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. In most cases, when BH collide, they release a sufficient pulse of energy that *they do not combine*. These collisions are supra elastic so that BH leave them 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, highly energetic, ultra-massive, (galaxy-acquired) black holes (UMBH), of a dying universe, as they accelerated their collapse into a 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 relativistic mass, that had been created with as galactic components fell into their UMBH, enlarged this succeeding universe. 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, aligned themselves at the intersections of inflation bubbles, grew to super-massive size (due to BB pressure) and then began building galaxies as continuing inflation converted accretion disk trajectories into stable galactic orbits.

These galaxies retained filament associations, which their central BH had established earlier. (A mechanism to maintain and sharpen these structures is discussed in the "Alternative Mechanisms…" note, which follows.) In rare cases, super massive BH (SMBH) also survived the BB, grew into astoundingly massive black holes ($\sim 10^{+13}$ solar mass, AMBH) and then organized clusters of galaxies like the Coma cluster.

Also rarely, the extreme differential energy/mass accretion pressures following the BB held some colliding BH together while they paired as intimately-coupled, binary SMBH. We see them today as ancient, energetic quasars spewing immense plasma radiation, or as younger, radio frequency, active galactic nuclei (AGN) -- depending their SMBH-orbital separation. Plasma 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 plasma-based, light-generating mechanism suggests that current quasar size estimates may be high. Plasma 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 tear electrons from their atomic nuclei and eject both as relativistic, radio frequency electrons and as extreme energy cosmic rays, respectively.

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

1. INTRODUCTION

This paper introduces several points, which challenge current theory:

- Most black holes (BH) explosively reject each other when they collide.
- The "universe" preceding the big bang (BB) was much like our own – though smaller.
- The BB was a detonation of ultra massive black holes (UMBH) that reached a critical density and temperature as they collapsed into a universal black hole.
- The BB produced inflation as it destroyed UMBH to release the space they had previously acquired (expansion pressure is an intrinsic attribute of space).
- Super-massive, galaxy-centered black holes (SMBH) arose from smaller, stellar BH (stBH) that survived the BB.
- Galaxy building began when continuing inflation shifted accretion disk trajectories out into stable galactic orbits.
- Dwarf galaxies, with larger than expected central BH, formed about SMBH after they were explosively ejected from their original galaxies by a collision with a larger SMBH.
- Galactic clusters formed about astoundingly massive BH (AMBH), which grew from rare SMBH that survived the BB.
- The most energetic plasma quasars are powered by closely-coupled, binary SMBH that were pressure-joined after the BB, and whose opposing gravities continually tear mass, energy and space from their partner's surface.
- Expired plasma quasars appear today as large, bright radio AGN whose intense intertwined magnetic fields now generate relativistic electrons and extreme energy cosmic rays.

The descriptions 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, though frozen in time, contributes 1/3 and often much more to their total mass, it is likely concentrated near their surface, and it is thus instantly available upon disruption of black hole gravity and time constraints. It prevents BH-BH accretion, fueled the BB and powers the most energetic quasars.

Given that BH usually 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.) Release of BH-trapped space also contributes to the BH-BH rejection mechanism, and it eventually assisted in moving intimately paired, plasma-quasar SMBH apart until they cease tearing at each other and 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 then began galaxy building as continuing inflation moved accretion trajectories out into stable galactic orbits.

This theory explains the billions of similar galaxies, inflation, large-scale universal structure and early appearance of large galaxies. It also explains how intense differential plasma pressure paired growing BH shortly after the BB. These pairs exchanged and accumulated mass and energy as they developed into closely coupled, equal mass and pole aligned binary BH that power plasma quasars. These quasars became intense radio galaxies as they expired.

2. BLACK HOLE / BLACK HOLE REJECTION MECHANISM

BHs' immense energy accrued as new energy and mass fell through their crushing gravity (and from antimatter annihilation shortly after the BB). BHs' gravity also acquired space. (And the BB would later release this same space as inflation.) BH/BH collisions break the BH's gravitational and time 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 the source of the explosive, rejecting plume. BHs' light-speed gravity, their time-stopped coolness and their extreme density combine to give them the toughness necessary to survive explosive collisions with other BH. (Section 3 explains the gravity wave observation of two accreting stBH.)

Three aspects of the of BH collisions promote explosive rejection by the larger BH:

1. The surface of the larger BH is more vulnerable to disruption because its newly acquired mass had fallen through stronger gravity to gain more relativistic mass before accretion, and because it's expanded event horizon has captured more space and energy per unit of surface area.
2. The smaller BH delivers enhanced impact to the larger partner because the smaller BH acquired extra relativistic mass, as it fell through the stronger gravity of its larger collision partner. This new mass increased its gravitational disruption to the larger black hole, while it gravitationally stabilized the smaller BH.
3. The smaller BH's near light speed velocity compresses its frontal gravity to further amplify its gravitational impact. This amplification occurs because its frontal gravity barely outruns its BH source, so that frontal gravity (or its spatial distortion) compresses within space that is but a small fraction of the volume of the space that it would normally occupy. And this amplified gravity further multiplies the smaller BH's impact on its larger partner.

