Interpretation of the Helix Planetary Nebula using Hydro-Gravitational-Dynamics: Planets and Dark Energy

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ABSTRACT

Hubble Space Telescope (HST/ACS) images of the Helix Planetary Nebula (NGC 7293) are interpreted using the hydro-gravitational-dynamics theory (HGD) of Gibson 1996-2006. HGD claims that baryonic-dark-matter (BDM) dominates the halo masses of galaxies (Schild 1996) as Jovian (Primordial-fog-particle [PFP]) Planets (JPPs) in proto-globular-star-cluster (PGC) clumps for all galaxy halo diameters bounded by stars. From HGD, supernova Ia (SNe Ia) events always occur in planetary nebulae (PNe) within PGCs. The dying central star of a PNe slowly accretes JPP mass to grow the white-dwarf to $1.44M_\odot$ instability from $\geq 1000M_\odot$ BDM within luminous PNe diameters. Plasma jets, winds and radiation driven by contraction and spin-up of the carbon star evaporate JPPs revealing its Oort accretional cavity. SNe Ia events may thus be obscured or not obscured by radiation-inflated JPP atmospheres producing systematic SNe Ia distance errors, so the otherwise mysterious “dark energy” concept is unnecessary. HST/ACS and WFPC2 Helix images show $> 7,000$ cometary globules and SST/IRAC images show $> 20,000 - 40,000$, here interpreted as gas-dust
cocoons of JPPs evaporated by the spin powered radiation of the PNe central white-dwarf. Observed JPP masses \( \approx 3 \times 10^{25} \) kg with spacing \( \approx 10^{14} \) m for galaxy star forming regions give a density \( \rho \) that fossilizes the primordial density \( \rho_0 \approx 3 \times 10^{-17} \) kg m\(^{-3}\) existing for times \( 10^{12} \leq t \leq 10^{13} \) s when the plasma universe fragmented into proto-superclusters, proto-clusters, and proto-galaxies. Pulsar scintillation spectra support the postulated multi-planet atmospheres.

Subject headings: ISM: structure – Planetary Nebula: general – Cosmology: theory – Galaxy: halo, dark matter, turbulence

1. Introduction

Brightness values of Supernovae Ia (SNe Ia) events, taken as standard candles for red-shift values \( 0.01 < z < 2 \), depart significantly from those expected for the decelerating expansion rate of a flat universe (Riess et al. 2004). Departures indicate a recent dimming at all frequencies by about 30%, but with large scatter attributed to uncertainty in the SNe Ia models. For \( \geq 15 \) years of study such evidence has accumulated with no explanation other than an accelerating(!) expansion rate of the universe, presumed to reflect a negative pressure from a time dependent \( \Lambda(t) \) “cosmological constant” component of the Einstein equations termed “dark-energy” (Bean et al. 2005). Hubble Space Telescope Advanced Camera for Surveys (HST/ACS) images have such high signal to noise ratios that both the scatter and the dimming are statistically significant over the full range of \( z \) values. Bright SNe Ia observed for \( z \geq 0.46 \) exclude “uniform grey dust” systematic errors, supporting a flat universe deceleration of expansion rate until the recent “cosmic jerk” to an accelerated expansion rate for \( z \leq 0.46 \). This physically mysterious “dark energy” interpretation is made from SNe Ia observations because no alternative exists in the commonly accepted (but fluid mechanically untenable) \( \Lambda \)-cold-dark-matter (\( \Lambda \)CDM) hierarchically clustering cosmological theory (\( \Lambda \)CDMHCC, Table 2). In the following we suggest that the primordial exoplanets of HGD provide just the fluid-mechanically-correct alternative demanded by the observed intermittent SNe Ia brightness dimming. New physical laws are not required by HGD but \( \Lambda \)CDMHCC must be discarded. The choice is between planets and dark energy.

When a massive primordial-planet (exoplanet, rogue-planet, planemo, Jovian) population comprised of plasma-fossil-density (\( \rho_0 \) frozen H-He) PGC clumps of JPPs is recognized as the baryonic dark matter (BDM) and the interstellar medium (ISM), new scenarios are required for planetary nebulae (PNe) formation and for star formation, star evolution, and star death. From HGD the average galaxy BDM-ISM mass is \( \approx 30 \times \) the luminous mass of stars and \( \gg \) the more diffusive NBDM-ISM (CDM) mass. The million trillion-planet-PGCs
per galaxy each have fossil-density \( \rho_0 \approx \rho_{PGC} \approx 10^4 \) greater than the \( \langle \rho_g \rangle \approx 10^{-21} \text{ kg m}^{-3} \) galaxy average and \( \approx 10^{9} \langle \rho_u \rangle \), where \( \langle \rho_u \rangle \approx 10^{-26} \text{ kg m}^{-3} \) is the flat universe average density at the present time. All stars and all JPP planets are thus born and grown within such \( 10^6 M_\odot \) PGCs by mergers and accretions of PFP and JPP planets from the large PGC supply. By gravity the planets collect and recycle the dust and water of exploded stars to explain solar terrestrial planets and life. Application of fluid mechanics to the big bang, inflation, and the plasma- and gas- self-gravitational structure formation epochs (Table 1) is termed hydo-gravitational-dynamics (HGD) theory (Gibson 1996, 2000, 2001, 2004, 2005). Viscosity, density and expansion-rate fix plasma gravitational fragmentation scales with a linear-spiral weak-turbulence protogalaxy geometry (Gibson 2006a; Nomura & Post 1998). Voids between the \( 10^{46} \rightarrow 10^{43} \text{ kg} \rho_0 \) supercluster-to-protogalaxy fragments first fill in the plasma epoch and later empty in the gas epoch by diffusion of a more massive neutrino-like population (\( \Omega_{NB} + \Omega_B = 1, \Omega_\Lambda = 0; \Omega = \langle \rho \rangle / \langle \rho_U \rangle \)). Instead of concordance cosmology values (\( \Omega_{NB} = 0.27, \Omega_B = 0.024, \Omega_\Lambda = 0.73 \)) commonly used, HGD gives (\( \Omega_{NB} = 0.968, \Omega_B = 0.032, \Omega_\Lambda = 0 \)). Supercluster voids with radio-telescope-detected scales \( \geq 10^{25} \text{ m} \) at redshift \( z \leq 1 \) (Rudnick et al. 2007) confirm this prediction of HGD, but decisively contradict \( \Lambda \)CDMHC where superclustervoids form last rather than first.

Many adjustments to standard cosmological, astrophysical, and astronomical models are required by HGD (Gibson 2006a, Gibson 2006b) and many puzzling questions are answered. For example, why are most stars binaries and why are population masses of small stars larger than population masses of larger stars (\( m_{SS} \geq m_{LS} \))? From HGD it is because all stars form and grow by a frictional-clumping binary-cascade from small PFP planets. Where do planetary nebulae and supernova remnants get their masses? From HGD these masses are mostly evaporated ambient BDM planets, just as the masses for many stars assumed larger than \( 2M_\odot \) can be attributed mostly to the brightness of the huge (\( \geq 10^{13} \text{ m} \)) dark-matter-planet atmospheres they evaporate (§3 Fig. 3). Masses of supergiant OB and Wolf-Rayet stars are vastly overestimated neglecting evaporated JPP brightness (Maund et al. 2004; Shigeyama & Nomoto 1990). Because stars form from planets the first stars must be small and early. Large \( \geq 2M_\odot \) population III stars forming directly from \( 10^6 M_\odot \) Jeans mass gas clouds in CDM halos never happened and neither did re-ionization of the gas-epoch back to a second plasma-epoch. CDM halos never happened. There were no dark ages because the first stars formed immediately from merging PFP planet-mass clouds before the luminous hot gas cooled (at \( \approx 10^{13} \text{ s} \)). All big stars were once little stars. All little stars were once planets. The mystery of massive low surface brightness galaxies (O’Neil et al. 2007) is solved. From HGD these are protogalaxies where, despite maximum tidal agitation, the central PGCs have remained in their original starless BDM state. All proto-galaxies were created simultaneously without stars at the end of the plasma epoch (at \( \approx 3 \times 10^5 \text{ y} \)).
Jovian rogue planets dominating inner halo galaxy mass densities \((\text{Gibson 1996})\) matches an identical, but completely independent, interpretation offered from Q0957+561A,B quasar microlensing observations \((\text{Schild 1996})\). Repeated, continuous, redundant observations of the Q0957 lensed quasar for \(>20\) years by several observers and telescopes confirm that the mass of galaxies within all radii containing the stars must be dominated by planets \((\text{Colley & Schild 2003}, \text{Schild 2004a}, \text{Schild 2004b}, \text{Gibson 2006a}, \text{Gibson 2006b})\). The non-baryonic dark matter (NBDM) is probably a mix of neutrino flavors, mostly primordial and sterile (weakly collisional) with mass \(m_{NBDM} \approx 30m_{BDM}\). NBDM is super-diffusive and presently forms large outer galaxy halos and galaxy cluster halos. From HGD, the function of NBDM is to continue the decelerating expansion of the universe toward zero velocity (or slightly less) by large scale gravitational forces. A matter dominated \(\Lambda = 0\) flat expanding universe monotonically decelerates from general relativity theory. The entropy produced by its big bang turbulent beginning \((\text{Gibson 2005})\) implies a closed contracting fate for the universe, not an open accelerating expansion driven by dark energy \((\text{Busa et al. 2007})\).

According to HGD, SNe Ia explosions always occur in PNe within PGC massive dense clumps of frozen primordial planets where virtually all stars form and die. Planetary nebulae are not just brief puffs of illuminated gas and dust ejected from dying stars in a vacuum, but are manifestations of \(\approx 3 \times 10^7\) primordial dark matter planets per star in galaxies of 3% bright and 97% dark PGCs. When the JPP supply-rate of H-He gas is too small, stars die and cool as small helium or carbon white dwarfs. With modest internal stratified turbulent mixing rates from larger JPP rates, gravity compresses the carbon core, the angular momentum, and the magnetic field giving strong axial plasma jets and equatorial stratified turbulent plasma winds \((\text{Gibson et al. 2007})\). Nearby JPP planets heated by the star and illuminated by the jets and winds evaporate and become visible as a PNe with a white-dwarf central star. PNe thus appear out of the dark whenever white-dwarf (WD) carbon stars are gradually growing to the Chandrasekhar limit of \(1.44M_\odot\) \((\text{Hamann et al. 2003}, \text{Pena et al. 2004}, \text{Hachisu & Kato 2001})\). Gradual star growth is dangerous to the star because its carbon core may collapse from inadequate radial mass mixing, giving a SNe Ia event. Modest star growth may be even more dangerous because enhanced turbulence may mix and burn the carbon core but not mix the resulting incombustible iron core, which explodes at \(1.4M_\odot\) to form a neutron star in a supernova II event. Rapid stably stratified turbulent mixing within a star forced by a strong JPP rain may mix away both carbon core and iron core instabilities to form \(\gg 2M_\odot\) superstars \((\text{Keto & Wood 2006})\).

Thus when JPPs in a PGC are agitated to high speed \(V_{JPP}\), the rapid growth of its stars will inhibit formation of collapsing carbon cores so that fewer carbon white dwarfs and fewer SNe Ia result. More stars with \(M_{Fe[crit]} \approx 1.4M_\odot < 1.44M_\odot\) will centrally mix and explode as supernova II (SNe II) due to iron core collapse to form neutron stars.
manifested as 1.4\(M_\odot\) pulsars (Thorsett & Chakrabarty 1999). Supernova II remnants such as the Crab are mostly evaporated or evaporating JPPs. The speed \(V_{JPP}\) of planets and planet clumps within a PGC, their spin, and the size and composition of their gas-dust atmospheres are critical parameters to the formation of larger planets, stars, and PNe, and will be the subject of future studies (see Fig. 2 below). These parameters are analogous to the small protein chemicals used for bacterial quorum sensing in symbiotic gene expressions (Loh & Stacey 2003) by providing a form of PGC corporate memory. Numerous dense, cold, water-maser and molecular-gas-clumps detected by radio telescopes in red giants and PNe (Miranda et al. 2001; Tafoya et al. 2007) are massive (\(\geq M_{Jup}\)) JPPs and should be studied as such to reveal important JPP parameters such as \(V_{JPP}\).

A gentle rain of JPP comets permits the possibility that a WD may grow its compressing carbon core to deflagration-detonation at the Chandrasekhar limit (Ropke & Niemeyer 2007). As the core mass and density grow, the angular momentum increases along with the strength of plasma beams and winds, giving strong increases in the WD surface temperature, photon radiation, and observable PNe mass \(M_{PNe}\). Strong JPP rains lead to Wolf-Rayet (C, N and O class) stars cloaked in massive envelopes of evaporating JPPs misinterpreted as superwind ejecta. With larger accretion rates, radially beamed internal wave mixing driven by buoyancy damped turbulence (Keeler et al. 2005; Gibson et al. 2006a; Gibson et al. 2006b) prevents both SNe II detonation at 1.4\(M_\odot\) and SNe Ia detonation at 1.44\(M_\odot\). Turbulence and internal waves cascade from small scales to large, mix and diffuse. With strong forcing, turbulent combustion can be quenched (Peters 2000). With moderate JPP accretion rates, white-dwarfs can gradually burn gas to precisely enough carbon to collapse, spin up, and explode within the PNes they produce.

