

Novel Descriptions of the Big Bang, Inflation, Galactic Structure and Energetic Quasars

Short Title: Black Hole Big Bang

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ABSTRACT

Black holes (BH) hold immense energy. When BH collide, they release sufficient energy that *they do not combine*. Their collision is supra elastic and thus BH leave these encounters with extra kinetic energy. With mutual BH rejection, new mechanisms emerge for the big bang (BB), inflation, galaxy formation and quasars.

Mutual BH rejection also held separate ultra-massive, (galaxy-acquired) black holes (UMBH), of a dying universe, as they accelerated their collapse toward a compacting, universal black hole. However, an instant before complete collapse, UMBH reached a critical temperature/pressure and detonated the big bang (BB) to consume all UMBH. The BB released energy, mass and space constrained by billions of UMBH. The freed space produced inflation, and the matter mass steered the new universe toward continued matter domination. But a few (hundred billion), much smaller (and previously far more numerous) stellar BH (stBH) survived both the collapse and BB, grew to super-massive size (due to BB pressure) and moved out, with continuing inflation, to organize individual galaxies. These galaxies retained loose associations they acquired just after the BB as large-scale galactic filaments. (A possible mechanism to maintain and sharpen these structures is discussed in the "Novel Effects..." note, which follows.) In rare cases, a super massive BH also survived the BB, grew to astoundingly massive size ($\sim 10^{12}$ solar mass, AMBH) and organized clusters of galaxies like the Coma cluster.

Also rarely, the extreme energy/mass pressures following the BB caused colliding BH to pair as intimately-coupled, binary, super-massive, black holes (SMBH), which we see today as ancient, energetic quasars spewing immense thermal radiation or as younger, radio-frequency, active galactic nuclei (AGN) -- depending their SMBH orbital separation. Thermal quasars orbit each other within their reactive (surface disruptive) distance, and radio AGN exceed it. BH precursors needed to be present at the time of the BB to be pressure-joined as close-coupled, equal-mass, SMBH pairs, and the high efficiency of their light-generating mechanism suggests that current quasar size estimates may be high. Thermal quasars expire when their SMBH separation distance exceeds their surface-disruptive distance; and they leave behind energetic, radio frequency AGN. As this paired AGN whips their intense, intertwined magnetic fields through the narrow gap between them, their compressed fields eject extreme energy cosmic rays and relativistic, radio frequency electrons.

Subject Key Words: black hole, black hole physics, big bang, inflation, galaxy formation, galaxies, galactic clusters, galactic filaments, Coma Cluster, Death Star Galaxy, Cygnus A, galactic jets, quasars, and large-scale structure of universe.

1. INTRODUCTION

This paper introduces several points, which challenge current theory:

- That black holes (BH) explosively reject each other when they meet,
- That the “universe” preceding the big bang (BB) was much like our own,
- That the BB was a detonation of ultra massive black holes (UMBH) that reached a critical density and temperature as they collapsed toward a universal black hole,
- That the BB produced inflation as it destroyed UMBH to release the space they had previously acquired (expansion pressure is an intrinsic attribute of space),
- That super-massive, galaxy-centered black holes (SMBH) arose from smaller, stellar BH (stBH) that survived the BB,
- That galactic clusters formed about astoundingly massive BH (AMBH), which grew from rare SMBH that survived the BB.
- That the most powerful thermal quasars are powered by energy released from closely-coupled, binary SMBH that were joined by BB pressure, and whose opposing gravities continually tear mass, energy and space from their partner’s surface, and
- That expired thermal quasar remnants appear today as large, bright radio AGN whose intense intertwined magnetic fields now generate relativistic electrons and the most powerful cosmic rays.

The descriptions presented below are internally consistent and supported by observations that are not well explained by current theory.

Black holes (BH) hold immense energy that accrued during their formation and mass accumulation. This energy contributes 1/3 or more to their total mass, it is likely concentrated near their surface, and it is thus instantly available upon disruption of black hole constraints. It prevents BH-BH accretion, fueled the BB and powers the most energetic quasars. Given that BH reject each other; simple mechanisms emerge for the BB, early galaxy appearance, inflation and energetic quasars. In addition to acquisition of mass and energy, intense BH gravity also acquired space. The BB released this space into a small volume as inflation. Inflation was an essential BB component. It enabled the BB to free mass and energy from the constraints of a universal BH. (Gravity could have otherwise contained the energy and mass released by the BB detonation.) Spatial release also contributes to the BH-BH rejection mechanism, and it eventually assisted in moving intimately paired, thermal-quasar BH apart until they cease tearing at each other to become intense radio galaxies.

The black hole big bang (BHBB) theory below describes a closed, cyclic universe, whose BB released the energy, mass and space (as inflation) held

by critically dense, ultra-massive black holes (UMBH) left from an expiring universe. Billions of much smaller stellar mass BH (stBH), survived the BB, quickly grew to super massive size, and moved out with continuing inflation to organize the young galaxies of a new universe.