The higher fraction of relativistic mass, previously acquired, by the larger BH raises the energy to mass ratio frozen on its surface, and the extra space and electro magnetic energy acquired by its larger event horizon further destabilized its surface. Likewise, the threat posed by the smaller BH increases as the mass disparity between the colliding BH masses decreases due to its added relativistic mass and from compressive amplification of its frontal gravity. Current theory proposes very cold surfaces on all BH due to near-complete time stoppage at their surface. Thus, time-frozen movement holds this extra energy and space at the BH surface, so that recent, higher-energy mass and faster spatial acquisitions leaves the larger BH surface more vulnerable to gravitational disruption. The added presence of the extra energy and spatial pressure increase its vulnerability, and may decrease its surface density to further reduce its gravitational threat to a smaller BH. Extra relativistic mass at the surface of the larger BH is likely the main driver of surface instability. As colliding BH reduce surface gravity, they also release the time stoppage, which had frozen the energy, space and mass on their surfaces. The affect of this time speedup is greater on the larger BH with its higher levels of constrained relativistic energy and the smaller BH's enhanced impact, so that it is quicker to explosively erupt and expel the smaller, intruding BH. Near limitless energy is available to this explosive eruption. And centrifugal force acts with the released energy to eject both BH into trajectories that will escape each other's gravity. While this collision description helps to visualize why most colliding BH do not mutually accrete, the rejection mechanism is sufficiently powerful, to have held separate UMBH of a rapidly imploding old universe, until a BB detonation consumed them all.

In some cases, the explosive BH rejection response also frees a plasma jet to escape both collision partners' gravity. As BH meet, a powerful explosive plume strikes the smaller partner to prevent its 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/centrifugal-force 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 its BH source rotates rapidly, counter to the direction of the collision. The misalignment also 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. Current theory describes this system as a smaller galaxy orbiting a larger one that just happened to cross a beam originating from the larger galaxy. However, there are several reasons to question that interpretation:

1. There is a brightly lit, massive gash in the larger galaxy. (Implying a recent pass-through by the smaller galaxy.)

2. There are several galactic fragments and clouds associated with the smaller galaxy. (Implying the smaller galaxy was responsible for their creation.)
3. The diffuse character of the galactic jet continues even between the galaxies. (Implying the beam was never compact and thus was not significantly disrupted by the smaller galaxy.)
4. There is no evidence of a twin jet opposite the observed jet. (Most jetted galaxies show twin jets in opposite directions.)

This author proposes that the large jet was 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 its SMBH was able to reacquire its home galaxy after the encounter. If the far end of the jet moves away from the galaxies faster than the near end, than the jet is more likely the product of a single SMBH/SMBH collision event, rather than the product of a continuing event – as current descriptions imply. (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 9.) SMBH are the only common concentrated sources of this much mass and the only objects or mechanisms that could free them.

Compact dwarf (CD) galaxies provide additional support of a BH/BH rejection mechanism. These galaxies rotate about vastly over sized central SMBH, and appear as jumbled collections of stars without normal galactic disks. Their small size and jumbled appearance suggests violent stripping of their primordial galaxies. A rejecting and course-altering collision with a larger SMBH would produce these effects. Significant SMBH course change would free the stars of the primordial galaxy to continue on their original course and eventually join the larger SMBH's galaxy. The smaller SMBH would leave the collision with only the primordial stars that it could turn from their original course and whatever new stars it could capture from its larger collision partner's galaxy. Regardless of their origin, these stars are unlikely to orbit neatly in their former galactic plane.

The disruptions, to these galaxies, span a broad range of original-galaxy survivals. The disruption level seems to generally rise as the collision partners' larger-to-smaller SMBH mass ratio increases. Thus the minor Death Star galaxy survived its encounter with its slightly larger partner relatively intact. Whereas Henize 2-10[1] (10^{+6} sm BH), which lost most of its original galaxy, probably encountered a significantly larger central SMBH, and M60-UCD1[2,3] ($3x10^{+7}$ sm BH) likely tangled with the M60 SMBH ($4.2x10^{+9}$ sm BH), which drastically altered its course, stripped away virtually all of its original galaxy and left it with only the small clutch of stars, that it could glean from its immediate vicinity as it quickly left M60. As more compact galaxies, with unusually large central SMBH, are discovered, the BH/BH rejection mechanism becomes a more likely explanation of their formation.