It is known (Padoan et al. 2005) that Pre-Main-Sequence (PMS) star formation is not understood. Numerical simulations from gas clouds and the Bondi-Hoyle-Littleton model of wake gas accretion show the larger the star the larger the gas accretion rate. By conventional models of stars collapsing from clouds of molecular gas without planets there should be more large (supersolar) stars than small (brown dwarf BD, red dwarf RD) stars, contrary to observations (Calchi-Novati et al. 2005; Alcock et al. 2000; Gahm et al. 2007) that globulette-star-population-mass \(m_{GS}\) decreases as globulette-star-mass \(M_{GS}\) increases; that is, \(m_G \geq m_{BD} \geq m_{RD} \geq m_\odot\). Such a monotonic decrease in \(m_{GS}\) with \(M_{GS}\) giving \(m_{PFP} \geq m_{JPP} \geq m_{BD} \geq m_{RD}\) is expected from HGD where all stars and planets form by hierarchical accretion from \(10^{-3} M_{Jup}\) PFP dark matter planets within \(3 \times 10^{15}\) m Oort cavities in the ISM. Because \(m = NM\), the decrease in \(m_{GS}\) with \(M_{GS}\) is also supported by observations of exoplanet numbers \(N\) showing \(dN/dM \sim M^{-1.2}\) for \(M = (0.04 - 15) M_{Jup}\) (Butler et al. 2006), contrary to conventional planet formation models (Ida & Lin 2004; Boss 2001) where stars form mostly giant \(\geq M_{Jup}\) planets within \(\leq 10^{12}\) m (10 AU) of the protostar.
Aging WR-stars, neutron stars, pulsars, and C-stars are most frequently identified in spiral-galaxy-disks (SGD) where tidal agitation is maximum for the ≈ $10^{18}$ planets of galaxy BDM halos. From HGD, SGDs reflect PGC accretion from the halo. As the initially gaseous PGCs of protogalaxies freeze they become less sticky and collisional, so they diffuse out of their protogalaxy cores (with Nomura scale $L_N \approx 10^{20}$ m ≈ 2 kpc) in growing orbits to form the present $\geq 30L_N$ baryonic dark matter halos \cite{Gibson2006a}. Some tidally agitated PGCs become luminous as they are captured and accreted back toward the original core region, forming SGD accretion disks. Dark or nearly dark PGCs leave thin great circle metal-free star wakes about the Galaxy center to $(2-3)L_N$ radii, triggered and stretched away by tidal forces \cite{Grillmair2006, Belokurov2006, Odenkirchen2001}, where the mass in these ancient star “streams” typically exceeds that of their sources (eg.: the “Orphan Stream”). Dwarf galaxy clumps of PGCs in orbits out to $7L_N$ leave streams of stars and globular clusters \cite{Ibata2002} and high-velocity-clouds of gas (HVCs) at the $15L_N$ distance of the Magellanic cloud stream \cite{Ibata2007}. Observations and HGD contradict suggestions of a non-baryonic dark matter origin or a capture origin for these recently discovered Galactic objects. Thousands of PGCs and their wakes covering $\approx 20\%$ of the sky may be identified with anomalous velocity HVC objects and $\approx 200$ isolated compact CHVCs covering $\approx 1\%$ from their neutral hydrogen signatures, masses $10^{4-5}M_\odot$, distances up to $6 \times 10^{21}$ m $(60L_N)$, and sizes $\approx 10^{17-18}$ m \cite{Putnam2002}. Stars should form slowly enough to make white dwarfs with intermittently dimmed SNe Ia events in such gently agitated PGCs with small $V_JPP$ values. Pulsars, however, always twinkle because lines of sight always intersect fossil electron density turbulence \cite{Gibson2007} atmospheres of planets powerfully evaporated by the SN II event and the pulsar (see Fig. 12 §4, §5).

From HGD, SNe Ia events will be intermittently dimmed by Oort-rim-distant JPP-atmospheres evaporated by the increasing radiation prior to the event that has ionized and accreted all JPPs in the Oort cloud cavity. Evidence of a massive (several $M_\odot$) H-rich circumstellar medium at distances of up to nearly a light year $(10^{16}$ m) after the brightness maximum is indicated by slow fading SNe Ia events \cite{Woods-Vasey2004}. Our scenario of SNe Ia formation by gradual carbon WD growth of $\leq M_\odot$ size stars fed by JPP comets contradicts the standard model for SNe Ia events (see §2.3.1) where superwinds dump most of the mass of $(3-9)M_\odot$ intermediate size stars into the ISM. Few SNe Ia events are seen at large redshifts because billions of years are needed to grow a $1.44M_\odot$ star. In §2.3.1 we question PNe models involving intermediate size stars, their envelopes, and their superwinds. Stars formed by a gassy merging planet clump binary cascade is supported by observations in star forming regions of $(10^{26}-10^{29}$ kg) spherical globulette objects with mass distributions dominated by the small mass globulettes \cite{Gahm2007}.

Theories describing the death of small to intermediate mass stars ($0.5M_\odot-9M_\odot$) to form
white-dwarfs and planetary nebulae are notoriously unsatisfactory (Iben 1984). Neglecting the ambient JPPs of HGD, observations of PNe mass and composition indicate that most of the matter for such stars is inexplicably expelled (Knapp et al. 1982) when they form dense carbon cores and die. Models of PNe formation have long been admittedly speculative, empirical, and without meaningful theoretical guidance (Iben 1984). Multiple dredge-up models reflect complex unknown stellar mixing processes. A counter-intuitive 1975 “Reimer’s Wind” expression gives stellar mass loss rates $\dot{M} \sim LR/M$ inversely proportional to the mass $M$ of the star dumping its mass, where $L$ is its huge luminosity (up to $10^6 L_\odot$) and $R$ is its huge radius (up to $10^2 R_\odot$). Why inversely? “Superwinds” must be postulated (§2.3) to carry away unexpectedly massive stellar envelopes of surprising composition by forces unknown to fluid mechanics and physics in unexpectedly dense fragments in standard numerical models of star evolution (Paxton 2004). Massive $\geq 2M_\odot$ main sequence stars with mass inferred from gravitational-cloud-collapse luminosity-models (Iben 1965) rather than JPP brightness are highly questionable. Mass and species balances in star, PNe and supernova formation models without HGD are uniformly problematic (Shigeyama & Nomoto 1990).

Radiation pressure, even with dust and pulsation enhancement, is inadequate to explain the AGB superwind (Woitke 2006). Shock wave effects cannot explain the large densities of the Helix cometary knots (§3). All these surprises vanish when one recognizes that the interstellar medium consists of primordial H-He planets rather than a hard vacuum. From HGD, planetary nebulae contain $\geq 1000M_\odot$ of unevaporated JPPs from observed PNe radii $3 \times 10^{16}$ m assuming the BDM density in star forming regions is $3 \times 10^{-17}$ kg m$^{-3}$. Less than 1% of these JPPs must be evaporated and ionized to form the unexpectedly massive stellar envelopes in place rather than ejected as superwinds. Why is it credible that a star can dump 94% of its mass into the ISM when it forms a carbon core? From HGD, the AGB-envelope-superwind concepts are failed working hypotheses like CDM, $\Lambda$ and dark energy.

By coincidence, the direction opposite to the peak Leonid meteoroid flux in November 2002 matched that of the closest planetary nebula (PNe) Helix (NGC 7293), so that the Hubble Helix team of volunteers could devote a substantial fraction of the 14 hour Leonid stand-down period taking photographs with the full array of HST cameras, including the newly installed wide angle Advanced Camera for Surveys (ACS). A composite image was constructed with a 4 m telescope ground based image mosaic (O’Dell et al. 2004) to show the complete system. Helix is only 219 (198-246) pc $\approx 6.6 \times 10^{18}$ m from earth (Harris et al. 2007) with one of the hottest and most massive known central white dwarf stars (120,000 K, $M_{WD} \approx M_\odot$), and is also the dimmest PNe (Gorny et al. 1997). With either a close (dMe) X-ray companion (Guerrero et al. 2001) or just a JPP accretion disk (Su et al. 2007) it powerfully beams radiation and plasma into the interstellar medium (ISM) surroundings. Thus Helix provides an ideal laboratory to test our claims from theory and
observation (Gibson 1996; Schild 1996) that both the ISM of star forming regions of galaxies and the baryonic-dark-matter (BDM) of the universe are dominated by dense collections of volatile primordial frozen-gas planets.

In §3 we compare HST/ACS Helix and other PNe observations with HGD and standard explanations of cometary globule and planetary nebula formation. Planetary nebulae from HGD are not just transient gas clouds emitted by dying stars, but baryonic dark matter brought out of cold storage. A new interpretation of Oort cloud comets and the Oort cloud itself appears naturally, along with evidence (Matese et al. 1999) of Oort comet deflection by an \( \approx 3 \times 10^{27} \) kg solar system \( \geq \)Jupiter-mass JPP at the Oort cavity distance \( \approx 3 \times 10^{15} \) m. The first direct detection of PFPs in Helix (O’Dell et al. 2007) is discussed in §4 and the detection of 40,000 infrared Helix JPP atmospheres (Hora et al. 2006) in §5, consistent with pulsar evidence (§4, §5).

In the following §2 we review hydro-gravitational-dynamics theory and some of the supporting evidence, and compare the PNe predictions of HGD with standard PNe models and the observations in §3. We discuss our “nonlinear grey dust” alternative to “dark energy” in §4 and summarize results in §5. Finally, in §6, some conclusions are offered.

### 2. Theory

#### 2.1. HGD structure formation

Standard CDMHC cosmologies are based on flawed concepts about turbulence, ill-posed, over-simplified fluid mechanical equations, an inappropriate assumption that primordial astrophysical fluids are collisionless, and the assumption of zero density to achieve a solution of the equations. This obsolete Jeans 1902 theory neglects non-acoustic density fluctuations, viscous forces, turbulence forces, particle collisions, differences between particles, and the effects of multiparticle mixture diffusion on gravitational structure formation, all of which can be crucially important in some circumstances where astrophysical structures form by self gravity. Jeans did linear perturbation stability analysis (neglecting turbulence) of Euler’s equations (neglecting viscous forces) for a completely uniform ideal gas with density \( \rho \) only a function of pressure (the barotropic assumption) to reduce the problem of self-gravitational instability to one of gravitational acoustics. Diffusivity effects were not considered.

To satisfy Poisson’s equation \( \nabla^2 \phi = 4\pi G\rho \) for the gravitational potential \( \phi \) of a collisionless ideal gas, Jeans assumed the density \( \rho \) was zero in a maneuver appropriately known as the “Jeans swindle”. The only critical wave length for gravitational instability with all
these questionable assumptions is the Jeans acoustical length scale $L_J$ where

$$L_J \equiv \frac{V_S}{(\rho G)^{1/2}} \gg (p/\rho^2 G)^{1/2} \equiv L_{JHS},$$

$G$ is Newton’s gravitational constant and $V_S \approx (p/\rho)^{1/2}$ is the sound speed.

The Jeans hydrostatic length scale $L_{JHS} \equiv (p/\rho^2 G)^{1/2}$ in Eq. 1 has been misinterpreted by Jeans 1902 and others as an indication that pressure can somehow prevent the formation of structures by gravity at length scales smaller than $L_J$. Viscosity, turbulence and diffusivity can prevent small scale gravitational structure formation at Schwarz scales (Table 1). Pressure cannot. In a hydrodynamic description, ratio $h = p/\rho$ is the stagnation specific enthalpy for gravitational condensation and rarefaction streamlines. The appropriate reference enthalpy $h_0$ is zero from Bernoulli’s equation $B = p/\rho + v^2/2 = constant$ from the first law of thermodynamics for adiabatic, isentropic, ideal gas flows at the beginning of structure formation, where $v = 0$ is the fluid speed. In an expanding universe where $v = r\gamma$ the positive rate of strain $\gamma$ is important at large radial values $r$ and favors fragmentation. In the initial stages of gravitational instability, pressure is a slave to the velocity and is irrelevant because it drops out of the momentum equation. “Where the speed is greatest the pressure is least” with $B$ constant quotes the usual statement of Bernoulli’s law. For supersonic real gases and plasmas at later stages the specific enthalpy term $p/\rho$ acquires a factor of $\approx 5/2$ famously neglected by Newton in his studies of acoustics without the second law of thermodynamics (Pilyugin & Usov 2007). Turbulence concepts of HGD are necessary (Gibson et al. 2007).

Pressure support and thermal support are concepts relevant only to hydrostatics. For hydrodynamics, where the velocity is non-zero, pressure appears in the Navier-Stokes momentum equation only in the $\nabla B \approx 0$ term. Non-acoustic density extrema are absolutely unstable to gravitational structure formation (Gibson 1996; Gibson 2000). Minima trigger voids and maxima trigger condensates at all scales not stabilized by turbulent forces, viscous forces, other forces, or diffusion (see Eqs. 3-5 and Table 1 below). The Jeans acoustic scale $L_J$ is the size for which pressure can equilibrate acoustically without temperature change in an ideal gas undergoing self gravitational collapse or void formation, smoothing away all pressure forces and all pressure resistance to self gravity. The Jeans hydrostatic scale $L_{JHS}$ is the size of a fluid blob for which irreversibilities such as frictional forces or thermonuclear heating have achieved a hydrostatic equilibrium between pressure and gravitation in a proto-Jovian-planet or proto-star. $L_{JHS}$ is generically much smaller than $L_J$ and has no physical significance until gravitational condensation has actually occurred and a hydrostatic equilibrium has been achieved.