This theory explains the billions of similar galaxies, inflation, large-scale universal structure and early appearance of large galaxies. It also explains how massive, close-coupled, equal-mass binary black holes paired and developed shortly after the BB to power high-energy, thermal quasars. These quasars became intense radio galaxies as they expired.

2. BLACK HOLE / BLACK HOLE REJECTION MECHANISM

BHs' immense energy accrued as new mass fell through their crushing gravity (and from antimatter annihilation shortly after the BB). BHs' gravity also acquired space. (And this same space would later be released as inflation during a BB.) BH/BH encounters break the BH gravitational constraint to explosively release some of this immense energy -- along with mass and space to cause a supra elastic collision, which sends colliding BH into independent trajectories. The larger BH of a colliding pair is more vulnerable to surface disruption than its smaller collision partner.

Two consequences of BH growth make larger BH more vulnerable to surface disruption than smaller BH:

1. Larger BH acquire more energy and space per unit of surface than smaller BH,
2. This extra energy and space combine to decrease larger BH density, and further expand their radius. Thus their surface gravity gradient (the disruptive component of BH/BH encounters) is less focused than that of a smaller BH.

The higher energy results from newly accreted mass having fallen through a more powerful gravitational field before it struck the surface of the larger BH. And the extra collapsed space accrues from an assumption that space, mass and energy acquisition rates are related to the area of a BH's event-horizon sphere. Thus acquisition rates of these entities increase as roughly the square of the BH mass. While BH surface area increases as the 2/3 power of new BH mass. So that the larger (l) partner would have acquired more collapsed space per unit of BH surface area than its smaller (s) partner by a ratio of their masses to the 4/3 power: $\sim(m_l/m_s)^{4/3}$. (Note: This ratio maybe somewhat reduced as faster energy and spatial acquisitions reduce BH surface densities.) The new energy and space acquisitions, that accompanied newly acquired mass, both leave the new surface less dense than earlier BH acquisitions. This extra energy and space likely remain near the BH surface or, at the very least, add extra

energy and collapsed space to the larger BH as a whole. In either case, recent higher-energy mass and faster spatial acquisitions leaves larger BH more vulnerable to gravitational disruption. And lower mass density of the larger BH expands its surface to diminish its surface gravitational gradient. The extra energy and space make the larger collision partner more vulnerable, and its added size reduces its gravitational threat to a smaller BH. Thus, when a smaller BH encounters a larger one, the surface of the larger BH erupts first to expel its smaller collision partner. Near limitless energy is available to this eruption. And centrifugal force acts with the released energy to eject both BH into trajectories that escape each other's gravity. While this collision description helps to visualize why colliding BH do not mutually accrete, the rejection mechanism is sufficiently powerful that even UMBH in a rapidly imploding old universe remained separate until a BB detonation consumed them all.

In some cases, the explosive BH rejection response also enables a plasma jet to completely escape both collision partners' gravity. As BH meet, a powerful explosive plume strikes the smaller partner to prevent accretion. Released (BH-constrained) space accompanies the plume to enhance its rejection power. A part of the plume also falls back to its source; but a fraction may escape capture by following a narrow, gravity-balanced escape path in the plane of the collision, around the back of the rapidly-receding, smaller partner. The size, duration and availability of this path depend on collision parameters: contact angle, relative sizes, and rotational speed and rotational axis of the larger partner. At near-light speeds, the strongest component of the gravity vector reached the larger partner's surface just after its source passed over the intersection point. This slight misalignment helps to free part of the plume from gravitational capture by either partner – especially if the BH source rotates rapidly, counter to the direction of the collision. The misalignment contributes to the collision's supra elasticity by adding even more momentum (as relativistic mass) in the direction of the smaller partner's new path.

We see evidence for past SMBH collisions as massive gas jets moving from other galaxies such as the "Death Star" galaxy (galaxy system 3C321, Figure 1.). This system consists of a larger and smaller galaxy with a large jet in line with the galaxies. The large jet was likely freed from the larger galaxy's SMBH as the smaller galaxy's SMBH made a fast, low-angle collision with it. Both the alignment of the jet with the smaller galaxy and their order (with the smaller galaxy in the middle) support a low-angle collision event. A low-angle collision explains both the jet and small galaxy survival: The large jet resulted from a significant displacement of the disruptive gravity gradient at the larger SMBH's surface behind its smaller SMBH source. And the small galaxy survived because the smaller SMBH was able to reacquire its home galaxy after the encounter. If the smaller

galaxy moves away from the larger one at a rate proportionate to the distance and separation rate of the gas jet, than the two likely left the larger galaxy at the same time and are linked to the same event. (The Magellanic Clouds near the Milky Way may be the remnants of smaller galaxies whose central SMBH were flipped by the Milky Way's SMBH to a course that prevented galactic reacquisition.)

Thus, galactic-sized, single-lobed gas jets are the likely result of close encounters between two SMBH. (Some double-sided jets and gas clouds, accompanying radio AGN, will be described in Section 8.) SMBH are the only common concentrated sources of this much mass and the only objects or mechanisms that could free them.