Thus the extreme galactic stripping shown by Henize 2-10 and especially M60-UCD1 most likely resulted from significant trajectory displacement of the smaller SMBH's path by an explosive rejection from with its larger collision partner. M60-UCD1's lower galaxy to SMBH mass ratio suggests that it left the SMBH collision in a direction that limited it's "contact" with the galactic planes of either interacting galaxy. Henize 2-10's collision left it with more time and opportunity to capture stars. This author contends that a one-pass SMBH trajectory-altering collision was more likely to have stripped M60-UCD1 than a "fairly radical orbit"[3] used to simulate tidal stripping.

CD galaxies began their existence as ordinary galaxies. They had masses appropriate to their central super massive BH, and typical galactic shape. And then they collided with larger galaxies. These galactic encounters often produced explosive collisions between their central SMBH, which sent the smaller SMBH partners careening off on independent trajectories, with only the limited stars and gases they could capture from the combined galaxies "on their way out the (new trajectory's) door". Thus CD galaxies are the stripped remnants of violent collisions between pairs of galactic SMBH, which radically changed the smaller SMBH's course. Had the smaller SMBH continued to follow their galaxies' trajectory, these SMBH would likely have retained more of their original galaxy's stars, gases and shape. These stripped galaxies lack typical galactic shape, and contain only the relatively few stars and gases, that they could capture after explosive encounters sent their smaller SMBH off in radically altered trajectories. The intact survival of the smaller SMBH, following trajectory-altering encounters, attests to an effective BH/BH rejection mechanism, as described above, between two SMBH. CD galaxies' violent history would predict Henise 2-10's disheveled appearance and lack of a well-defined galactic plane. Its ragged appearance is more consistent with a quick SMBH grab of nearby stars and gases, than with CD galaxies as methodically stripped remnants of once-normal galaxies. The above scenario suggests that the central SMBH of CD galaxies – while much larger than expected for these galaxies – will be smaller, on average, than SMBH of conventional galaxies, because their SMBH came out "second best" in a galactic collision.

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Six recently observed brilliant, ultraviolet "supernovas" with no trace of hydrogen[4] 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 before hydrogen began to recombine. (The atomic spectrum of hydrogen is absent from their emitted light.) Other explanations are offered which seem more complex than a rare but simple BH/BH collision.

3. THE GRAVITY WAVE OBSERVATION

Recently observed gravity waves revealed that two near-equal mass stBH spiraled into each other and combined[5]. About one billion years ago, this event generated high-energy, rising-frequency gravity waves. Their tremendous energy was likely generated as ~12, contact-induced, increasingly explosive energy releases, caused the paired BH to pulsate to and from each other at ~½ light speed, during the final orbits. Their projected gravity waves eventually consumed the 3 solar masses of the energy missing from the newly-created single BH (62 solar mass). Its predecessors were relatively small, "cool" (36 and 29 solar mass) BH, and their mutual tangential approach reduced their collision striking power, so they did not generate the single strong energy pulse needed to separate their BH trajectories. Instead, the two BH were caught in a series of rejective explosions that siphoned off their available energy into energetic gravity waves until they could no longer explosively resist merger. Their similar sizes also meant that any rejection energy was split between both BH so that neither was able to receive the full force of a rejecting explosion braced against a more massive and "solid" footing. And finally, their smaller sizes limited the energy available for rejection. This limitation occurred because their recently acquired masses had fallen through only their "modest" stBH gravities, and it did not add on the significant extra relativistic mass available from SMBH acquisitions. Thus, their energy to mass ratio paled in comparison with that of their much larger SMBH sisters. The total gravity-wave energy released (3 solar mass) implies that vigorous, explosive energy injections into BH movements caused them to generate gravity waves. If that total energy (or some fraction of it) had been released as a single explosive pulse, during a hard collision, than that pulse (along with significant extra kinetic energy) could have produced rejection into independent trajectories. In fact, given the unique and violent nature of this BH/BH accretion, it may be "the exception (that) proves the rule" of normally-rejective BH/BH encounters.

4. THE EVENT HORIZON DILEMMA

Visible objects crossing a BH event horizon are normally 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

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

5. THE BIG BANG

The BB was a detonation of hot UMBH (UMBH are SMBH that have acquired their former galactic masses) remnants of an expired universe. This detonation released immense energy and "significant" mass, along with accompanying inflation from released space. It detonated 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, inter-UMBH temperatures climbed exponentially -- virtually without limit -- until detonation occurred. The ensuing detonation destroyed all UMBH in its path to instantly release their constrained energy, mass and space. UMBH are the least stable of all common BH because their most recent mass acquisitions had fallen through a very long and powerful gravitation field to reach their surface. These extreme acceleration paths gave new acquisitions kinetic energy and relativistic mass far above $½mc^2$. 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. Spatial presence is space and all things associated with it – they included: a stiff lattice and an intrinsic pressure to expand.