When gas condenses on a non-acoustic density maximum due to self gravity a variety of results are possible. If the amount is much larger than the Eddington limit $110 M_\odot$ permitted by radiation pressure, a turbulent maelstrom, superstar, and possibly a black hole
(or magnetosphere eternally collapsing object MECO) may appear. If the amount is small, a gas planet can form in hydrostatic equilibrium as the gravitational potential energy is converted to heat by turbulent friction, and is radiated. The pressure force \( F_p \approx p \times L^2 \) matches the gravitational force of the planet at \( F_G \approx \rho^2 G L^4 \) at the hydrostatic Jeans scale \( L_{JHS} \). Pressure \( p \) is determined by a complex mass-momentum-energy balance of the fluid flow and ambient conditions. A gas with uniform density is absolutely unstable to self gravitational structure formation on non-acoustic density perturbations at scales larger and smaller than \( L_J \) and is unstable to acoustical density fluctuations on scales larger than \( L_J \) (Gibson 1996). Pressure and temperature cannot prevent structure formation on scales larger or smaller than \( L_J \). Numerical simulations showing sub-Jeans scale instabilities are rejected as “artificial fragmentation” based on Jeans’ misconceptions (Truelove et al. 1997). The fragmentation is real, and the rejection is a serious mistake.

Density fluctuations in fluids are not barotropic as assumed by Jeans 1902 except rarely in small regions for short times near powerful sound sources. Density fluctuations that triggered the first gravitational structures in the primordial fluids of interest were likely non-acoustic (non-barotropic) density variations from turbulent mixing of temperature and chemical species concentrations reflecting big bang turbulence patterns (Gibson 2001, 2004, 2005) as shown by turbulence signatures (Bershadskii and Sreenivasan 2002; Bershadskii 2006) in the cosmic microwave background temperature anisotropies. From Jeans’ theory without Jeans’ swindle, a gravitational condensation on an acoustical density maximum rapidly becomes a non-acoustical density maximum because the gravitationally accreted mass retains the (zero) momentum of the motionless ambient gas. The Jeans 1902 analysis was ill posed because it failed to include non-acoustic density variations as an initial condition.

Fluids with non-acoustic density fluctuations are continuously in a state of structure formation due to self gravity unless prevented by diffusion or fluid forces (Gibson 1996). Turbulence or viscous forces can dominate gravitational forces at small distances from a point of maximum or minimum density to prevent gravitational structure formation, but gravitational forces will dominate turbulent or viscous forces at larger distances to cause structures if the gas or plasma does not diffuse away faster than it can condense or rarify due to gravity. The concepts of pressure support and thermal support are artifacts of the erroneous Jeans criterion for gravitational instability. Pressure forces could not prevent gravitational structure formation in the plasma epoch because pressures equilibrate in time periods smaller that the gravitational free fall time \( (\rho G)^{-1/2} \) on length scales smaller than the Jeans scale \( L_J \), and \( L_J \) in the primordial plasma was larger than the Hubble scale of causal connection \( L_J > L_H = ct \), where \( c \) is light speed and \( t \) is time. Therefore, if gravitational forces exceed viscous and turbulence forces in the plasma epoch at Schwarz scales \( L_{ST} \) and \( L_{SV} \) smaller than \( L_H \) (Table 1) then gravitational structures will develop, independent of the
Jeans criterion. Only a very large diffusivity \((D_B)\) could interfere with structure formation in the plasma. Diffusion prevents gravitational clumping of the non-baryonic dark matter (cold or hot) in the plasma epoch because \(D_{NB} \gg D_B\) and \((L_{SD})_{NB} \gg L_H\). Diffusion does not prevent fragmentation of the baryonic material at 30,000 years when \((L_{SD})_B \leq L_H\).

Consider the gravitational response of a large motionless body of uniform density gas to a sudden change at time \(t = 0\) on scale \(L \ll L_J\) of a rigid mass perturbation \(M(t)\) at the center, either a cannonball or vacuum beach ball depending on whether \(M(0)\) is positive or negative (Gibson 2000). Gravitational forces cause all the surrounding gas to accelerate slowly toward or away from the central mass perturbation. Integrating the radial gravitational acceleration \(dv_r/dt = -GM/r^2\) gives the radial velocity

\[
v_r = -GM(t)tr^{-2}
\]

so the central mass increases or decreases at a rate

\[
dM(t)/dt = -v_r4\pi r^2\rho = 4\pi\rho GM(t)t
\]

substituting the expression for \(v_r\). Separating variables and integrating gives

\[
M(t) = M(0)exp(\pm2\pi\rho Gt^2), t \ll t_G
\]

respectively, where nothing much happens for time periods less than the gravitational free fall time \(t_G = (\rho G)^{-1/2}\) except for a gradual build up or depletion of the gas near the center. Note that the classic Bondi-Hoyle-Littleton accretion rate \(dM_{BH}/dt \approx 4\pi\rho(GM)^2V_S^{-3}\) on point masses \(M\) in a gas of density \(\rho\) is contradicted. The sound speed \(V_S\) is irrelevant to point mass accretion rates for the same reasons \(V_S\) is irrelevant to gravitational structure formation for times \(t \ll t_G\).

For condensation, at \(t = 0.43t_G\) the mass ratio \(M(t)/M(0)\) for \(r < L\) has increased by only a factor of 2.7, but goes from 534 at \(t = t_G\) to \(10^{11}\) at \(t = 2t_G\) during the time it would take for an acoustic signal to reach a distance \(L_J\). Hydrostatic pressure changes are concentrated at the Jeans hydrostatic scale \(L_{JHS} \ll L_J\). Pressure support and the Jeans 1902 criterion clearly fail in this exercise, indicating failure of CDMHC cosmology.

The diffusion velocity is \(D/L\) for diffusivity \(D\) at distance \(L\) (Gibson 1968a; Gibson 1968b) and the gravitational velocity is \(L(\rho G)^{1/2}\). The two velocities are equal at the diffusive Schwarz length scale

\[
L_{SD} \equiv [D^2/\rho G]^{1/4}.
\]

Weakly collisional particles such as the hypothetical cold-dark-matter (CDM) material cannot possibly form clumps, seeds, halos, or potential wells for baryonic matter collection
because the CDM particles have large diffusivity and will disperse, consistent with observations \cite{Sand et al. 2002}. Diffusivity $D \approx V_p \times L_c$, where $V_p$ is the particle speed and $L_c$ is the collision distance. Because weakly collisional particles have large collision distances with large diffusive Schwarz lengths the non-baryonic dark matter (possibly neutrinos) is the last material to fragment by self gravity and not the first as assumed by CDM cosmologies. The first structures occur as proto-supercluster-voids in the baryonic plasma controlled by viscous and weak turbulence forces, independent of diffusivity ($D \approx \nu$). The CDM seeds postulated as the basis of CDMHCC never happened because ($L_{SD,NB} \gg ct$) in the plasma epoch. Because CDM seeds and halos never happened, hierarchical clustering of CDM halos to form galaxies and their clusters never happened (Gibson 1996, 2000, 2001, 2004, 2005, 2006a, 2006b).

Cold dark matter was invented to explain the observation that gravitational structure formed early in the universe that should not be there from the Jeans 1902 criterion that forbids structure in the baryonic plasma because ($L_J_B > L_H$) during the plasma epoch (where sound speed approached light speed $V_S = c/\sqrt{3}$). In this erroneous CDM cosmology, non-baryonic particles with rest mass sufficient to be non-relativistic at their time of decoupling are considered “cold” dark matter, and are assumed to form permanent, cohesive clumps in virial equilibrium that can only interact with matter and other CDM clumps gravitationally. This assumption that CDM clumps are cohesive is unnecessary, unrealistic, and fluid mechanically untenable. Such clumps are unstable to tidal forces because they lack particle collisions necessary to produce cohesive forces to hold them together \cite{Gibson 2006a}.

Numerical simulations of large numbers of falsely cohesive CDM clumps show a tendency for the clumps to clump further due to gravity to form “dark matter halos”, falsely justifying the cold dark matter hierarchical clustering cosmology (CDMHCC). The clustering “halos” grow to $10^6 M_\odot$ by about $z = 20$ \cite{Abel et al. 2002} as the universe expands and cools and the pre-galactic clumps cluster. Gradually the baryonic matter (at $10^{16}$ s) falls into the growing gravitational potential wells of the CDM halos, cools off sufficiently to form the first (very massive and very late at 300 Myr) Population III stars whose powerful supernovas reionized all the gas of the universe \cite{O'Shea & Norman 2006}. However, observations show this never happened \cite{Aharonian et al. 2006; Gibson 2006a}. Pop-III photons are not detected, consistent with the HGD prediction that they never existed and that the first stars formed at $10^{13}$ s (0.3 Myr) and were quite small except at the cores of PGCs at the cores of the protogalaxies. The missing hydrogen cited as (“Gunn-Peterson trough”) evidence for reionization is actually sequestered as PGC clumps of frozen JPP planets. As we have seen, CDMHCC is not necessary since the Jeans 1902 criterion is incorrect. Baryons (plasma) begin gravitational structure formation during the plasma epoch when the horizon scale exceeds the largest Schwarz scale \cite{Gibson 1996; Gibson 2000}.
Clumps of collisionless or collisional CDM would either form black holes or thermalize in time periods of order the gravitational free fall time \((\rho G)^{-1/2}\) because the particles would gravitate to the center of the clump by core collapse where the density would exponentiate, causing double and triple gravitational interactions or particle collisions that would thermalize the velocity distribution and trigger diffusional evaporation. For collisional CDM, consider a spherical clump of perfectly cold CDM with mass \(M\), density \(\rho\), particle mass \(m\) and collision cross section \(\sigma\). The clump collapses in time \((\rho G)^{-1/2}\) to density \(\rho_c = (m/\sigma)^{3/2}M^{-1/2}\) where collisions begin and the velocity distribution thermalizes. Particles with velocities greater than the escape velocity \(v \approx 2MG/r\) then diffuse away from the clump, where \(r = (M/\rho)^{1/3}\) is the initial clump size. For typically considered CDM clumps of mass \(\approx 10^{36}\) kg and CDM particles more massive than \(10^{-24}\) kg (WIMPs with \(\sigma \approx 10^{-42}\) m\(^2\) small enough to escape detection) the density from the expression would require a collision scale smaller than the clump Schwarzschild radius so that such CDM clumps would collapse to form black holes. Less massive motionless CDM particles collapse to diffusive densities smaller than the black hole density, have collisions, thermalize, and diffuse away. From the outer halo radius size measured for galaxy cluster halos it is possible to estimate the non-baryonic dark matter particle mass to be of order \(10^{35}\) kg (10 ev) and the diffusivity to be \(\approx 10^{30}\) m\(^2\) s\(^{-1}\) (Gibson 2000). Thus, CDM clumps are neither necessary nor physically possible, and are ruled out by observations (Sand et al. 2002). It is recommended that the CDMHC scenario for structure formation and cosmology be abandoned.

The baryonic matter is subject to large viscous forces, especially in the hot primordial plasma and gas states existing when most gravitational structures first formed (Gibson 2000). The viscous forces per unit volume \(\rho v \gamma L^2\) dominate gravitational forces \(\rho^2 GL^4\) at small scales, where \(v\) is the kinematic viscosity and \(\gamma\) is the rate of strain of the fluid. The forces match at the viscous Schwarz length

\[
L_{SV} \equiv (v \gamma / \rho G)^{1/2},
\]

which is the smallest size for self gravitational condensation or void formation in such a flow. Turbulent forces may permit larger mass gravitational structures to develop; for example, in thermonuclear maelstroms at galaxy cores to form central black holes. Turbulent forces \(\rho \varepsilon^{2/3} L^{8/3}\) match gravitational forces \(\rho^2 GL^4\) at the turbulent Schwarz scale

\[
L_{ST} \equiv \varepsilon^{1/2} / (\rho G)^{3/4},
\]

where \(\varepsilon\) is the viscous dissipation rate of the turbulence. Because in the primordial plasma the viscosity and diffusivity are identical and the rate-of-strain \(\gamma\) is larger than the free-fall frequency \((\rho G)^{1/2}\), the viscous and turbulent Schwarz scales \(L_{SV}\) and \(L_{ST}\) will be larger than the diffusive Schwarz scale \(L_{SD}\), from (3), (4) and (5).
The criterion for structure formation in the plasma epoch is that both $L_{SV}$ and $L_{ST}$ become less than the horizon scale $L_H = ct$. Reynolds numbers in the plasma epoch were near critical, with $L_{SV} \approx L_{ST}$. From $L_{SV} < ct$, gravitational structures first formed when $\nu$ first decreased to values less than radiation dominated values $c^2t$ at time 30,000 years or $t \approx 10^{12}$ seconds (Gibson 1996), well before $10^{13}$ seconds which is the time of plasma to gas transition (300,000 years). Because the expansion of the universe inhibited condensation but enhanced void formation in the weakly turbulent plasma, the first structures were proto-supercluster-voids in the baryonic plasma. At $10^{12}$ s

$$(L_{SD})_B \gg L_{SV} \approx L_{ST} \approx 5 \times L_K \approx L_H = 3 \times 10^{20} \text{m} \gg (L_{SD})_B,$$

where $(L_{SD})_B$ refers to the non-baryonic component and $L_{SV}$, $L_{ST}$, $L_K$, and $(L_{SD})_B$ scales refer to the baryonic (plasma) component. Acoustic peaks inferred from CMB spectra reflect acoustic signatures of the first gravitational structure formation and the sizes of the voids (see §4 Fig. 9). These supercluster voids are cold spots on the CMB and completely empty at $10^{25}$ m scales from radio telescope measurements (Rudnick et al. 2007). Because such scales require impossible clustering speeds, this strongly contradicts $\Lambda$CDM HC.