Six recently observed brilliant, ultraviolet "supernovas" with no trace of hydrogen¹ are well explained as the product of BH/BH collisions. The energy and plasma released by these events would be sufficiently large, to account for their brightness, and sufficiently hot to produce their primarily ultraviolet emissions and prevent hydrogen recombination. (The atomic hydrogen spectrum of is absent from their emitted light.) Other explanations are offered which seem more complex than a rare but simple BH/BH collision.

The lack of other evidence of accreting collisions between two SMBH is a weak but collaborating argument for a rejection mechanism. It is difficult to imagine that the most common, massive, singular objects in the universe (galaxy-center SMBH) would not occasionally encounter each other, and that these encounters (even with mutual accretion) would not leave recognizable signature. These massive objects would approach each other at relativistic speeds. It is doubtful that even their considerable combined gravity and spatial constraint, could contain the instantaneous release of an additional energy equivalent of $>1/2$ the smaller partner's mass to the colliding pair, without leaving a visible signature.

3. THE EVENT HORIZON DILEMMA

Visible objects crossing a BH event horizon are never seen again. This behavior implies that another (smaller) BH would suffer the same fate if it crossed a larger BH's horizon. However it does not "vanish" for long. The smaller BH uses all of the momentum and energy that it acquired falling toward its larger partner (along with the added explosive rejection energy from its partner) to propel itself into a trajectory that is independent of its larger partner. The extra relativistic mass, that the smaller BH acquired as it fell through its larger partner's gravity, stored all of the energy and

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momentum it would need to for an elastic collision. The explosive interaction made their collision supra elastic. BH acquire ordinary matter, energy and space without leaving visible evidence of the event. The key, to the continued and separate existence of both BH, is their supra elastic encounter, due to the additional explosive energy released from the larger partner.

4. THE BIG BANG

The BB was a detonation of hot UMBH (UMBH include their former galactic masses) remnants of a rapidly collapsing, old universe. This detonation released immense energy and "universal" mass along with the accompany inflation of space itself. It ignited during the final instant of BH and spatial collapse toward a singularity of the universe-as-a-whole -- which was never reached. During this final collapse, temperatures climbed exponentially -- virtually without limit -- until detonation occurred. The ensuing detonation destroyed all UMBH in its path to instantly release their constrained mass, energy and space. UMBH are the least stable of all BH because their most recent mass acquisitions had fallen through a very long and strong gravitation field to reach their surface. These extreme acceleration paths gave new acquisitions kinetic energy far above $\frac{1}{2}mc^2$ due to the additional relativistic mass they acquired during their descent. Similarly, the outer layers of UMBH also acquired large swaths of space, as their event-horizon spheres expanded and later as space collapsed along with the mass of a dying universe, to enable its rapid (and near-complete) acquisition by UMBH. Ultimately, the BB consumed all UMBH while bypassing many "cooler" and more nimble stBH, and an occasional SMBH.

Ultra massive BH include not only the mass of their previously associated galaxies, but also the relativistic mass that this mass acquired as it fell through the intense UMBH gravity. This energy-as-mass could approach or even exceed the rest mass of the acquired galaxy. Despite relativistic speed restrictions, (and the speed of light inside an event horizon -- where both space and light are falling through beyond-light-speed gravity -- may be poorly defined), UMBH mass acquisitions eventually traverse these intense gravity fields, and should have accumulated all of the kinetic energy available from this path -- even if it shows up as extra relativistic mass moving at very near light speed. These added UMBH masses raise their combined gravitational attraction significantly above the sum of their galactic and SMBH gravities before galactic acquisition, and these extra attractions initiate universal collapse.

Both energy and inflation (from released space) were necessary to free a new universe from the grip of a collapsing universal BH. Without accompanying inflation, BH gravitational constraints of the universal BH

could continue to contain virtually all of the energy released by destruction of the UMBH – as precursor BH had done. Thus, in a cyclic universe, successive BBs freed mass, energy and space that had been trapped by galaxy-devouring UMBH of dying universes, and replaced them with fresh, new, expanding universes like our own. In fact, (in near-infinite time) our existence on Sun-bathed Earth is supporting evidence for a cyclic universe.

The BB detonation began near the center of a dense cloud of UMBH and stBH collapsing toward a universal black hole. The light-speed detonation quickly traversed the short distance to the edge of a rapidly imploding universal black hole. The detonation wave traveled at light speed within its space, however, just before the detonation, UMBH gravity was still accreting residual space, as the old universe collapsed toward a universal singularity. Thus the BB detonation traversed the old universe before the inflation it released could extinguish its furry. In fact, this old universe may have briefly approached the small size claimed by current theory, as the last remnants of space itself disappeared into collapsing UMBH. But this imploding universe still retained its original structure as billions of UMBH violently resisted mutual accretion despite exponentially increasing temperature and pressure. There was effectively no lower limit to its size and no upper limit to its temperature, and the universal collapse accelerated inward until detonation unleashed the BB. It released $<2/3$ of UMBH mass as matter and $>1/3$ of it as energy. But some, much smaller and “cooler”, stBH survived universal collapse and the BB, became super massive from BB pressures and seeded galaxy formation in the new universe.