Thus lattice stiffness and expansion pressure indicate the level of spatial presence within a region. (It is intriguing to speculate that spatial presence increased as space fell through UMBH gravity – in much the same way that mass added relativistic mass during acquisition.) 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 galactic mass acquired as it fell through 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 difficult to define), UMBH mass acquisitions eventually traverse these intense gravity fields, and should have accumulated all of the kinetic energy available from this path. And this kinetic energy potential shows up as extra relativistic mass moving at very near light speed. These added relativistic masses raise the new UMBH's gravity significantly above the pre-acquisition sum of galactic and SMBH gravities. This added gravity contributes to universal collapse, and it also assures that the succeeding universe will be even larger than its predecessor. This concept, of successively larger universes, is aesthetically pleasing because (with many preceding universes) it helps to explain how our universe became so large.

There are three additional pleasing features of a BB detonation of UMBH:

1. The inflation sources (hundreds of billions of UMBH) were evenly distributed throughout the BB source, so that inflation occurred evenly as well. (Single-body sourced inflation is less likely to have been as homogeneous.)
2. The collapsing UMBH provide reliable trigger mechanism to set off the BB (exponentially increasing universal temperatures). If everything had collapsed into a single BH, it might last forever.
3. The BHBB scenario allows continuance of time and physical laws though out the BB process. It requires neither "instantaneous" inflation nor temporary suspension of gravity, electro-magnetism or strong and weak nuclear forces.

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 the precursor UMBH had done. Thus, in a cyclic universe, successive BBs freed mass, new relativistic mass, energy and space that had been trapped by galaxy-devouring UMBH of dying universes, and replaced them with successively larger, fresh, new, and 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 (which unfurled at below light speed) 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.

6. INFLATION

The BB released gravity-trapped space from billions of UMBH to unfurl as inflation. (This BHBB theory considers expansion pressure to be an intrinsic property of space.) 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 continuing 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 connection between space and mass – similar to the connection that lengthens radiation wavelengths as space expands, also bends space near mass, and enabled BH to acquire space. This spatial acquisition is especially important in later stages of universe aging -- as space and universal mass accelerated their collapse leading up to the next BB. There is little reason to expect that space is significantly more capable of resisting BH gravity than light.

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 initial, very rapid, inflationary burst. Thus, while "initial" inflation may have inserted significant space into the universe, the universe could have remained within a universal BH event horizon and at risk of collapse without continuing inflation pressure from released space. Continuing inflation later played a key role in galaxy formation (Section 8, "Galactic & Large-Scale Structure…").
2. It does not require conjecture of quantum effects within high-density matter to produce an otherwise unanticipated result -- inflation.
3. 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 from risk of continued implosion following the BB, and inflation's remnants aided galaxy formation and 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 moved toward the BB compaction. This process left behind emptiness, void of space, that the new universe inflated into – unimpeded by residual space from its predecessor.

7. MATTER

We live in a "matter" universe because the "matter" component of UMBH survived the BB along with stBH, which also 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 BHBB theory, as a detonation destroyed UMBH (with their high energy content), and converted them to a less-constrained, expanding, high-temperature – high pressure plasma.

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

8. 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 have produced a broader galactic range, including more small galaxies, or condensed directly into primordial stars -- with no BH formation.

BB-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 galactic, central SMHB.

Young SMBH moved out with inflation to organize galaxies from the vast plasma left by the BB. Continuing inflation was likely important and necessary for galaxy formation: Following the BB, early plasma pressure, rapidly moved mass, energy and space to a straight-in, all-angle bombardment of young SMBH. However, as time progressed, the universe expanded, plasma pressure dropped, and the accumulation mechanism shifted toward passage through an accretion disk. This shift stopped SMBH growth as continuing inflation shifted mass accumulation, in accretion disks, toward galaxy building. Continuing significant inflation moved the inward spiraling masses out from their accretion trajectories and into stable galactic orbits. This orbit expansion stopped SMBH growth and shifted it to their associated galaxies. Over time, as the galaxies grew, they became the dominant local gravities. They continued to draw in significant new mass, while distributing its angular momentum across the growing galactic disk. By this time, accretion disks had disappeared and the rapid inflation that had defeated them mellowed to a slower expansion pace. However, without significant early inflation, SMBH would have continued to acquire new galactic mass directly, to preclude galaxy formation. Fortunately, that did not happen, and instead new galaxies blossomed from mass originally destined to join their central SMBH. (Note that our Sun contains 99.8% of solar system mass, whereas galactic central-bulge masses are ~500 times larger than their central SMBH. This ratio disparity implies that galaxies coalesced with a vastly different formation mechanism than stellar/planetary systems.)