As proto-supercluster mass plasma fragments formed, the voids filled with non-baryonic matter by diffusion, thus inhibiting further structure formation by decreasing the gravitational driving force. The baryonic mass density $\rho \approx 3 \times 10^{-17} \text{kg/m}^3$ and rate of strain $\gamma \approx 10^{-12} \text{s}^{-1}$ were preserved as hydrodynamic fossils within the proto-supercluster fragments and within proto-cluster and proto-galaxy objects resulting from subsequent fragmentation as the photon viscosity and $L_{SV}$ decreased prior to the plasma-gas transition and photon decoupling (Gibson 2000). As shown in Eq. 6, the Kolmogorov scale $L_K \equiv [\nu^3/\varepsilon]^{1/4}$ and the viscous and turbulent Schwarz scales at the time of first structure matched the horizon scale $L_H \equiv ct \approx 3 \times 10^{20} \text{m}$, freezing in the density, strain-rate, and spin magnitudes and directions of the subsequent proto-cluster and proto-galaxy fragments of proto-superclusters. Remnants of the strain-rate and spin magnitudes and directions of the weak turbulence at the time of first structure formation are forms of fossil vorticity turbulence (Gibson 1999).

The quiet condition of the primordial gas is revealed by measurements of temperature fluctuations of the cosmic microwave background radiation that show an average $\delta T/T \approx 10^{-5}$ too small for much turbulence to have existed at that time of plasma-gas transition ($10^{13}$ s). Turbulent plasma motions were strongly damped by buoyancy forces at horizon scales after the first gravitational fragmentation time $10^{12}$ s. Viscous forces in the plasma are inadequate to explain the lack of primordial turbulence ($\nu \geq 10^{20} \text{m}^2 \text{s}^{-1}$ is required but, after $10^{12}$ s, $\nu \leq 4 \times 10^{26}$, Gibson 2000). The observed lack of plasma turbulence proves that large scale buoyancy forces, and therefore self gravitational structure formation, must have begun in the plasma epoch $\approx 10^{11} - 10^{13}$ s.
The gas temperature, density, viscosity, and rate of strain are all precisely known at transition, so the gas viscous Schwarz mass $L_{3SV}^3 \rho$ is $10^{21-25}$ kg, the mass of a small planet (Mars-Earth), or about $10^{-6} M_\odot$, with uncertainty a factor of ten. From HGD, soon after the cooling primordial plasma turned to gas at $10^{13}$ s (300,000 yr), the entire baryonic universe condensed to a fog of hot planetary-mass primordial-fog-particle (PFPs) clouds, preventing collapse at the acoustic Jeans mass. In the cooling universe these gas-cloud objects cooled and shrank, formed H-He rain, and froze solid to become the BDM and the basic material of construction for stars and everything else, presently $\approx 30 \times 10^6$ rogue planets per star in trillion-planet Jeans-mass ($10^{36}$ kg) PGC clumps.

The Jeans mass $L_J^3 \rho$ of the primordial gas at transition was about $10^6 M_\odot$, also with $\approx \times 10$ uncertainty, the mass of a globular-star-cluster (GC). Proto-galaxies fragmented at the PFP scale but also at this proto-globular-star-cluster PGC scale $L_J$, although not for the reasons given by the Jeans 1902 theory. Density fluctuations in the gaseous proto-galaxies were absolutely unstable to void formation at all scales larger than the viscous Schwarz scale $L_{3SV}$. Pressure can only remain in equilibrium with density without temperature changes in a gravitationally expanding void on scales smaller than the Jeans scale. From the second law of thermodynamics, rarefaction wave speeds are limited to speeds less than the sonic velocity. Density minima expand due to gravity to form voids subsonically. Cooling could therefore occur and be compensated by radiation in the otherwise isothermal primordial gas when the expanding voids approached the Jeans scale. Gravitational fragmentations of proto-galaxies were then accelerated by radiative heat transfer to these cooler regions, resulting in fragmentation at the Jeans scale and isolation of proto-globular-star-clusters (PGCs) with the primordial-gas-Jeans-mass.

These PGC objects were not able to collapse from their own self gravity because of their internal fragmentation at the viscous Schwarz scale to form $\approx 10^{24}$ kg PFPs. The fact that globular star clusters have precisely the same density $\approx \rho_0$ and primordial-gas-Jeans-mass from galaxy to galaxy proves they were all formed simultaneously soon after the time of the plasma to gas transition $10^{13}$ s. The gas has never been so uniform since, and no mechanism exists to recover such a high density, let alone such a high uniform density, as the fossil turbulent density value $\rho_0 \approx 3 \times 10^{-17}$ kg/m$^3$. Young globular cluster formation in BDM halos in the Tadpole, Mice, and Antennae galaxy mergers (Gibson & Schild 2003a) show that dark PGC clusters of PFPs are remarkably stable structures, persisting without disruption or star formation for more than ten billion years.
2.2. Observational evidence for PGCs and PFPs

Searches for point mass objects as the dark matter by looking for microlensing of stars in the bulge and the Magellanic clouds produced a few reliable detections and many self-lenses, variable stars and background supernova events, leading to claims by the MACHO/OGLE/EROS consortia that this form of dark matter has been observationally excluded (Alcock et al. 1998). These studies have all assumed a uniform (“Gaussian”) density rather than the highly clumped (“log-Gaussian”) density (Gibson & Schild 1999) with a non-linear frictional accretion cascade for the MAssive Compact Halo Objects (MACHOs) expected from HGD. Sparse sampling reduces detection sensitivity to small clumped planetary mass objects. Since PFPs within PGC clumps must accretionally cascade over a million-fold mass range to produce JPPs and stars their statistical distribution becomes an intermittent lognormal that will profoundly affect an appropriate sampling strategy and microlensing data interpretation. This rules out the exclusion of PFP mass objects as the baryonic dark matter (BDM) of the Galaxy by MACHO/OGLE/EROS (Gibson & Schild 1999). OGLE campaigns focusing on large planetary mass \( 10^{-3} M_\odot \) to brown dwarf mass objects have revealed 121 transiting and orbiting candidates, some with orbits less than one day (Udalski et al. 2003). More recent observations toward M31 give 95% confidence level claims that brown dwarf MACHOs comprise \( \approx 20\% \) of the combined MW-M31 dark matter halo (Calchi-Novati et al. 2005). Estimates for the MW halo of \( \approx 0.2 M_\odot \) lenses from LMC stars have increased to \( \approx 16\% \) (Alcock et al. 2000; Bennett 2005). Both of these estimates increase by a large factors (\( \gg 5 \)) from HGD when JPP clumping into PGCs is taken into account since microlensing by a JPP planet requires a line of sight passing through a PGC and PGCs (as CHVCs) occupy a small fraction of the sky (\( \approx 1\% \)) with HVC wakes (\( \approx 20\% \)).

Evidence that planetary mass objects dominate the BDM in galaxies has been gradually accumulating and has been reviewed (Gibson & Schild 2003b). Cometary knot candidates for PFPs and JPPs appear whenever hot events like white dwarfs, novas, plasma jets, Herbig-Haro objects, and supernovas happen, consistent with the prediction of HGD that the knots reveal Jovian planets that comprise the BDM, as we see for the planetary nebulae in the present paper. However, the most convincing evidence for our hypothesis, because it averages the dark matter over much larger volumes of space, is provided by one of the most technically challenging areas in astronomy; that is, quasar microlensing (Schild 1996). Several years and many dedicated observers were required to confirm the Schild 1996 measured time delay of the Q0957 lensed quasar images so that the twinkling of the subtracted light curves could be confirmed and the frequency of twinkling interpreted as evidence that the dominant point mass objects of the lensing galaxy were of small planetary mass.

By using multiple observatories around the Earth it has now been possible to accurately
establish the Q0957 time delay at 417.09 ± 0.07 days (Colley et al. 2002, 2003). With this unprecedented accuracy a statistically significant microlensing event of only 12 hours has now been detected (Colley & Schild 2003) indicating a $7.4 \times 10^{22}$ kg (moon-mass) PFP. An additional microlensing system has been observed (Schechter et al. 2003) and confirmed, and its time delay measured (Ofek and Maoz 2003). To attribute the microlensing to stars rather than planets required Schechter et al. 2003 to propose relativistic knots in the quasar. An additional four lensed quasar systems with measured time delays show monthly period microlensing. These studies support the prediction of HGD that the masses of their galaxy lenses are dominated by small planetary mass objects as the baryonic dark matter (Burud et al. 2000, 2002; Hjorth et al. 2002) that may produce intermittent systematic dimming errors rather than dark energy (Schild & Dekker 2006).

Flux anomalies in four-quasar-image gravitational lenses have been interpreted as evidence (Dalal and Kochanek 2002) for the dark matter substructure predicted by CDM halo models, but the anomalies may also be taken as evidence for concentrations of baryonic dark matter such as PGCs, especially when the images are found to twinkle with frequencies consistent with the existence of planetary mass objects. Evidence that the small planetary objects causing high frequency quasar image twinkle are clumped as PGCs is indicated by the HE1104 (Schechter et al. 2003) damped Lyman alpha lensing system (DLA $\equiv$ neutral hydrogen column density larger than $10^{24.3}$ m$^{-2}$), suggesting PGC candidates from the evidence of gas and planets. Active searches are underway for quasar lensing DLAs with planetary frequency twinkling that can add to this evidence of PGCs. Twenty $10^5 - 10^6 M_\odot$ (PGC-PFP) galaxy halo objects have been detected $\geq 10^{21}$ m from M31 (Thilker et al. 2004).

Perhaps the most irrefutable evidence for galaxy inner halos of baryonic PGC-PFP clumps is the HST/ACS image showing an aligned row of $42 - 46$ YGCs (see §2.3.2 and Fig. 1) precisely tracking the frictionally merging galaxy fragments VVcdef in the Tadpole system (Gibson & Schild 2003a). Concepts of collisionless fluid mechanics and collisionless tidal tails applied to merging galaxy systems are rendered obsolete by this image. Numerous YGCs are also seen in the fragmenting galaxy cluster Stephan’s Quintet-HGC 92 (Gibson & Schild 2003c). The mysterious red shifts of this dense Hickson Compact Galaxy Cluster (HGC) support the HGD model of sticky beginnings of the cluster in the plasma epoch, where viscous forces of the baryonic dark matter halo of the cluster have inhibited the final breakup due to the expansion of the universe to about 200 million years ago and reduced the transverse velocities of the galaxies to small values so that they appear aligned in a thin pencil by perspective. Close alignments of QSOs with bright galaxies (suggesting intrinsic red shifts) have been noted for many years (Hoyle et al. 2000), but are easily explained by the HGD concept that proto-galaxies formed in the plasma epoch by viscous-gravitational fragmentation of larger objects termed proto-galaxy-clusters (Gibson 2000).
2.3. Planetary Nebula formation

2.3.1. The standard model

According to the standard model of white dwarf and planetary nebula formation, an ordinary star like the sun burns less than half of its hydrogen and helium to form a hot, dense, carbon core (Busso et al. 1999; Iben 1984). White dwarf masses are typically $0.6 M_\odot$ or less even though the initial star mass is estimated from the increased brightness at WD formation to be $8 M_\odot$ or more. Are intermediate stars really so massive? If so, how does all this mass escape? Radiation pressures are much too small for such massive ejections either as winds, plasma beams, or clumps, even assisted by dust and pulsations (Woitke 2006). Most of the large mass inferred from the brightness probably just reflects the bright JPP atmospheres as the massive frozen planets near the new white-hot dwarf evaporate and ionize, increasing the JPP entrainment rate by friction. Claims of red-blue supergiant stripping (Maund et al. 2004) are highly questionable. The brightness of the JPP atmospheres masquerades as huge central stellar masses and envelopes. Friction from the gas and dust of evaporated JPPs accelerates the formation of the PNe and the growth of central carbon white dwarf(s) toward either a SNe Ia event or a bypass of the event by enhanced mixing of the carbon core giving critical mass $1.4 M_\odot$ iron-nickel cores and SNe II events. How much of the $9 - 25 M_\odot$ mass of SNe II remnants can be attributed to the precursor star?

Interpretation of nuclear chemistry from spectral results to describe the physical processes of stellar evolution to form white dwarfs (Herwig 2005) is limited by a poor understanding of modern stratified turbulent mixing physics. Methods that account for fossil and zombie turbulence radial internal wave transport in mixing chimneys are required (Keeler et al. 2005; Gibson et al. 2006a; Gibson et al. 2006b; Gibson et al. 2007) focusing on the smallest scales (Wang & Peters 2006). New information about carbon stars is available at the critical infrared spectral bands of cool AGB stars from the Spitzer Space Telescope (Lagadec et al. 2006) but the mass loss problem remains unsolved. Crucial contributions of mass and luminosity from the ISM are not taken into account in the standard models of PNe formation and evolution and in standard models of star formation and evolution.

From standard star models, the neutral atmosphere of a dying red giant with approximate density $\rho \approx 10^{-17}$ kg m$^{-3}$ (Chaisson & McMillan 2001) is somehow expelled to the ISM along with a very massive (but unobserved and likely mythical) envelope by (unexplained) dynamical and photon pressures when the hot, $T \approx 10^5$ K, dense, $\rho \approx 10^{10}$ kg m$^{-3}$, carbon core is exposed as a white dwarf star with no source of fuel unless accompanied by a donor companion. The density of this $10^{16}$ kg atmosphere expanded to the distance of the inner
Helix radius is trivial ($\approx 10^{-20}$ kg m$^{-3}$). At most this could bring the PNe ejected atmosphere density to a small fraction ($\approx 10^{-15}$) of $\rho \approx 10^{-14}$ kg m$^{-3}$ values observed in the knots (Meaburn et al. 1998). Why are small and intermediate mass main sequence stars ($1 - 9M_\odot$) so inefficient that they burn only a small fraction of their initial mass before they die to form ($0.5 - 1.44M_\odot$) white dwarfs? We suggest small stars are likely to be more efficient than large stars in their burning of gravitationally collected mass. What they don’t burn is returned as helium and carbon white dwarfs, neutron stars (if the small star gets large) and SNe ashes, not superwinds. The ashes are collected gravitationally by the $\geq 1000M_\odot$ of ambient PFPs and JPPs influenced by an average star in its evolution from birth to death, and a small fraction returned to the stars as the dust of comets. From HGD, most intermediate mass stars and superwinds are obsolete working hypotheses used to explain unexpected brightness of JPP atmospheres formed from the ISM and not ejected (Herwig 2005).