5. INFLATION

The BB released gravity-trapped space from billions of UMBH to unfurl as inflation. The inflation (unfurling) rate, is likely some inverse function of “universal volume,” and thus it began as near-instantaneous expansion from a very small volume, and it continues to expand the universe today. The destroyed UMBH released the energy equivalent of $>1/3$ of their mass; however BH gravity was likely capable of constraining this energy. Thus inflation needed to accompany this energy release in order to defeat the collapse toward a universal singularity. But inflation, due to the newly freed space, did not just exit the region -- it carried the plasma’s mass and energy along with it to begin universal expansion. This action implies a connection between space and mass – similar to the connection that lengthens radiation wavelengths as space expands. And this same connection, that expanded the universe during its initial inflation, enabled BH to reacquire space (along with added mass and energy) as they moved through it – especially later as space and universal mass accelerated their collapse leading up to the BB. There is little reason to expect that space is

significantly more capable of resisting BH gravity than light – we still have much to learn.

The concept that inflation derived from an unfurling of BH-acquired space has several advantages over “instantaneous” inflation of current theory:

1. Its effects continue to expand the universe – beyond its very rapid initial burst of inflation. Thus, while “initial” inflation may have inserted significant space into the universe, the universe would likely have remained within a universal BH event horizon and at risk of collapse without continuing inflation pressure from released space.
2. It does not require conjecture of quantum effects within a massive body to produce an otherwise unanticipated result.
3. It represents a continuing process that explains both initial inflation and continued acceleration of universal expansion.
4. Unfurling inflation eventually drops off as some function of universal volume, which contributes to eventual gravitational dominance and ultimately the next BB.

Inflation played an essential role in freeing the universe during the BB, and its remnants are likely responsible for ongoing acceleration of universal expansion, due to an intrinsic expansion propensity of space itself.

Note that, according to this theory, collapsing UMBH had swept in most space from the old universe as they move toward the BB compaction. This process leaves behind emptiness, void of space, that the new universe can inflate into – unimpeded by residual space from its predecessor.

6. MATTER

We live in a “matter” universe because the “matter” component of UMBH survived the BB along with stBH, which survived intact. These matter sources tilted matter/antimatter competition following the BB in favor of matter. Matter, antimatter and energy exchanged with each other at the extreme temperatures following the BB, however some extra matter was present from time zero. And this matter tilted the new universe toward continued matter domination. Antimatter never had a chance. Though it may have formed equally with matter in the hot, energy-rich plasma after the BB, there was always enough matter to maintain its dominance -- despite its active participation in creation/destruction processes.

After the BB, rapid, high-energy nuclear reactions partitioned: baryons and radiation, protons and neutrons, and hydrogen and helium (along with other light elements), as described by current theory. All of these reactions occur similarly in this theory, as a detonation destroyed UMBH (with their

high energy content), and converted them to a less-constrained, expanding, high-temperature/pressure plasma.

After the big-bang detonation passed, the hot, new universe soon acquired the thermal and expansion characteristics of current theory, with two notable exceptions: The presence of rapidly-growing stBH survivors, and a far lower concentration of antimatter – due to the presence of residual matter from destroyed UMBH and surviving stBH. Expansion continued and eventually the new universe cooled to 3740K, hydrogen “recombined”, the universe became transparent and the precursor light to cosmic “microwave” background (CMB) radiation burst free. Fluctuations in CMB intensities may have been influenced by the presence of billions of rapidly growing, new SMBH and their associated galactic clouds; however, current CMB variations seem too large in scale to be solely attributed to these proto galaxies.

7. GALACTIC & LARGE-SCALE STRUCTURE OF UNIVERSE

At first glance, galaxies seem more similar than they are different. The billions of similar galaxies in our universe indicate a size-determining feature of their formation. This (logarithmically) narrow range is consistent with galactic coalescence around SMBH that had grown from stBH survivors of the BB. It seems more difficult to explain SMBH as condensations around subtle mass discontinuities in primordial plasma, which would seem to have produced a broader galactic range and included smaller galaxies.

Surviving, stBH are the size-defining feature of galactic formation. They would have received additional mass as they caromed among their larger, UMBH sisters during the collapse, and many of them would have been trapped and accreted by the massive, rejection plumes between UMBH. However, surviving stBH had not acquired the roughly 8 orders of magnitude of new mass needed to equal UMBH size. Thus, some stBH remained sufficiently nimble and “cold” to move with the BB detonation rather than holding position to absorb its full impact (especially if they happened to be moving in the direction of the detonation when it hit). The stBH had a well-defined minimum size at the time of their formation. And those that survived the BB grew quickly in the immense pressure of the BB until they achieved super-massive size and reigned in galactic masses. However, the lower size limit for stBH formation carried through these mass accumulations, and explains the minimum size of galaxies.