Current theory – that small density spikes in the BB gas cloud built upon themselves to produce SMBH/galaxies -- has three problems:

1. Nuclear reactions, which are promoted by higher pressures, likely sidetracked any plasma movement away from direct BH formation. Thus, plasma initially condenses into a “super” star state, whose core nuclear reactions would vigorously resist further compaction. These super stars would grow rapidly and die young (to form BH), but the time delay would seriously impede onset of SMBH and galaxy formation. Similarly shortly after the BB, very hot and dense, nuclear-reactive, plasma would also resist early direct collapse to BH by increasing its nuclear activity with increasing pressure.
2. Coalescing matter does not proceed directly to the black hole state: A 3+ solar mass neutron star is necessary, however briefly, to achieve an external event horizon, which initiates matter’s final collapse into a BH. Neutron stars are products of iron-induced super novas, and iron was uncommon in the early universe.
3. A coalescence mechanism to initiate SMBH formation would seem to predict a broad continuum of SMBH/galaxy sizes. Many later forming “SMBH” would produce many small ordinary galaxies, which the universe lacks – the BH kernel needed to have been present during the maximum pressures of the BB in order to achieve their more “uniform” super-massive size. Also, according to current theory, later-forming SMBH would likely have passed through a “quasar” phase (according to current quasar theory), fueled by massive accretion disks, 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 plasma and radio quasars support their description as close-coupled, binary SMBH (Section 9, below) and precludes accretion-disk, quasar mechanisms that would likely produce more quasars and a broader galaxy size distribution, skewed toward smaller ordinary galaxies.

Small variations in CMB seem too large in scale to have been produced by billions of proto-galaxies, although low plasma densities from astoundingly massive BH (ASBH – described below) acquisitions might produce them. While some early-universe, computer models may be adjusted to predict SMBH and galaxy formation[6], their BH-seeding mechanisms are weak. 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 Merritt[7] observed that galactic bulges turned out to be 500 times more massive than the giant BH at the hub of their galaxies. The consistency of this ratio suggests that all galaxy building began at a similar time – perhaps at the time of an optimal universal inflation rate for galaxy building. Galactic 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 universe[8] 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 note, "Alternative Mechanisms…", 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. Fischer[9] 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. As the BB detonation wave passed, the surviving BH were located between the detonating UMBH. Thus, behind the detonation, these BH were nudged into filaments along intersections of the inflation "bubbles" that were released by the destroyed UMBH. Here surviving BH established gravitational bonds with their companion BH, and began to accumulate the mass and energy they would need to become super massive. These associations are an early phase of the galactic filaments we see today. Note that spacing

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of the filament structures may thus provide a clue about the number of UMBH that were present in the former universe. 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 galactic filaments is discussed in the "Alternative Mechanisms…", 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 ~10^{+5} times their starting size (as did stBH to become super massive). (The surviving SMBH had lost most their associated galaxies during a much earlier encounter with another larger 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 and "cooler" than its UMBH sisters. Thus, these SMBH may have weighted in at ~10^{+7} solar mass just before the BB and have grown to ~10^{+12} sm by the time common SMBH had stopped acquiring mass. The basic mechanism of mass and energy accumulation into a AMBH from BB plasma was enhanced by significant relativistic mass additions to their new mass and by continued mass accumulation after common SMBH had stopped accumulating mass and begun galaxy building. (Galactic masses are ~500 times the mass of their associated SMBH.) These enhancements or others could have easily added an extra order of magnitude or more to produce final AMBH masses of ~$10^{+13 \text{ or } 14}$ sm. This AMBH, by itself, would be capable of constraining even the Shapley Supercluster[10] (10^{+16+} sm, the largest galactic cluster within a billion light years).

An AMBH's event horizon would likely have swallowed any conventional galaxy that might otherwise have formed around it, and its considerable gravity could certainly constrain neighboring galaxies to orbit about it. Current theory offers no mechanism to form these AMBH, and their existence at the center of the Coma Cluster, the Great Attractor or the Shapley Supercluster would support this aspect of the BHBB theory.

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

This description of quasars, as binary SMBH, explains the unique energy source and stability 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 3) 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 4) possesses smaller dual clouds and a more diffuse electron beam, but may

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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. Note that gravity waves from binary SMBH would be lower in frequency and energy, than those recently observed from accreting stBH, so gravity waves would remove only insignificant energy from paired SMBH.

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

1. Rare, distant, and broad-spectrum, “plasma” 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 radiation. The strong light emissions from this plasma may cause overestimates of quasar size due to current use of accretion disk models for light generation estimates.
2. Strong and stable, 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.

Thus the BHBB theory provides a viable description of the power sources for both objects.