From radio telescope measurements (Knapp et al. 1982) large stars up to $9M_\odot$ form white dwarfs and companions with huge envelopes that have complex histories with superwind Asymptotic Giant Branch (AGB) periods where most of the assumed initial mass of the star is mysteriously expelled into the ISM (Busso et al. 1999). The possibility is not mentioned in the literature that the ISM itself could be supplying the unexpectedly large, luminous, envelope masses and superwind mass losses inferred from radio and infrared telescope measurements (Knapp et al. 1982), OH/IR stars (de Jong 1983), and star cluster models (Claver et al. 2001). It has been speculated in versions of the standard model that shock wave instabilities somehow produce cometary knots ejected by PNe central stars (Vishniac 1994, Vishniac 1983), or that a fast wind impacts the photo-ionized inner surface of the dense ejected envelope giving Rayleigh-Taylor instabilities that somehow produce the cometary globules and radial wakes observed (Garcia-Segura et al. 2006, Capriotti 1973). Such models produce cometary globule densities much smaller than observed, and require globule wake densities much larger than observed.

Several other problems exist for standard PNe models without HGD. Huge ($3 - 9M_\odot$) H-He masses observed in PNe are richer in other species and dust than one would expect to be expelled as stellar winds or cometary bullets during any efficient solar mass star evolution, where most of the star’s H-He fuel should presumably be converted by thermonuclear fusion to carbon in the core before the star dies. More than a solar mass of gas and dust is found in the inner nebular ring of Helix, with a dusty H-He-O-N-CO composition matching that of the interstellar medium rather than winds from the hydrogen-depleted atmosphere of a carbon star, but up to $11M_\odot$ may be inferred for the total PNe (Speck et al. 2002). The cometary globules are too massive and too dense to match any Rayleigh-Taylor instability model. Such models (Garcia-Segura et al. 2006) give cometary globule densities of only $\rho \approx 10^{-19}$ kg m$^{-3}$ compared to $\rho \approx 10^{-14}$ kg m$^{-3}$ observed.
The closest AGB C star is IRC+10216 (Mauron & Huggins 1999). It is brighter than any star at long wavelengths, but invisible in the blue from strong dust absorption. Loss rates inferred from its brightness are large ($2 \times 10^{-5} M_\odot/\text{yr}$). The possibility that the mass indicated by the brightness could have been brought out of the dark in place has not been considered. Multiple, fragmented and asymmetric rings are observed, indicating a central binary. The rings are irregular and extend to $4 \times 10^{15}$ m, with central brightness of the envelope confined to $2 \times 10^{14}$ m. The observed ring structures appear to be wakes of Jovian orbital planets evaporating in response to the red giant growth and powerful radiation from the central star(s). Rather than superwinds outward we see the effects of enhanced JPP accretion inward, clearing the Oort cloud cavity prior to PNe formation.

The density increase due to maximum expected Mach 6 hypersonic shock waves in astrophysical gases is only about a factor of six, not $10^5$. Rayleigh-Taylor instability, where a low density fluid accelerates a high density fluid, causes little change in the densities of the two fluids. Turbulence dispersion of nonlinear thin shell instabilities (Vishniac 1994; Vishniac 1983) should decrease or prevent shock induced or gravitational increases in density. The masses of the inner Helix cometary globules are measured and modeled to be $\gg 10^{25}$ kg, much larger than expected for PFP planets that have not merged with other PFPs to form globulette clumps and JPPs. No mechanism is known by which such massive dense objects can form or exist near the central star. Neither could they be ejected without disruption to the distances where they are observed. Measurements of proper motions of the cometary knots provide a definitive test of whether the knots are in the gas and expanding at the outflow velocity away from the central binary, as expected in the standard model, or moving randomly with some collapse component toward the center. Proper motion measurements to date (O’Dell et al. 2002) suggest they are mostly moving randomly with approximately virial PGC speeds (also see Fig. 2 below in §3).

2.3.2. The HGD model

According to HGD, all stars are formed by accretion of PFP planets, larger Jovian PFP planets (JPPs), and brown and red dwarf stars within a primordial PGC interstellar medium. The accretion mechanism is likely to be binary with clumping, where two JPPs experience a near collision so that internal tidal forces and frictional heating of their atmospheres produces evaporation of the frozen H-He planets and an increase in the amount of gas in their atmospheres. Smaller JPP and PFP planets within the atmospheres are collected as comets or merging moons. Increased size and density of planet atmospheres from collisions, tidal forces, or star radiation results in “frictional hardening” of binary planets
until they fragment, evaporate, merge and then shrink and refreeze by radiation. The binary accretion cascade to larger mass clumps of planet-binaries and star-binaries continues until inhibited by thermonuclear processes. Hence “3 out of every 2 stars is a binary” (personal communication to RES from Cecilia Helena Payne-Gaposchkin, pioneer astronomer). This classic astronomical overstatement could actually be true if one of the “stars” is a binary and the other a binary of binaries or a triplet of two binaries and a rogue. Small binary stars with lots of moons and planets is the signature of star formation from planets. Large single stars with no planets and no moons is what you get from the large clouds of gas collected by CDM halos (Abel et al. 2002; O’Shea & Norman 2006).

Exotic clumped binary-star and binary-planet systems are highly likely from the nonlinear nature of HGD star and JPP planet formation. Heating from a binary PFP merger results in a large atmosphere for the double-mass PFP-binary that will increase its cross section for capture of more PFPs in growing clumps. Evidence is accumulating that most PNe central stars are binaries as expected from HGD (De Marco et al. 2004; Soker 2006; Moe & De Marco 2006). One of the brightest stars in the sky is Gamma Velorum in Vela, with two binaries and two rogues all within $10^{16}$ m of each other, the nominal size of a PNe. One of the binaries is a WR star and a blue supergiant B-star with $1.5 \times 10^{11}$ m (1 AU) separation. From aperture masking interferometry using the 10-m aperture Keck I telescope, another WR-B binary is the pinwheel nebula Wolf-Rayet 104 in Sagitarius, where the stars are separated by only $3 \times 10^{11}$ m (3 AU) and are $10^5$ brighter than the sun (Tuthill et al. 1999). How much of the apparent brightness and apparent masses of these systems is provided by evaporating JPPs? The pinwheel nebula dust clouds are surprising this close to large hot stars ($\approx 50kK$) that should reduce dust to atoms. Complex shock cooling induced dust models from colliding superwinds (Usov 1991; Pilyugin & Usov 2007) to explain the dust of pinweel nebulea are unnecessary if the stars are accreting a rain of dusty evaporating JPPs. When one member of the binary dies to become a shrinking white-dwarf it appears that the smaller star begins to eat the larger one (creating a brown dwarf desert). Few WD binaries are found with large mass ratios (Hoard et al. 2007). Either the WD binary has an equal mass companion or just a JPP accretion disk (Su et al. 2007).

Large PFP atmospheres from mergers and close encounters increase their frictional interaction with other randomly encountered ambient PFP atmospheres. This slows the relative motion of the objects and increases the time between their collisions and mergers. Radiation to outer space will cause the PFP atmospheres to cool and eventually rain out and freeze if no further close encounters or collisions occur, leading to a new state of metastable equilibrium with the ambient gas. To reach Jupiter mass, $10^{-6}M_\odot$ mass PFPs and their growing sons and daughters must pair 10 times ($2^{10} \approx 10^3$). To reach stellar mass, 20 PFP binary pairings are required ($2^{20} \approx 10^6$). Because of the binary nature of PFP structure
formation through JPPs, it is clear that matched double stars and complex systems will result, as observed, and that the stars will have large numbers of large gassy planets with many moons that the stars capture in orbit or absorb as comets, as observed.

Rocky and nickel-iron cores of planets like the Earth and rock-crusted stainless-steel Mercury in this scenario are simply the rocky and iron-nickel cores of rogue interstellar Jupiters that have processed the SiO dust, water, organics, iron and nickel particles accumulated gravitationally from supernova remnants in their cores and in the cores of the thousands of PFPs that they have accreted to achieve their masses. Rather than being accreted as comets by the growing star, these massive JPPs were captured in orbits and their gas layers evaporated as their orbits decayed to leave terrestrial planets (Vittone & Errico 2006). They were not created by any star as often assumed (Boss 1995, Boss 2004). A hot-Saturn exoplanet observed in orbit at only $6 \times 10^9$ m with a $4 \times 10^{26}$ kg rocky-metal core conflicts with such stellar Jeans gravitational instability models (Sato et al. 2005) as well as with core accretion-gas capture models (Kornet et al. 2002) and proto-star dynamical fragmentation models (Bodenheimer et al. 2000). From HGD this size core implies a multi-Jupiter or red dwarf that has already lost most of its atmosphere to the central star or stars.

Without PFPs, the existence of rocks and unoxidized iron-nickel cores of planets are mysteries. It has been known since the end of the bronze age that very high temperatures are needed for carbon to reduce iron oxides to metallic iron, as will happen in supernovas IIab where hydrogen, silicon and carbon will form oxides by reducing oxides of iron and nickel to metal particles. All this stardust will be swept up by gravitational fields of the PFPs, which should by now be deeply crusted with dry magnetic talcum powder after their $\approx 13$ billion years in existence as interstellar gravitational vacuum cleaners. Samples of cometary material confirm large quantities of stardust in comet tails and in comet bodies. Crashing a 364 kg object into Jupiter comet Tempel 1 revealed a $\gg 10$m deep crust of 1-100 micron particle size low strength powder (A'Hearn et al. 2005; Feldman et al. 2006; Sunshine et al. 2006). Exotic refractory dust particles lacking carbonates or hydrates as collected by NASA's Stardust mission to Jupiter comet Wild 2 require high temperatures of formation ($\gg 800-1400$ K) and no wetness (Brownlee et al. 2006). Unexpectedly powerful mixing from creation in sub-Mercury orbits with transport far beyond Jupiter must be postulated for such comets to be created as the sun formed. The comets are easy to understand as pieces of PFP crust if stars, large planets and comets all form from dusty primordial planets in primordial PGC molecular clouds.

Large gas planets from PFP accretion cascades may form gently over long periods, with ample time at every stage for their atmospheres to readjust with ambient conditions and return to metastable states of random motion. These are probably the conditions under
which the old globular star clusters (OGCs) in the halo of the Milky Way Galaxy formed their small long-lived stars, and their large ancient planets (Sigurdsson et al. 2003). However, if the PFP accretional cascade is forced by radiation or tidal forces from passing stars or ambient supernovae, a more rapid cascade will occur where the PFP atmospheres become large and the relative motions in a PGC become highly turbulent. The turbulence will mix the PFPs and their large planet descendants and inhibit large average density increases or decreases. In this case another instability becomes possible; that is, if the turbulence weakens the creation of large central density structures but enhances accretion and clumping to form large planets and brown dwarfs, the increase of density at an accretion center can become so rapid that buoyancy forces may develop from the density gradients. This will suddenly damp the turbulence at the Schwarz turbulence scale $L_{ST}$ (see Table 1) to produce fossil turbulence (Gibson 1999) in a volume containing $> M_\odot$ of gas, PFPs, JPPs, and a complex of binary stars in formation.

Turbulence fossilization due to buoyancy then creates a gravitational collapse of an accretion center of the resulting non-turbulent gas and PFPs from the sudden lack of turbulence resistance. A fossil turbulence hole in the ISM will be left with size determined by the turbulence levels existing at the beginning of fossilization. The accretion of the planets and gas within the hole will be accelerated by the rapidly increasing density. The total mass of the stars produced will be the volume of the “Oort cloud” hole (Oort cavity) times the ISM density. If the mass is many solar masses then the superstars formed will soon explode as supernovae, triggering a sequence of ambient PFP evaporations, accretional cascades, and a starburst that may consume the entire dark PGC and its PFPs to produce a million stars and a young globular cluster (YGC) or a super-star cluster (Tran et al. 2003).

Numerous YCCs are triggered into star formation by galaxy mergers, such as the merging of two galaxies and some fragments revealing a 130 kpc ($4 \times 10^{21}$ m) radius baryonic dark matter halo in the VV29abcdef Tadpole complex imaged by HST/ACS immediately after installation of the ACS camera (Benitez et al. 2004). Figure 1 shows an SSC dwarf galaxy, revealed in the baryonic dark matter halo of the central Tadpole galaxy VV29a by a dense narrow trail of YGCs pointing precisely to the spiral star wake produced as the dwarf blue galaxy VV29c and companions VV29def merged with VV29a (Gibson & Schild 2003a).

Planetary nebulae form when a small star formed by gradual PFP accretion uses up all its H-He fuel to form a dense white dwarf carbon core with temperature less than $8 \times 10^8$ K. The high exposed core temperature and spin enhanced radiation of plasma in jets and winds from the white dwarf evaporate JPPs remaining nearby from its red giant phase giving an AGB (asymptotic giant branch) red giant star (eg: Arcturus) that appears to be a massive envelope from its brightness. As discussed previously for the standard model, red giant stars
have envelope diameter $\approx 10^{12}$ m, atmosphere density $\approx 10^{-17}$ kg m$^{-3}$ and a $6 \times 10^6$ m diameter $\rho \approx 10^{10}$ kg m$^{-3}$ carbon star core ([Chaisson & McMillan 2001]). The total mass expelled is thus only $\approx 10^{16}$ kg, or $\approx 10^{-8}M_\odot$, much less than the gas mass values $(3-1) \times M_\odot$ claimed to be observed in planetary nebulae from their luminosity. Without HGD, this much gas is mysterious.