Young SMBH moved out with inflation to organize galaxies from the vast plasma cloud left by the BB. Current theory – that small density spikes in the BB gas cloud built upon themselves to produce SMBH/galaxies – would seem to predict a much broader continuum in galaxy size, some later-

forming ones with insufficient core mass to be called super massive – the BH kernel needed to have been present during the maximum pressures of the BB in order to achieve more “uniform” super-massive size. Small variations in CMB seem too large in scale to have been produced by billions of galaxies, although low plasma densities from AMBH acquisitions might produce them. Some early-universe, computer models may be adjusted to predict galaxy formation², the BHBB theory, with its surviving BH cornels, offers a simple, direct description of early super-massive, galactic-core BH formation. Similarly, the correlation of a galaxies’ outer-star speed and central galactic mass with the central-black-hole mass implies that super-massive, central BH were present during the organization of the galaxies and played an important role in this process. If SMBH had formed later in the universe-organization process, then they would have had less influence on outer-star speed. Karl Gebhard along with Laura Ferrarese and David Merritt³ observed that galactic bulges turned out to be 500 times more massive than the giant BH at the hub of their galaxies. These bulges can have a 20,000 light-year radius – well beyond the one light-year black-hole influence distance. The apparent influence over such a large distance implies that the central black hole was present and important during a denser phase of the universe, before the time that current theory ascribes to galactic organization. The observation of mature galaxies in a young universe⁴ also supports an early arrival of SMBH. (Note: the author asserts that galaxies expand along with the universe as a whole – but at a slower rate. This effect is discussed in the “Novel Effects...” note, viXra: 1401.0230, which “follows” this paper.)

Large-scale galactic filaments imply more structure in their source than is likely from current theories. These large-scaled structures as originally described by R. B. Tully and J. R. Fischer⁵ are one of E. J. Lerner’s strongest criticism of the current BB theory in his book “The Big Bang Never Happened”. These structures developed early and naturally (in BHBB theory) as newly formed associations among the BB-surviving stBH. The BB released tremendous pressure, energy and inflation, and left dense plasma and stBH behind the detonation front. The surviving BH established gravitational links that remained influential during the period of rapid universal expansion, exponential BH growth and galaxy organization. Thus as the universe expanded, the pull between neighboring BH also increased as they grew to super massive size and later with their newly-acquired galactic clouds in tow. (A mechanism to maintain and sharpen these

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filaments is discussed in the "Novel Effects..." note, viXra: 1401.0230, which "follows" this paper.)

Large galactic clusters, such as the Coma Cluster, likely developed around astoundingly massive BH (AMBH). These rare AMBH grew along with SMBH in the high-pressure plasma released by the BB. Rare, BB-surviving SMBH seeded these monsters, which grew to $\sim 10^5$ times their starting size (as did stBH). (The SMBH may have lost its associated galaxy during an earlier encounter with another galaxy-centered SMBH, long before universal collapse.) This SMBH would have gained significant mass during the collapse leading up to the BB, but would have remained smaller than its UMBH sisters. Thus, they may have weighted in at $\sim 10^7$ solar mass just before the BB and have grown to $\sim 10^{12}$ sm following it. (Note: The estimated mass of an AMBH has been reduced to 10^{12} sm, from a larger earlier estimate, based on the more likely BB survival of a rare SMBH than on survival of an UMBH.) Several factors could raise or lower AMBH post BB acquisition rates, but it is difficult to estimate their relative impacts. The event horizon for an AMBH would likely have swallowed any conventional galaxy that might otherwise have formed around it, but its considerable gravity could certainly constrain neighboring galaxies to orbit about it. Current theory offers no mechanism to form AMBH, and the existence of one at the center of the Coma Cluster would support this BHBB theory.

If galactic-centered SMBH formed from subtle eddies within the expanding BB cloud, than we would be more likely see some remnants of this cloud that were not gravitationally bound to a SMBH cornel in their neighborhood. Thus later-forming SMBH are not consistent with the near-complete capture of visible matter in galaxies.

Also, according to current theory, later-forming SMBH would need to have passed through a "quasar" phase (according to current quasar theory), fueled by massive acquisitions, in order to attain their super-massive size. Thus current-theory implies that we should see more quasars, and that they would present a continuum of phases – depending on their rates of mass capture. The rarity, brightness and signatures of energetic thermal and radio quasars support their description below as close-coupled, binary SMBH.

8. QUASARS AND SOME ACTIVE GALACTIC NUCLEI AS BINARY BLACK HOLES

This description of quasars, as binary SMBH, explains the unique energy source of the most ancient and powerful of active galactic nuclei (AGN). It flows naturally from the BHBB theory described above. Observation of the enormous radio energy emitted by Cygnus A (3C 405, Figure 2) and of the (dual) massive galactic clouds connected to their source by narrow, stable electron beams support its description as a binary SMBH. Confirmation of Cygnus A as a binary SMBH would be an important validation of the BH/BH rejection mechanism. Centaurus A (NGC 5128, Figure 3) possesses smaller dual clouds and a more diffuse electron beam, but may also be powered by binary SMBH, since high resolution radio images show its electron beams originate closer to its core than current theory would predict.

