hot helium and hydrogen are lighter than the upper layers. The heavier upper layers squeeze the lighter helium and hydrogen nuclei **toward** to the axis of rotation and upwards along the axis of rotation until they reach the poles and are expelled as jets.

There the helium and hydrogen nuclei are ready to be the **particles** in the axis of rotation that are pushed farther and faster by the **collimating radiation** from the **cones** of the **torus** of the thick accretion disk surrounding the quasar, AGN or microquasar, and **accelerated to relativistic velocity jets**.

TWO CONES IN A TORUS COLLIMATE RADIATION TO TWO OPPOSITE JETS



Quasi-tori k=0.3-0.9, 0.99



Nature did not think it was her business to make the discovery of her laws easy for us
Albert Einstein