Because white dwarfs have close companion stars and continuous JPP accretion, as observed for Helix and Cats-Eye and easily inferred for many other PNe’s ([O’Dell et al. 2002]), the companions and JPP accretion disk will contribute to the WD growth. Spinning magnetic field lines at the white dwarf poles and magnetohydrodynamic turbulence at its equator capture the incoming plasma and magnetic fields to produce powerful plasma jets, plasma winds, and photon radiation. The accretion disk of the white dwarf may shield some of its radiation and broadly beam some of its radiation. The following observations show the effects of such plasma beams and radiation in PNe.

3. Observations

Figure 2 is an HST image of the Large Magellanic Cloud PNe N66 (SMP 83, WS 35, LM1-52) at a distance of $1.7 \times 10^{21}$ m (57 pc), taken on 06/26/1991 with the European Space Agency Faint Object Camera (FOC) filtered for 540 seconds at the 5007 Å doubly ionized oxygen emission line (O III). This remarkable object is the only confirmed PNe where the central star is classified as a Wolf-Rayet of the nitrogen sequence type (WN). LMC-N66 has recently exhibited highly variable brightness, with an indicated mass loss rate increase from 1983 to 1995 by a factor of 40 ([Pena et al. 1997]). Its central binary is surrounded by a looped $\approx 6M_\odot$ mass PNe of bright cometary globules, interpreted in Fig. 2 as partially evaporated clumping JPPs in multi-Jupiter mass globulettes ([Gahm et al. 2007]). From spectal analysis and modeling the central binary system is a 1.2$M_\odot$ white dwarf with a non-degenerate companion that is building the WD toward the Chandrasekhar limit and a SN Ia event in $\approx 10^5$ years ([Pena et al. 2004, Hamann et al. 2003]) along with the rain of JPP comets. Part of the mass stream to the WD is ejected as a mutating plasma beam that evaporates JPPs in the looped arcs shown in Fig. 2. The mass $M_{PNe}$ of the observed nebular material is more than 5$M_\odot$. From HGD this implies about 0.5% of the 1000$M_\odot$ PFPs and JPPs of the interstellar medium within the $2.5 \times 10^{16}$ m luminous range of the PNe have been brought out of the dark by radiation and plasma jets from the central star system.

Some of the JPPs in Fig. 2 have detectable O III emission (5007 Å) wakes that indicate JPP velocities $V_{JPP}$ are in random directions with at least virial values, as expected from HGD. The virial velocity $V_{vir} = (2MG/r)^{1/2}$ for a PGC is about $1.7 \times 10^4$ m/s, where $M$
is the PGC mass, \( G \) is Newton’s constant, and \( r \) is the PGC radius. In PGC metastable equilibrium the PFP speed should slow to less than \( V_{\text{vir}} \) due to gas friction, so that the growth of JPPs and the rate of star formation are low. Most PGCs will never develop a star. Some have developed a million.

Wolf-Rayet (WR) stars are very bright, red, and until recently have been claimed to be very massive (\( \geq 20M_\odot \)) with large mass loss rates (\( \geq 10^{-5}M_\odot/\text{yr} \)). Star mass models derived from the increased luminosity with mass of gas cloud collapse (Iben 1965) are unreliable if stars form from planets. WR stars are often found with surrounding nebulae (Morgan et al. 2003), generally in galaxy disks where PGCs are accreted and where \( V_{\text{JPP}} \) values should be large. High He, C, N, and O concentrations suggest final stages of evolution toward white dwarf status for at least one of the central stars. HST images reveal most WRs to be binary or in multiple star systems, with numerous dense clumps in their envelopes that appear to be evaporating globulette-JPPs as in Fig. 2. Most of their claimed mass and most of their claimed large mass loss rates are likely the result of bright evaporating JPPs spin-radiated by a central dying star and misinterpreted as massive stellar envelopes and superwinds. For example, see WR124 in nebula M1-67, STSci-1998-38 in the HST archives. From the 1998 news release nebular clumps have mass \( 2 \times 10^{26} \) kg and scale \( 10^{14} \) m, giving a density \( 10^{-16} \) kg m\(^{-3} \). How can such massive dense objects be ejected from a star? From HGD the clumps are clearly bright JPP planet atmospheres evaporated from the PGC-ISM. Vast overestimates result for WR star masses, SN II precursor star masses (Maund et al. 2004; Podsialowski et al. 1993), and initial White-Dwarf star masses. To explain the extreme brightness of SN 1993J with a single star without JPPs requires a \( 40M_\odot \) precursor mass (Aldering et al. 1994).

Figure 3 shows a standard stellar-model white dwarf mass evolution diagram for planetary nebulae in Praesepe (circles) and Hyades (squares) star clusters (Claver et al. 2001), compared to Helix and LMC-N66 and our pulsar precursor model. In an 80 PNe collection (Gorny et al. 1997), Helix has the most massive central white dwarf. It is also the dimmest, and therefore has the smallest estimated PNe mass \( M_{\text{PNe}} \) (shown as an open star in Fig. 3). From HGD, \( M_{\text{Initial}} \approx M_{\text{PNe}} \) masses are vastly overestimated from the brightness of evaporated JPPs that dominate \( M_{\text{PNe}} \). Observed \( M_{\text{PNe}} \) should therefore not be interpreted as the initial masses \( M_{\text{Initial}} \) of central white dwarfs, as assumed using the standard PNe model (Weidemann 2000). Masses of WR stars and SNe II precursors are overestimated from their extreme JPP atmosphere brightness and implied super-massive Hayashi tracks (Iben 1965) by even larger factors. Rather than \( 9 - 25M_\odot \) (Gelfand et al. 2007; Maund et al. 2004; Shigeyama & Nomoto 1990) such stars are likely no larger than \( 1.4M_\odot \) since neutron stars have mass \( 1.4M_\odot \) (Thorsett & Chakrabarty 1999) precisely known from pulsar timing. Any central WD of a PNe has the possibility to grow.
to the SNe Ia size by accretion of JPPs, as shown by the LMC-N66 (hexagon) point in Fig. 3. If the WD is fed by a companion red giant (RB) accretion disk \cite{Hachisu2001} as well as by JPP rain the probability of a SN Ia or SN II event increases. In the final stages of growth, the WD will likely be surrounded by a PNe similar to that of Helix, where the central Oort cavity sphere has been depleted of JPPs by gravity to form the central star and its JPP accretion disk \cite{Su2007} and the PNe is formed by radiative evaporation of JPPs to form large atmospheres by plasma jets and plasma and photon radiation powered by JPP accretion and the rapid spinning and complex magnetohydrodynamics of the central white dwarf. Supernova Ia events will always be subject to intermittent dimming depending on the line of sight. PNe can appear around hot central stars at any time during the life of the star, which is more than $10^{10}$ years for the small stars leading to SNe Ia events, not $10^4$ years as assumed in the standard PNe model.

Figure 4 shows a mosaic of nine HST/ACS images from the F658N filter ($H\alpha$ and N II) that enhances the ionized cometary globules and their hydrogen tails \url{http://archive.stsci.edu/hst/helix/images.html}. A sphere with radius $5 \times 10^{15}$ m is shown. A much smaller sphere will give an adequate supply of primordial-fog-particles (PFPs) with PGC primordial mass density $\rho_0 = 3 \times 10^{-17}$ kg m$^{-3}$ to form two central solar mass stars. The large comets closest to the central stars must be evaporating massive planets (Jupiters) to survive measured evaporation rates of $2 \times 10^{-8} M_\odot$ year$^{-1}$ \cite{Meaburn1998} for the 20,000 year kinematic age of Helix. Massive planets are formed in the accretional cascade of PFPs to form stars according to HGD. The younger (2,000 year old) planetary nebula Spirograph (IC 418) shown below shows shock wave patterns from the supersonic stellar winds but no cometary PFP candidates within its fossil turbulence accretion sphere corresponding to the Oort cloud source of long period comets.

Is the sun surrounded by an Oort cavity of size $L_{Oort} \approx (M_\star/\rho_{ISM})^{1/3} \approx 4 \times 10^{15}$ m reflecting its 1$M_\odot$ of accretion in a PFP dominated interstellar medium with primordial density $\rho_0$? Rather than an Oort cloud of comets, are long period “Oort Cloud Comets” actually PFP and JPP planets accreting from the inner boundary of the Oort cavity? In a remarkable application of celestial mechanics to Oort cloud comets (“Cometary evidence of a massive body in the outer Oort cloud”) a multi-Jupiter (JPP) mass perturber within 5° of the Galactic plane has been inferred \cite{Matese1999}. Out of 82 “new” first-time entrant long period comets with orbit scales less than $10^{16}$ m, 29 have aphelion directions on the same great circle, suggesting that the galactic-tide-Saturn-Jupiter loss cylinder has been smeared inward along the track of the perturber. An apparently independent 99.9% detection \cite{Murray1999} gives the object a retrograde orbit with period of $5.8 \times 10^6$ years assuming it is gravitationally bound to the sun, and excludes a variety of explanations (eg: star encounter, solar system ejection) for its existence as extremely unlikely. The object is
easy to explain from HGD as one of many JPPs at distance ≥ $2 \times 10^{15}$ m on the inner surface or our Oort cavity as in Figs. 4 for Helix, Fig. 7 for Eskimo and Fig. 8 for Dumbbell PNe.

Assuming density $\rho_0$, the inner spherical nebular shell for Helix contains $\approx 20M_\odot$ of dark PFPs, from which $1.5 \times M_\odot$ has been evaporated as gas and dust (Speck et al. 2002). Evidence for bipolar beamed radiation is shown by the brighter regions of the nebula in Fig. 4 at angles 10 and 4 o’clock, and by the light to dark transition after 11:30 suggesting the bipolar beam is rotating slowly clockwise. Note that the tails of the comets are long ($\approx 10^{15}$ m) before 11:30 and short or nonexistent afterward. Rayleigh-Taylor instability as a mechanism to produce the globules (Capriotti 1973) gives densities much too low. The WD plasma beams appear to have started rotation at about 1 o’clock with deep penetration of the radiation on both sides, revolved once, and is observed with bright edge at 11:30 having completed less than two revolutions to form the Helix spiral.

Figure 5 shows a Hubble Space Telescope Helix WFPC2 1996 image to the northeast in Helix where the closest comets to the center are found (O’Dell & Handron 1996). The cometary globules have size about $6 \times 10^{13}$ m and measured atmospheric mass $(2 - 11) \times 10^{25}$ kg (Meaburn et al. 1992, O’Dell & Handron 1996, Huggins et al. 2002), with spacing $\approx 3 \times 10^{14}$ m, as expected for $\approx 8 \times 10^{26}$ kg evaporating JPP gas planets in a relic concentration corresponding to the primordial ($\rho_0$) plasma density $3 \times 10^{-17}$ km m$^{-3}$ at the time of first structure 30,000 years after the big bang. These largest cometary globules must have much larger mass planets than PFPs at their cores to have survived the 20,000 year lifetime of the Helix planetary nebula with measured mass loss rates of order $10^{-8} M_\odot$ year$^{-1}$ (Meaburn et al. 1998). The spacing of the cometary knots becomes closer for distances farther from the central stars, consistent with these objects having PFPs or small JPPs at their cores (see Fig. 11 below).

Figure 6 shows an example of the new ACS/WFPC composite images from the northern region of Helix nebula confirming the uniform density of the cometary globules. From HGD this reflects the uniform ambient distribution of virialized, dark-matter, frozen PFPs and JPPs expected in PGCs with primordial density $\rho_0 \approx 3 \times 10^{-17}$ kg m$^{-3}$. Thus planets provide raw material to produce and grow the central white dwarf of a PNe by binary hierarchical clustering and clumping. Once clustering and clumping begins the star formation is highly non-linear. The more clustering the more gas. The more gas the more clustering. Thus the larger JPPs and globulettes of PFPs in the Jupiter mass range are more likely to be found at Oort cavity distances and the brown dwarfs near the center or merged as stars and close binaries. Within the ionized cavity of the PNe accreted JPPs are evaporated by radiation from the white dwarf and absorbed or captured in orbits. Images and properties of “knots” in Helix, Eskimo, Dumbbell and other PNe (O’Dell et al. 2002) are consistent with
this PFP-JPP-globulette star formation interpretation.

Figure 7 shows the Eskimo planetary nebula (NGC 2392), which at $7.2 \times 10^{19}$ m (2.4 kpc) is 11 times more distant from earth than Helix \cite{Gorny1997}, but is still close enough for numerous cometary globules to be resolved by HST cameras. The PNe is smaller than Helix and has a central shocked region with no comets, just like the small, even younger, Spirograph nebula shown at the bottom of Fig. 4. Eskimo PNe has a few very large widely separated cometary globules dominating its brightness, suggesting these may be evaporating JPPs with multi-Jupiter masses. Note the large gas wakes without cometary globules at the 6 o’clock position (in the beard). Presumably these were even brighter while their JPPs were evaporating.

Figure 8 shows details of the central region of the Dumbbell planetary nebula featuring numerous cometary globules and knots. The spacing of the objects is consistent with PFP and JPP planets with average mass density $\approx 10^4$ times the average $10^{-21}$ kg m$^{-3}$ for the Galaxy. Because of their primordial origin, planets with this same density $\rho_0$ dominate the mass and species content of the ISM in all galaxies, fossilizing the primordial baryonic density from the time of first structure in the plasma epoch 30,000 years after the big bang as predicted by HGD. The dumbbell morphology reflects the existence of a binary central star system and its plasma beam jet to evaporate JPPs at the Oort cavity edge.