The rare binary SMBH, that power plasma 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). Note, that counter rotation directions of the SMBH pair is the only configuration that is not conflicted by offsets of repulsive explosion effects and that N-S, S-N magnetic alignment is lowest energy and assures that equal and opposite intertwined magnetic fields accelerating particles in both directions along the common orbital axis. 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 into independent paths. The intense energy continually radiating from energetic plasma 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 cleared by pressure from expelled plasma, originating from its central black hole(s). “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.”[10] 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 that 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 some of the largest SMBH may turn out to be interacting binary pairs, which were born active and destine 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+0641[11]. Current theory does not anticipate a quasar this large, this early in a young universe. Recall that hot-plasma is a very efficient light source (per unit of source mass) – likely brighter than current quasar light mechanisms (based on accretion disks) and could lead to over estimates of quasar mass.

The appearance of dual mass-jets or gas clouds leaving quasar galaxies is consistent with plasma quasars as reactive, close-coupled, binary BH. Extreme pressures within the quasar interactive zone push some mass and energy to escape along the low- gravity, binary rotation axis, and (aided by their intense, focused magnetic fields) it 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, emit intense radio frequency radiation. (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 ions[12]. The nuclei that gave up the visible electrons are likewise

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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. Its emitted electron beams appear to be "straight as an arrow" over their 150,000-year path from their central emission source. Also, if we consider that the massive gas clouds at either end of Cygnus A were generated from a much earlier active plasma emission phase, and that the current electron beams still strike near their centers, than their Cygnus A source may have been "rock solid" stable for over 10 billion years. This level of extreme continuity would seem to require an orbiting pair of SMBH rather than a solitary SMBH. A solitary SMBH could become defocused or redirected by a relatively common encounter with a BH or even a neutron star. Thus, two aspects of the beams and clouds demonstrate incredible stability, and this and this stability is a strong argument that their source is a binary pair of SMBH. An earlier plasma quasar phase, of Cygnus A, ejected substantial plasma jets along its orbital axis, to produce its two massive radio gas clouds. Cygnus A's unique stability and extensive gas clouds would be more 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"[13], than current theory would predict. (A binary-pair would originate its jets directly between the two, paired SMBH). Thus, both radio galaxies may turn out to be strong evidence for the BHBB scenario described above.

As the universe expands, the high impact energy between SMBH 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, energy and spatial leakage from the ejected plasma 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, plasma quasars (whose light would be younger) do not exist.

Energetic, radio AGN are longer lived and likely a second or "burned-out" phase of reactive, plasma quasars. Even the super-massive size of plasma quasars cannot sustain them

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indefinitely, and they eventually cease their broad-spectrum emissions– as energy and mass emissions accompanied by spatial release move their separation distance beyond their reactive radius.

10. CONCLUSIONS

The Black Hole Big Bang (BHBB) theory derives from the supported proposition that most colliding black holes (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. A detonation of ultra massive BH (UMBH) powered the BB by releasing their constrained energy (equal to >1/3 of their mass). These UMBH had acquired their galactic masses (along with the added relativistic mass, that these galactic masses had gained during acquisition) to initiate and speed collapse of an old, expiring universe and add new mass to the larger, succeeding 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 (stBH) provided immediate accretion kernels, which quickly grew to super massive size, and then continuing inflation changed accretion disk trajectories into stable galactic orbits to begin galaxy formation.
4. Unexpectedly large SMBH, at the center of compact, dwarf galaxies (CD), were stripped of their original galaxies by a course-altering collision with a larger SMBH, and they left the region as CD galaxies with only the stars and gases they could capture as they departed.
5. Six recently observed, exceptionally bright, ultraviolet “supernovas” are well explained as the product of BH/BH collisions.
6. Recent gravity wave observations, of two stellar BH combining, were generated by ejective explosions, which quickly moved the colliding BH apart – to be followed by a fast gravitational collapse.
7. Close-coupled, binary super-massive BH (SMBH) power energetic plasma 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.
8. Early filaments of linked galaxies, that persist today, began their associations when inflation plumes released by detonated UMBH, nudged BB-surviving stBH into filaments along plume intersections. Growing BH and early galaxy formation extended their initial gravitational attractions. (A filament-maintenance mechanism is described in the “Novel Effects…” note, viXra: 1401.0230, that “follows” this paper.)
9. Galactic clusters coalesced around rare $\sim 10^{+13}$ solar mass astoundingly massive BH that grew to this size from a BB-surviving SMBH.

This BHBB theory uses known entities acting in an evidence-supported scenario to describe BBs that will continue to produce ever-larger succeeding universes indefinitely.