Close-coupled, binary, SMBH likely power two types of continuous, high-energy objects:

1. Rare, distant, and broad-spectrum, "thermal" quasars whose binary SMBH circle each other within a reactive distance such that their respective gravities continually tear plumes of ultra-hot plasma from their partner. These plumes produce massive, plasma jets along the orbital axis to efficiently emit vast quantities of very-hot, plasma-sourced, thermal radiation. The strong light emissions from this plasma may cause overestimates of thermal quasar size due to current use of accretion models for light generation estimates.
2. Strong, radio galaxies such as Cygnus A, and possibly Centaurus A, whose close-coupled orbiting SMBH have rebounded (from BB constraints), and eventually rejected sufficient mass and space to expand their orbital separation beyond a reactive distance. These binaries remain as cosmic high-energy particle accelerators, whose intense, intertwined magnetic fields eject focused, relativistic electrons and invisible, extreme energy, cosmic rays.

The power sources for both objects and their origins have puzzled astronomers, and this theory provides a viable description of both.

The rare binary SMBH, that power thermal and radio quasars, coupled shortly after the BB detonation, when the surviving, solar mass BH population density was greatest, and when maximum, massive (differential) mass and energy infusions from the BB could defeat their normal rejection mechanism. During (and shortly after) the BB, surviving BH accreted plasma at astounding rates, to quickly make them super massive. If two of these rapidly growing BH encountered each other at near-peak pressure, they would shadow each other from plasma accretion between them. Continuing, unobstructed accretions from other directions would hold the pair together – despite the continuing rejective plasma plume from one or both partners. Meanwhile, preferential frontal accretion continually slowed the partners' orbital velocity, moved them ever closer

together, and created an efficient accretion duo that captures new plasma and energy even faster than independent SMBH. After a short time, plasma ejections and close proximity would have: balanced the partners' masses, and aligned their rotations and magnetic fields (in opposite directions & perpendicular to the orbital plane). By the time accretion pressures subsided, paired BH would have lost the orbital velocity needed to help the partners escape each other. And their continual eruptive interaction would maintain separation, but would lack the pulse of power needed to push them further apart. The intense energy continually radiating from energetic thermal quasars and radio galaxies illustrates the immense power available from the near-limitless energy constrained within BH.

The galaxy cluster, M0735.6+7421, includes two giant cavities likely formed by expelled material. "Over a distance of a million light years, jets from this super-massive black hole appear to have pushed out as much gas as is contained in a trillion suns. The eruption has already released hundreds of millions of times as much energy as is contained in a gamma-ray burst, the most violent type of explosion that scientists had previously detected."⁶ This structure could form as the ejected mass from a reactive, binary pair of AMBH. This very rare pair would have the mass available to eject similar quantities of mass, and its paired structure provides a mechanism for its release. The above reference also cites Martin Rees and Joe Silks' calculation that no black hole can become heavier than 3 billion solar masses. Observations of instability may also be explained if paired BH acquired mass more quickly following the BB than solitary BH because their high orbital speed swept a greater volume during mass accretion. Thus many of the largest of BH may turn out to be interacting binary pairs, which were born active and destined to expel some part of their energy as radiation, matter or relativistic ions. These conclusions are consistent with the recent observation of a 2 billion solar mass, 12.9 billion year old quasar, ULAS J1120+0641⁷. Current theory does not anticipate a quasar this large, this early in a young universe. Recall that hot-plasma sourced light is likely a more efficient light source (per unit of source mass) than by current quasar light mechanisms and could lead to over estimates of quasar mass.

The appearance of dual mass-jets leaving quasar galaxies is consistent with thermal quasars as reactive, close-coupled, binary BH. Extreme pressures within the quasar interactive zone push mass and energy to escape by any possible route. Some high-speed, plasma follows the binary rotational axis to avoid the intense local gravity from individual quasar BH and (aided by

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their intense, focused magnetic fields) escapes even their combined gravities. These two plasma jets eventually expand, cool and become transparent as atoms recombine. Thus, the quasar light we see derived from hot plasma in massive axial ejected jets, and the massive clouds at both ends of Cygnus A are evidence of a more active stage in its past. Some younger AGN appear to be associated with interacting galaxies -- these are not necessarily the most powerful emitters; and their emissions are likely due to rapid accretion of new mass, as described by current theory.

Energetic radio galaxies, like Cygnus A, demonstrate an energy source of immense power. (Cygnus A is the most powerful radio source outside of our galaxy.) A binary SMBH pair possesses the energy to supply this power, and their close proximity and short orbital times would generate and focus the strong, intertwined magnetic field needed to strip electrons from their atoms and expel the dual jets of relativistic electrons and ions⁸. The nuclei that gave up the visible electrons are likewise accelerated by the same fields and along the same paths as the electron beams to become extreme energy cosmic rays, (which are not normally light emitting). Note that only binary BH of identical mass with opposed pole orientations would generate intricately balanced magnetic fields of sufficient consistency and symmetry to produce the sharp electron jets illustrated by high-resolution images of Cygnus A at 5 GHz. This condition implies that the binary partners have equalized their masses, and aligned their magnetic and rotation axes. BB external pressure would be necessary to produce these binaries, (and an effective rejection mechanism would have been required to resist merger of the binary pairs). Also, the extreme stability of Cygnus A's electron beam implies an exceptionally stable orientation of their source. This stability more likely results from an orbiting binary pair than from a single rotating SMBH. The massive bright radio gas clouds, at both ends of Cygnus A suggest that it was once a thermal quasar, which ejected substantial plasma jets along its orbital axis. Cygnus A's unique stability and extensive gas clouds would be difficult to explain as originating from a solitary SMBH.