4. The “Nonlinear Grey Dust” Systematic Error of “Dark Energy”

Figure 9 summarizes the hydro-gravitational-dynamics (HGD) theory of gravitational structure formation leading to the formation of baryonic dark matter and the resulting dark energy misconception \cite{Gibson2005}. A Planck scale quantum-gravitational instability triggers big bang turbulent combustion. The resulting turbulent temperature patterns are fossilized by nucleosynthesis in the energy epoch as random H-He density fluctuations, which seed the first gravitational formation of structure by fragmentation at the horizon and Schwarz viscous scale and Schwarz turbulent scale in the plasma epoch ($L_H \approx L_{SV} \approx L_{ST}$, Table 1). The first gravitational structures are super-cluster-voids starting at $10^{12}$ seconds and growing with sonic ($c/3^{1/2}$) speed until the plasma-gas transition at $10^{13}$ s (300,000 years). An observed -73 $\mu$K CMB cold spot reflects a $10^{25}$ m void for $z \leq 1$ \cite{Rudnick2007} as expected from HGD. The maximum probability for such a large void from $\Lambda$CDMHC is much less than $10^{-9}$ \cite{Hoyle2004}.

The smallest gravitational fragments from the plasma epoch are proto-galaxies formed by fragmentation with the $10^{20}$ m Nomura scale ($L_N \approx L_{ST} \geq L_{SV} \approx L_K$, Table 1) and
chain-clump spiral-clump morphology (Gibson 2006b) along stretching turbulent vortex lines and compressing spirals of the weak plasma turbulence. The kinematic viscosity reduction by a factor of $10^{13}$ gives two fragmentation scales and structures in the primordial gas; that is, the $10^6 M_\odot$ Jeans acoustic scale and PGCs, and the $10^{-6} M_\odot$ viscous Schwarz scale and the PFPs. With time the planetary mass PFPs freeze to form the baryonic dark matter. Some small fraction accrete to form JPPs and stars. Because SNe Ia occur surrounded by evaporating PFPs and JPPs, a random “nonlinear grey dust” dimming of the supernova brightness is likely.

Figure 10 shows the proposed interpretation of the ground based (open circle) and (Riess et al. 2004) HST/ACS (solid circle) SNe Ia dimming for red shifts $0.01 \leq z \leq 2$. The wide scatter of the amount of SNe Ia dimming appears to be real, and is consistent with our “nonlinear grey dust” model, where a random amount of absorption should be expected depending on the line of sight to the supernova and the degree of evaporation of the baryonic dark matter interstellar medium. A “uniform grey dust” systematic dimming increases with $z$ contrary to observations. The “dark energy” concept seems unlikely because it requires a radical change in the physical theory of gravity. HGD requires changes in the standard (CDMHC) model of gravitational structure formation and the interpretation of planetary nebulae. The slight random dimming found in the observations is just what one expects from “nonlinear grey dust” formed as the growing hot carbon star evaporates Oort cavity and rim planets to form large, cold, dusty atmospheres that may be on the line of sight to the SNe Ia that eventually occurs. Planetary nebulae such as the Helix and other PNe described above illustrate the process we are suggesting. Radiation from the proto-SNe Ia can be directly from the shrinking carbon star or from plasma jets and winds formed as any companion stars or just a JPP accretion disk (Su et al. 2007) feeds its carbon growth.

Figure 11 shows a closeup view of clumped JPPs and PFPs in the northern rim of the Helix Oort cavity imaged in molecular hydrogen H$_2$ at 2.12 microns (O’Dell et al. 2007). The distance scales are derived from the new O’Dell et al. images and a trigonometric parallax estimate of 219 (198-246) pc for the distance to Helix (Harris et al. 2007). O’Dell et al. 2007 conclude H$_2$ is in local thermodynamic equilibrium, as expected for evaporated planet atmospheres produced by intense radiation and not by any shock phenomenon.

Figure 12 shows a collection of interstellar medium electron density spectral estimates often referred to as the “Great Power Law on the Sky” from the remarkable agreement with the same $q^{-11/3}$ Kolmogorov, Corrsin, Obukhov spectral form over 11 decades of wavenumber $q$ (Armstrong et al. 1981; Gibson 1991; Armstrong et al. 1995). An ‘inner scale’ at $\approx 10^{12}$ m from pulsar scintillations can be understood as the Obukhov-Corrsin scale $L_C \equiv (D/\varepsilon)^{1/4}$ marking the beginning of a fossil turbulence inertial-diffusive spectral subrange $q^{-15/3}$ (shown
in Fig. 12), where electron density is a strongly diffusive passive scalar property with diffusity \( D \approx 30 \times \) larger than the kinematic viscosity \( \nu \) (Gibson 1968a; Gibson 1968b; Gibson et al. 2007). Evidence that observed pulsar scintillation spectra (You et al. 2007) represent forward scattering from discrete features is provided by observations of parabolic scintillation arcs (Trang & Rickett 2007; Hill et al. 2005). The observed scintillations with small inner scales \( \leq 10^{10} \) m and possibly \( \leq 10^7 \) m indicate turbulent partially ionized atmospheres evaporated from dark matter planets by neutron star supernova and pulsar plasma jets and radiation. The \( \varepsilon \approx 1 \) m\(^2\) s\(^{-3}\) and Reynolds number \( \approx 10^{5} \) values implied by the spectra indicate fossilized strong turbulent mixing driven by the planet evaporation. For a gas to be a fluid and produce the observed scintillations with strong turbulence and turbulent mixing spectra requires gas density \( \rho \geq 10^{-14} \) kg m\(^{-3}\) in the scintillation regions; that is, higher than average in the Galaxy by \( \geq 10^7 \). Such a large density matches that measured for the cometary globules of Helix, also interpreted as dark matter planet atmospheres. The well-studied Crab supernova II remnant at \( 6 \times 10^{19} \) m shows strong evidence of evaporated dark matter planets with wakes pointing to the path of the pulsar and its close companions, revealing powerful pulsar jets and evaporated JPP atmospheres in a series of HST images. Atmosphere diameters (1 arc sec ‘knots’) as large as \( 3 \times 10^{14} \) m are reported (Schaller & Fessen 2002), \( \approx \times 10 \) larger than those in Helix.

Extreme scattering events (ESE), multiple images of radio pulsars and quasars, and other indications of small \( \approx 10^{13} \) m dense \( \approx 10^{-12} \) kg m\(^{-3}\) refractors are detected frequently using the \( \leq 10^{-3} \) arc sec resolution of radio telescopes. From the detection frequency and the size and \( \approx 10^{27} \) kg mass of the ionized and neutral clouds observed, authors have suggested the objects may provide most of the Galaxy mass (Walker & Wardle 1998; Hill et al. 2005). We agree. From HGD, these radio telescope detections manifest gas atmospheres of Galaxy disk primordial dark matter Jovian planets. No other explanation seems plausible.

5. Discussion of results

HGD theory combined with high-resolution multi-frequency space telescope observations require major changes in the standard models of cosmology, star formation, star death, and planetary nebulae formation. Trails of young globular clusters in merging galaxies and bright gases of clumpy nebulae and dense masers surrounding white-dwarf stars, Wolf-Rayet stars and neutron stars provide a growing body of clear evidence for the existence of the millions of frozen primordial planets (PFPs and JPPs) per star in metastable-planet-clusters (PGCs) suggested (Gibson 1996; Schild 1996) as the baryonic dark matter and interstellar medium. Even though the primordial planets are dark and distant they make their presence
known because of their enormous total mass, the brightness and scattering properties of their evaporated atmospheres, and because they are the raw material for everything else. PFPs are now individually detectable in the Helix PNe from their H$_2$ signal at 2.12 microns (Fig. 11). JPPs with molecular atmospheres in great abundance ($\geq 20,000-40,000$) are detected in Helix from their 5.8 and 8 micron purely rotational lines of molecular hydrogen from the infrared array camera IRAC on the *Spitzer* space telescope with Helix resolution of $6 \times 10^{13}$ m (Hora et al. 2006). Since these JPP atmospheres are mostly evaporated by spin-powered beamed plasma jets and winds of the white dwarf, they represent a small fraction of the $>1000M_\odot$ of JPPs in its range. Similar results are obtained from the NICMOS NIC3 camera with the 2.12 micron molecular hydrogen filter from HST (Meixner et al. 2005).

When disturbed from equilibrium by tidal forces or radiation, JPP planets grow to stellar mass by binary accretion with neighbors where friction of close encounters causes growth of planetary atmospheres, more friction, merger, reprocessing and cooling to a new state of metastable equilibrium with shrinking planetary atmospheres as the gases refreeze. This non-linear binary cascade to larger size gas planets in pairs and pairs of pairs leads to star formation as stellar binaries within the PGC clumps. It explains the presence of the massive JPPs that persist in Helix in the shells closest to the central stars, as shown in Figs. 4, 5, 6, 10 and 11. HGD theory explains why most stars are binaries and why most galaxies and galaxy clusters are not. Stars are formed by hierarchical clustering of planets, not condensation within gas clouds, and galaxies and galaxy clusters are formed in strings and spirals by gravitational fragmentation of weakly turbulent plasma, not by hierarchical clustering of CDM halos. Measured supervoid sizes are so large they must have begun growth by gravitational fragmentation in the plasma epoch as predicted by HGD. The CDMHCC paradigm should be abandoned along with $\Lambda$ and dark energy. Supernova models based on supergiant stars and their 9 $- 25M_\odot$ envelopes are highly questionable along with PNe models and estimates of WD and SNe II precursor star masses (Fig. 3).

Hundreds of PNe are observed in the LMC and SMC galaxies, interpreted from HGD as tidally agitated star forming clumps of PGCs in the BDM halo of the Milky Way equivalent to the super-star-clusters (SSCs) of YGCs formed in the BDM halo of the Tadpole (VV29) merger (Fig. 1). Fig. 1 (Tran et al. 2003; Gibson & Schild 2003a) shows the SSC as a linear string of $\geq 42$ young globular star clusters with star formation triggered by passage of one of the merging galaxy fragments (VV29cdef) passing through the BDM halo of VV29a. The YGCs have 3-10 My ages, showing they must have been formed in place and not ejected as a frictionless tidal tail in this 500 My old merging system. Collisionless fluid mechanical modeling of galactic dynamics with frictionless tidal tails instead of star trails in the baryonic dark matter is highly misleading and should be abandoned.
One of the LMC PNe (LMC-N66) has recently shown strong brightness variation and appears to be in the final stages of white-dwarf growth leading to a SNE Ia event\cite{Pena2004}. Fig. 2 shows an archive HST image at the 5007 Å wavelength OIII emission line. The heavy rain of JPPs on the central star(s) appears to be adding carbon to the WD and fueling a powerful plasma beam that brings JPPs and their O III wakes out of the dark to diameters $\approx 5 \times 10^{16}$ m, a region containing $\geq 1000M_\odot$ of JPPs using the primordial density $\rho_0 \approx 3 \times 10^{-17}$ kg m$^{-3}$ from HGD. The wakes point in random directions, indicating that the evaporating JPP velocities $V_{JPP}$ are large and random, consistent with a rapid JPP accretion rates and rapid white-dwarf growth. Will the C-N core of the WD be mixed away by this rapid accretion to give Fe and a SN II event?

From HGD and the observations it seems clear that most stars form as binary star systems from Jovian primordial planets that grow by binary accretion within dark primordial PGC clumps of such planets. Unless the JPPs are strongly agitated the stars formed will be small. The white dwarf and its companion can then both slowly grow toward the Chandrasekhar limit drawing mass from accreted JPPs and possibly each other. Because SNe Ia events result from dying small stars that have very long lives, we can understand why it took nearly 10 billion years with red shift $z = 0.46$ for “dark energy” effects to appear, and why SNe Ia events are not seen at red shifts much larger than 1.

Why do all pulsars twinkle? It is because the progenitors of neutron stars form in PGCs surrounded and generously fed by partially evaporated planets with large atmospheres. Over 50 pulsar binaries and doubles in complex dense systems including exo-planets have been detected\cite{Sigurdsson2003, Bisnovatyi-Kogan2006, Lyne2004, Thorsett1999}. The supernovae IIab in agitated Galaxy disk PGCs where pulsars usually occur generate so many large atmosphere JPPs that all lines of sight to pulsars pass through at least one large turbulent or previously turbulent planet atmosphere (Fig. 12). It should therefore be no surprise that less strongly agitated PGCs forming poorly mixed carbon stars that explode as SNe Ia events will occasionally have unobscured and occasionally obscured lines of sight (Fig. 10), calling the dark energy hypothesis into question.

6. Conclusions

High resolution wide angle HST/ACS images and 4m ground based telescope images\cite{ODell2004} confirm and extend the previous WFPC2 HST picture of the Helix planetary nebula\cite{ODell1996} showing thousands of closely-spaced cometary globules. Slow comet rains on central white dwarfs in dense primordial metastable molecular clouds of planets are interpreted from HGD as generic features of PNe. Frozen BDM planets
(PFPs and JPPs sometimes in globulettes) evaporated by spin driven plasma beams and plasma winds from the central white dwarf form the PNe. A slow rain of planet-comets grow the WD to Chandrasekhar instability. Evaporation rates from the largest cometary globules suggest they possess $\geq$Jupiter mass cores (Meaburn et al. 1998), consistent with background radiation absorption masses $(2 - 11)10^{25}$ kg for the Helix cometary globule atmospheres (Meaburn et al. 1992; O’Dell & Handron 1996; Huggins et al. 2002). From their spacing and HGD, the largest cometary globules have multiple Jupiter masses (Fig. 5) and are termed JPPs. From HGD, all SN Ia events should occur in PNe subject to random dimming by JPP atmospheres, as observed (Fig. 10) and misinterpreted as dark energy.