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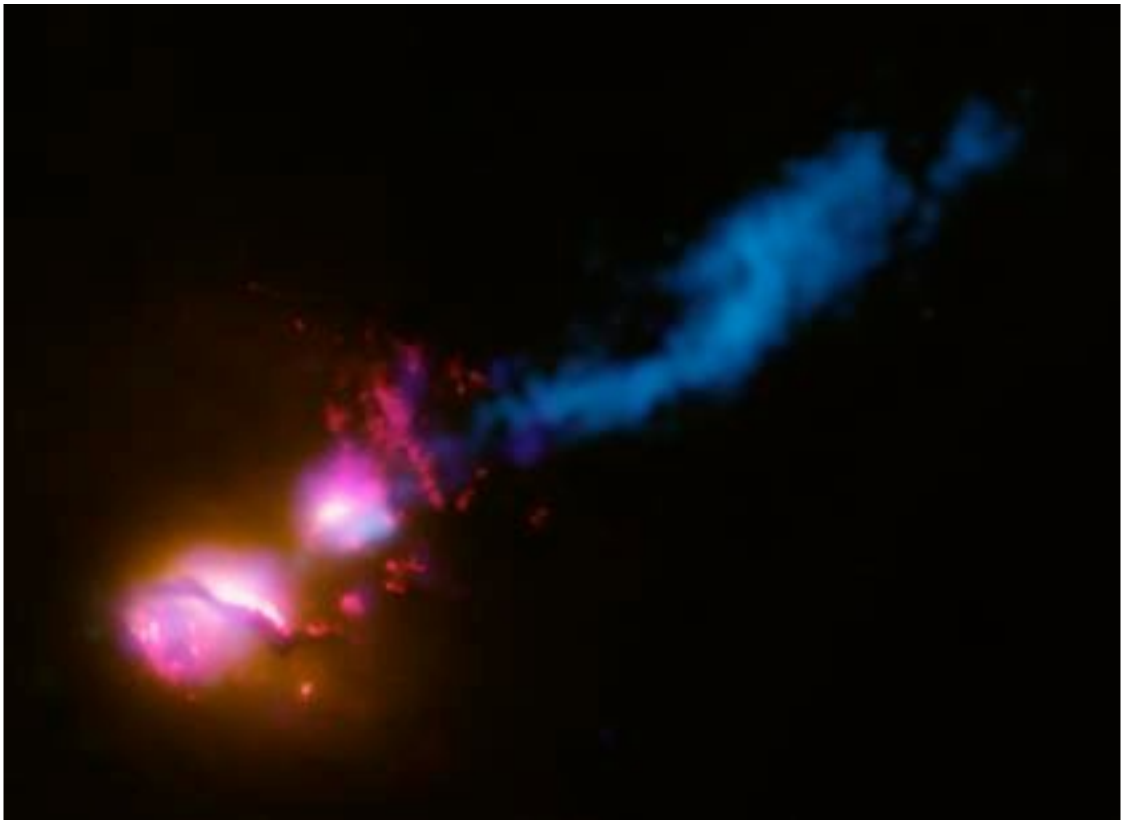

Figure 1. "Death Star Galaxy" (3c321), Credit: X-ray: NASA/CXC/CfA/D.Evans et al.; Optical/UV: NASA/STScI; Radio: NSF/VLA/CfA/D.Evans et al.,STFC/JBO

Figure 2. Henize 2-10, Credit: X-ray (NASA/CXC/Virginia/A.Reines et al); Radio

(NRAO/AUI/NSF); Optical (NASA/STScI)