Centaurus A shows these same features, but its gas cloud is smaller and its electron beam is more diffuse. Its possible identity as a binary SMBH is based in part on high-resolution radio images, which reveal that the electron jets originate closer to the central "BH"⁹, than current theory would predict. (A binary-pair would originate its jets virtually between the two, paired SMBH). Thus, both radio galaxies may turn out to be strong evidence for the BHBB scenario described above.

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As the universe expands, the high impact energy between BH that had been widely separated before their 'collision', assures that the rejecting explosion will deliver sufficient additional energy to send the participants on independent paths. Thus, we see no recently-formed, energetic quasars, and most energetic quasars that we see today have significant red shifts. The substantial mass and energy leakage from the ejected beams (whose light we observe billions of years later) likely quiets most quasars within the first few billion years of their existence. Thus near-Earth energetic, thermal quasars (whose light would be younger) do not exist. Energetic, radio AGN are longer lived and are likely a second or "burned-out" phase of reactive, thermal quasars. Even the super-massive size of thermal quasars cannot sustain them indefinitely, and they eventually cease their broad-spectrum emissions – as mass emissions and space release moves their separation distance beyond their reactive radius.

9. CONCLUSIONS

The BHBB theory derives from the supported proposition that BH do not combine with other BH into larger units, but rather explosively reject mutual accretion. This different perspective of interacting BH enables us to explain several phenomena that are not well described by current theory:

1. The energy source of the BB was the energy constrained within ultra massive BH (UMBH) (equal to $>1/3$ of their mass). These UMBH had acquired their galactic masses (accompanied by the energy-as-mass of their extreme impact energies) to speed collapse of an old, expiring universe.
2. Inflation accompanied the BB because space, previously acquired by hundreds of billions of UMBH, was instantly released, when the BB detonation destroyed all UMBH (expansion pressure is an intrinsic property of space).
3. BB-surviving, stellar-mass BH provided immediate accretion kernels, which quickly grew to super massive size, organized their proportionately sized, associated galaxies.
4. Six recently observed, exceptionally bright, ultraviolet "supernovas" are well explained as the product of BH/BH collisions.
5. Close-coupled, binary super-massive BH power energetic thermal quasars. These binaries continually tear at each other to release concentrated mass and energy along their rotation axis. They paired shortly after the BB and leave intense radio galaxies when they expire.
6. Early filaments of linked galaxies, that persist today, began their existence due to early formation of galaxies and the associations they formed between them (A filament-maintenance mechanism is

described in the "Novel Effects..." note, viXra: 1401.0230, that "follows" this paper.).

7. Galactic clusters coalesced around rare $\sim 10^{12}$ solar mass AMBH that grew to this size from a BB-surviving SMBH.

This theory uses known entities acting in an evidence-supported scenario to describe BBs that will continue indefinitely.

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Figure 1. "Death Star Galaxy" (3c321), Credit: X-ray: NASA/CXC/CfA/D.Evans et al.;
Optical/UV: NASA/STScI; Radio: NSF/VLA/CfA/D.Evans et al., STFC/JBO