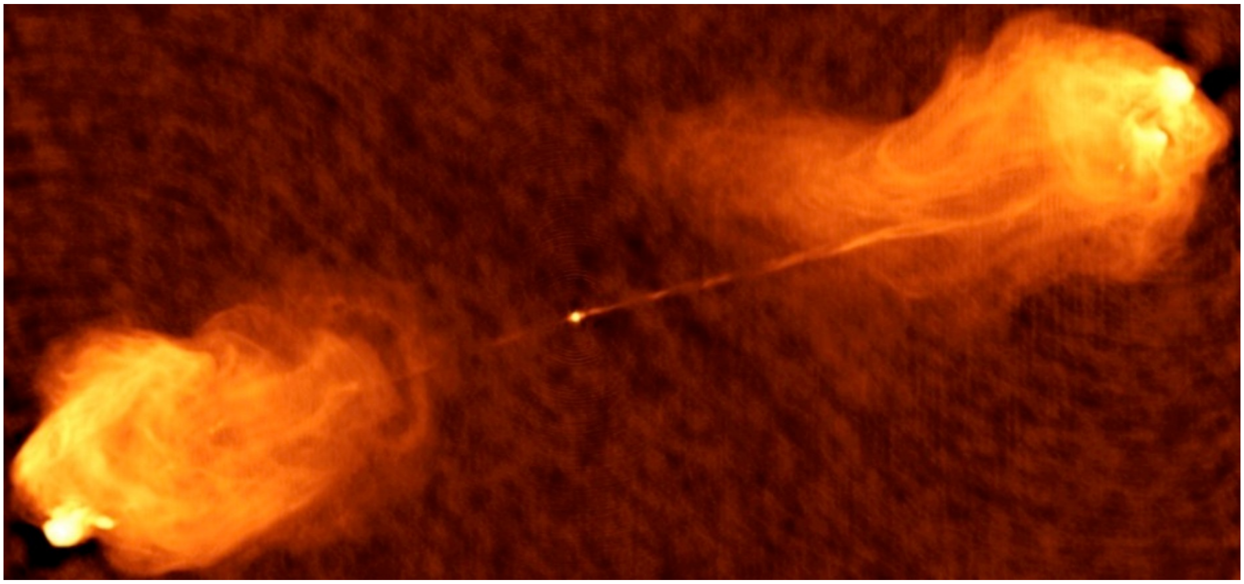

Figure 3. Cygnus A (3C 405), Credit: NRAO/AUI

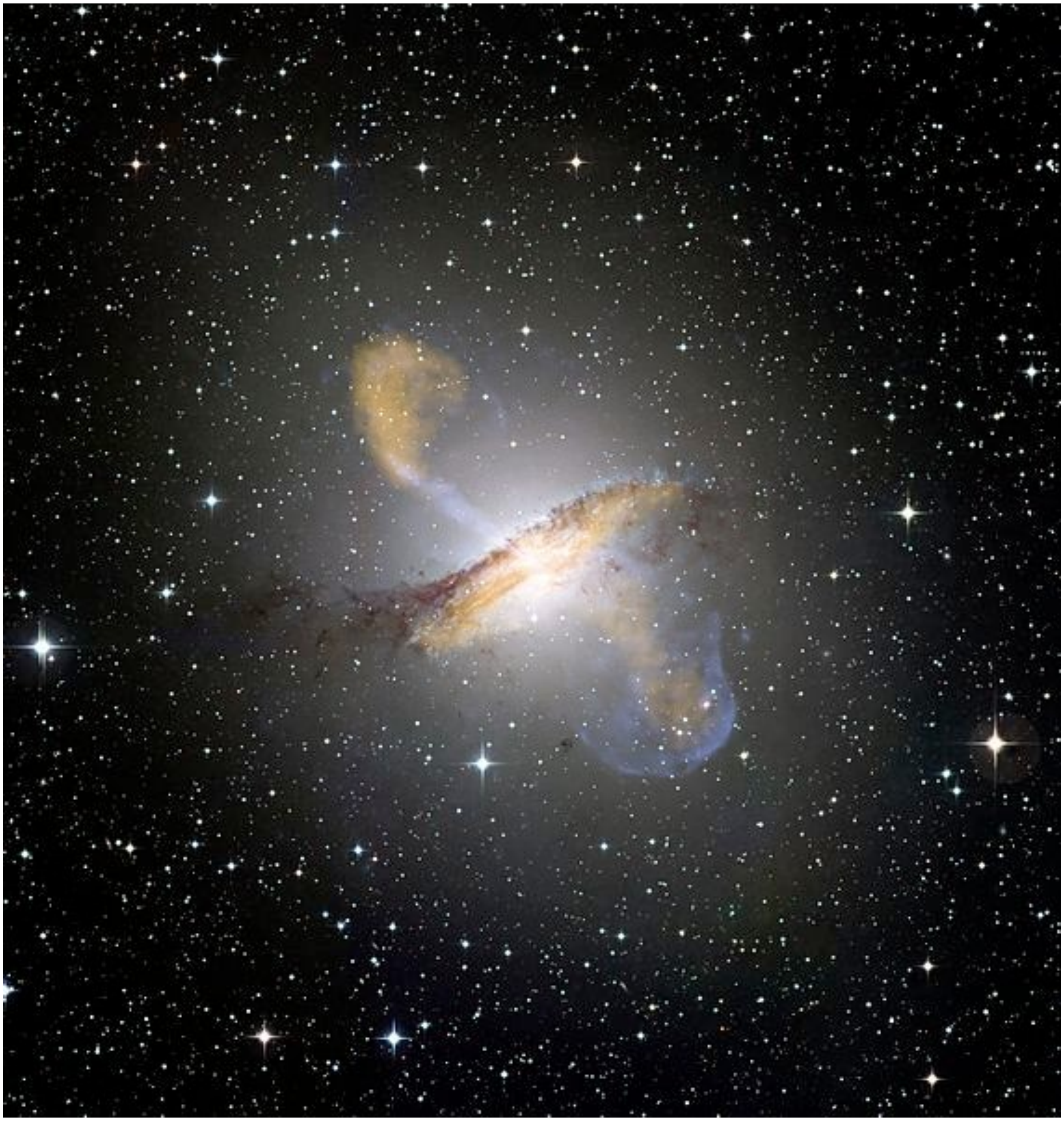

Figure 4. Centaurus A (NGC 5128), Credit: ‘NASA/IPAC Extragalactic Database’.

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