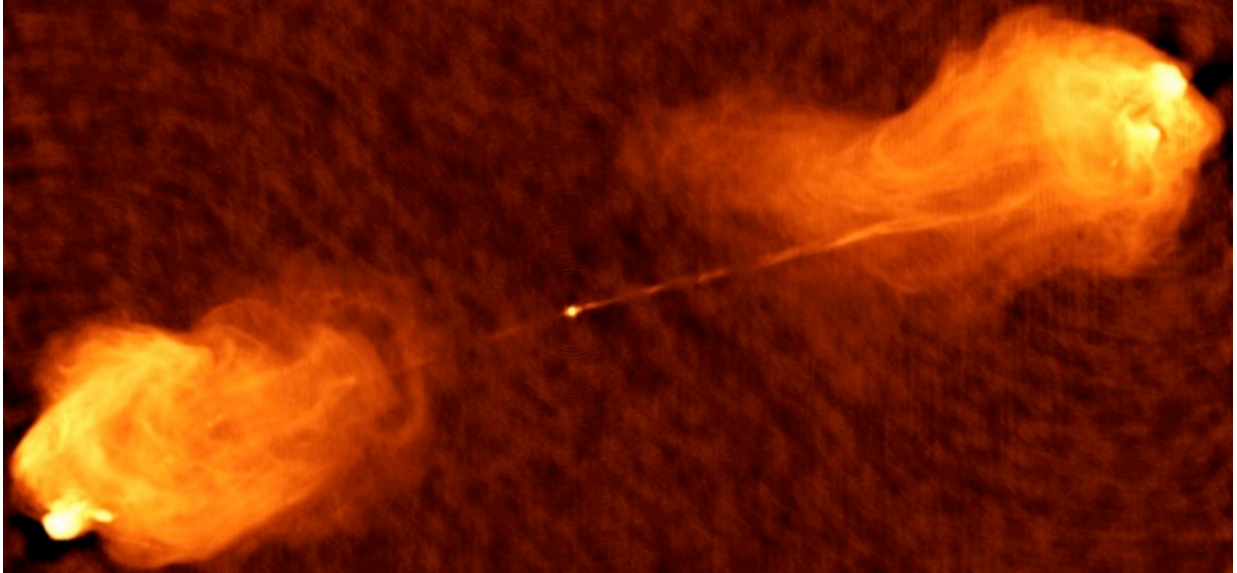


Figure 2. Cygnus A (3C 405), Credit: NRAO/AUI

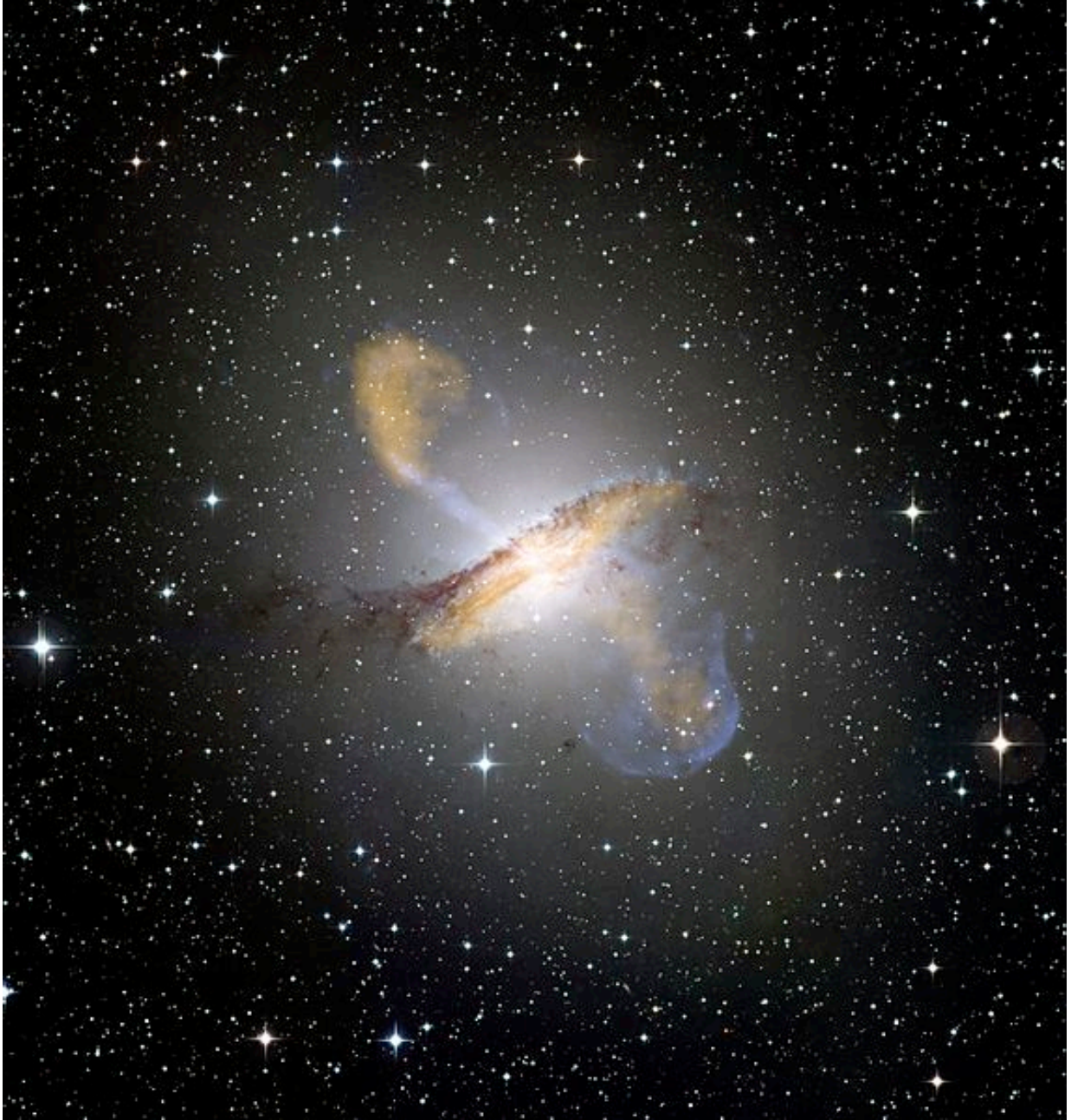


Figure 3. Centaurus A (NGC 5128), Credit: 'NASA/IPAC Extragalactic Database'.

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