Models are questioned for planetary nebula formation where Rayleigh-Taylor instabilities of a postulated (unexplainably) dense and massive superwind outer shell are triggered by collision with a later, rapidly expanding, less-dense, inner shell to form the globules (Capriotti 1973; Garcia-Segura et al. 2006). Such two wind PNe models cannot account for the morphology, regularity, and large observed densities and masses of the globules. Speculations that accretional shocks or variable radiation pressures in stars can trigger gravitational instabilities (Vishniac 1994; Vishniac 1983) to achieve such large density differences underestimate powerful turbulence, radiation, and molecular dispersion forces existing in stellar conditions that would certainly smooth away any such dense globules. From HGD, superwinds are not necessary to explain PNe and never happen. Star mass overestimates indicating superwinds have neglected the brightness of evaporated JPP atmospheres (Fig. 3). Luminous galaxy masses have probably been overestimated for the same reason and should be reexamined. Stars with mass $2M_\odot \rightarrow 100M_\odot$ may exist, but require strong turbulent mixing from exceptionally large JPP accretion rates.

No convincing mechanism exists to produce or expel dense objects from the central stars of PNe. Dense OH and SiO maser cloudlets near red giants observed by high resolution radio telescopes (Alcock & Ross 1986a; Alcock & Ross 1986b) are interpreted as evaporating JPPs from their high densities $\rho \geq 10^{-9}$ kg m$^{-3}$. Such densities cannot be achieved by shocks in the relatively thin red giant atmospheres. Shock fronts can be seen to exist in younger PNe than Helix (Figures 4 and 7) but are not accompanied by any cometary globules. Models for white dwarf and planetary nebula formation (Busso et al. 1999; Iben 1984) cannot and do not explain either the cometary globules or the tremendous loss of mass for stars with initial mass $M_{Initial} = (1 - 9)M_\odot$ by superwinds to form white dwarfs with final mass $M_{Final} = (0.5 - 1)M_\odot$ (Fig. 3). Observations of post AGB stars with multiple masers and bipolar flows reflect JPP evaporation and accretion, not envelope formation (Zijlstra et al. 2001).

We conclude that a better model for interpreting the observations is provided by hydro-gravitational-dynamics theory (HGD, Fig. 9), where the brightest cometary globules in
PNe are indeed comets formed when radiation and plasma jets from the white dwarf and its companion evaporate and reveal volatile frozen gas planets of the ISM at Oort cavity distances. Observed Oort cavity sizes (Figs. 4, 7, 10) $L_{\text{Oort}} \approx 3 \times 10^{15}$ m produced when a star forms from accreting planets in a PGC confirms the the primordial density $\rho_0$ of HGD for the first gravitational structures from the expression $L_{\text{Oort}} \approx (M_\odot/\rho_0)^{1/3} = 4 \times 10^{15}$ m. The planets are JPP Jovian accretions of primordial-fog-particle (PFP) frozen H-He proto-planets formed at the plasma to gas transition 300,000 years after the big bang in proto-globular-star-cluster (PGC) clumps (Gibson 1996), consistent with quasar microlensing observations showing a lens galaxy mass dominated by rogue planets “likely to be the missing mass” (Schild 1996). All stars are formed from primordial planets in these dense primordial clumps.

From HGD and all observations, PFPs and JPPs in PGCs dominate the mass and gases of the inner halo mass of galaxies within a radius of about 100 kpc ($3 \times 10^{21}$ m) as most of the dark matter. Proto-galaxies formed during the plasma epoch fragmented after transition to gas at primordial Jeans and Schwarz scales (Table 1) to form PGC clouds of PFPs that comprise the BDM and ISM of all inner galaxy halos. From HST/ACS Helix images and previous observations, the density of the Galaxy disk ISM is that of proto-superclusters formed 30,000 years after the big bang; that is, $\rho_0 \approx 3 \times 10^{-17}$ kg/m$^3$, preserved as a hydrodynamic fossil and revealed by the $(10 - 4) \times 10^{13}$ m separations of the PFP candidates (cometary globules) observed in Helix that imply this density (Fig. 11).

HST images of other nearby planetary nebula support our interpretation. Cometary globules brought out of the dark by beamed and other spin enhanced radiation from a shrinking central white dwarf is a generic rather than transient feature of planetary nebulae. Thus, the ISM is dominated by small frozen accreting planets with such small separations that the indicated mass density is that of a PGC; that is, $\rho \approx \rho_{\text{PGC}} \approx \rho_0$, which is $\approx 10^4$ larger than that of the Galaxy. Standard PNe models that suggest planetary nebulae are brief ($10^4$ year) puffs of star dust from dying white dwarfs by superwinds from massive envelopes (Fig. 3) must be discarded. Large PNe masses $M_{PNe}$ formed by the evaporation of JPPs (Fig. 2) must not be confused with $M_{\text{Initial}}$ for the white dwarf (Fig. 3). Infrared detections of dense molecular hydrogen clumps in Helix from both HST and Spitzer space telescopes provide $\approx 40,000$ JPP and PFP clump (globulette) candidates (O’Dell et al. 2007; Meixner et al. 2005; Hora et al. 2006) from the $\geq 1000M_\odot$ mass of JPPs and PFPs expected to exist in the observed $2.5 \times 10^{16}$ m radius of Helix from HGD. JPPs should form within globulette clumps of PFPs from the stickiness of PFP atmospheres (Gahm et al. 2007).

From HGD, most stars form as binary pairs from the binary and globulette accretion of baryonic dark matter PFP and JPP planets in PGC clumps leaving Oort cloud size holes in the ISM. When one of the stars in a binary forms a white dwarf it can draw on the fuel
of its companion and accreted JPPs to form a PNe of cometary globules (Fig. 2) and a proto-SNe Ia from the growing central stars (Fig. 3). Radiation from the pair can be seen as precessing plasma jets that evaporate rings of cometary globules as in the Helix PNe (Figs. 4, 5, 6, 10, 11) and in other planetary nebulae (Figs. 2, 7, 8). These JPP atmospheres give the “nonlinear grey dust” random-systematic-error-dimming indicated in Fig. 10. Pulsar scintillation spectra (Fig. 12) require stratified turbulence and turbulent mixing in dense weakly ionized gases [Gibson et al. 2007], strongly indicating large evaporated Jovian planet atmospheres agitated by the supernova and pulsar winds as seen in HST images of the Crab nebula and inferred for PNe in Fig. 10. Both the dark energy concept and the ΛCDM cosmology required to justify dark energy seem hopelessly problematic.

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Fig. 1.— Trail of 42 young-globular-star-clusters (YGCs) in a dark dwarf galaxy examined spectrosopically by Tran et al. 2003 using the Keck telescope. The 1″ Echellette slit and a loose super-star-cluster (SSC arrow) are shown at the left. Ages of the YGCs range from 3-10 Myr. The aligned YGC trail is extended by several more YGGs (arrow on right) and points precisely to the beginning, at $2 \times 10^{21}$ m distance, of the spiral star wake of VV29c in its capture by VV29a. The baryonic dark matter halo of Tadpole is revealed by a looser trail of YGCs extending to a radius of $4 \times 10^{21}$ m from VV29a, or 130 kpc (Gibson & Schild 2003a).
Fig. 2.— HST/FOC 5007 Å image (HST archives, 6/26/1991) of distant \(1.7 \times 10^{21} \text{ m}\) LMC/N66 PNe with a central \(1.2M_\odot\) WD-companion close binary rapidly growing toward SN Ia formation (Pena et al. 2004). Wakes in O III emission (magnified inserts) show random velocities \(V_{\text{JPP}}\) of the evaporating planets in globulette clumps of PFPs (Gahm et al. 2007). From its spectrum the central star is a Wolf-Rayet of class WN. Arc-like patterns show strong nutating plasma beams from the binary have evaporated \(\approx 5M_\odot\) of the ambient JPPs (Fig. 3). From HGD and \(\rho_0\) the \(2.5 \times 10^{16} \text{ m}\) radius nebular sphere for LMC/N66 should contain \(\geq 1000M_\odot\) of PFP and JPP Jovian planets.
Fig. 3.— Mass evolution of white dwarf stars to the Chandrasekhar limit by accretion of JPPs. The standard PNe model incorrectly estimates the initial white dwarf mass $M_{\text{Initial}}$ to be the total PNe mass $M_{PNe}$, but this includes the brightness mass of evaporated JPPs. Measurements for the N66 PNe of Fig. 2 (hexagon) and the Helix PNe of Figs. 4-6 (star) are compared to star cluster PNe of Praesepe (circles) and Hyades (squares) (Claver et al. 2001). Infrared detection of JPP atmospheres in Helix indicate $M_{PNe} \geq 40M_\odot$ (Hora et al. 2006). Neutron star precursor masses (upper right) should be $\leq 1.4M_\odot$ pulsar masses, and much less than SN II remnant masses of $(9 - 25)M_\odot$ (Gelfand et al. 2007; Maund et al. 2004).
Fig. 4.— Helix Planetary Nebula HST/ACS/WFC F658N image mosaic. A sphere with radius $3 \times 10^{15}$ m corresponds to the volume of primordial-fog-particles (PFPs) with mass density $\rho_0 = 3 \times 10^{-17}$ kg m$^{-3}$ required to form two central stars by accretion. The comets within the sphere are from large gas planets (Jupiters, JPPs) that have survived evaporation rates of $2 \times 10^{-8} M_\odot$/year (Meaburn et al. 1998) for the 20,000 year kinematic age of Helix. The younger planetary nebula Spirograph (IC 418) shown below with no PFPs is within its accretion sphere. From HGD the $2.5 \times 10^{16}$ m radius nebular sphere for Helix contains $\geq 1000 M_\odot$ of dark PFP and JPP planets, from which $1.5 \times M_\odot$ has been evaporated as detectable gas and dust (Speck et al. 2002).
Fig. 5.— Helix Planetary Nebula HST/WFPC2 1996 image (O’Dell & Handron 1996) from the strongly illuminated northeast region of Helix containing massive JPP comets close to the central stars ($\approx 4 \times 10^{15}$ m) with embedded $\geq 0.4$ Jupiter-mass planet atmospheres. The largest JPPs have about Jupiter mass $1.9 \times 10^{27}$ kg from their spacing $\approx 4 \times 10^{14}$ m assuming primordial density $\rho_0 = 3 \times 10^{-17}$ kg m$^{-3}$. The $2^{10}$ stage binary cascade from Earth-mass to Jupiter-mass is shown in upper left.
Fig. 6.— Detail of closely spaced cometary globules to the north in Helix from the 2002 HST/ACS images at the dark to light transition marking the clockwise rotation of the beamed radiation from the binary central star. Comets (evaporating JPPs) in the dark region to the right have shorter tails and appear smaller in diameter since they have recently had less intense radiation than the comets on the left. Two puffs of gas deep in the dark region suggest gravitational collection by planet gravity occurred during the several thousand years since their last time of strong irradiation. Dark PFPs are detected in Fig. 11 (circle).
Fig. 7.— The Eskimo planetary nebula (NGC 2392) is $\approx 12$ times more distance from earth than Helix, but still shows numerous evaporating PFP and JPP candidates in its surrounding interstellar medium in the HST/WFPC images. The nebula is smaller and younger than Helix, with a central shocked region like that of Spirograph in Fig. 4.
Fig. 8.— Close-up image of the Dumbbell planetary nebula (M27, NGC 6853) shows numerous closely spaced, evaporating, irradiated PFP and JPP candidates in its central region. The PNe is at a distance $\approx 500$ pc, with diameter $\approx 2 \times 10^{16}$ m. The white dwarf central star appears to have a companion from the double beamed radiation emitted to produce the eponymous shape. The lack an apparent accretional hole may be the result of a different viewing angle (edgewise to the binary star plane of radiation) than the face-on views of Ring, Helix (Fig. 4) and Eskimo (Fig. 7).
Fig. 9.— Hydro-Gravitational-Dynamics (HGD) description of the formation of structure (Gibson 2005; Gibson 2004). The CMB (a) viewed from the Earth (b) is distant in both space and time and stretched into a thin spherical shell along with the energy-plasma epochs and the big bang (c and d). Fossils of big bang turbulent temperature nucleosynthesize fossil density turbulence patterns in the H-He density (black dots). These trigger gravitational $L_{SV}$ scale structures (Tables 1 and 2) in the plasma epoch as proto-supercluster-voids that fill with NBDM (green, probably neutinos) by diffusion. The smallest structures emerging from the plasma epoch are linear chains of fragmented $L_N$ scale proto-galaxies. These fragment into $L_J$ scale PGC clumps of $L_{SV}$ scale PFP Jovian planets that freeze to form the baryonic dark matter (Gibson 1996; Schild 1996) and “nonlinear grey dust” sources of SNe Ia dimming presently misinterpreted as “dark energy” (see Fig. 10).
Fig. 10.— Dimming of SNE Ia magnitudes (top) as a function of redshift $z$ (Riess et al. 2004). The “uniform grey dust” systematic error is excluded at large $z$, but the “nonlinear grey dust” systematic error from baryonic dark matter PFP and JPP evaporated planet atmospheres is not, as shown (bottom) Helix PNe (O’Dell et al. 2004). Frozen primordial planets comprise the ISM beyond the Oort cavity, which is the spherical hole left in a PGC when the central star is formed by accretion of PFPs and JPP planets. Planet atmospheres appear from the dark forming the PNe when the star runs out of fuel and the carbon core of the central star contracts. The rapidly spinning $0.7M_{\odot}$ white dwarf powers axial and equatorial plasma jets and winds that evaporate “nonlinear grey dust” planet atmospheres as the white dwarf is fed to $1.44M_{\odot}$ supernova Ia size by a slow rain of planets.
Fig. 11.— Detail of Helix image in H$_2$ from Figs. 1 and 2 of O’Dell et al. 2007. Distance scales have $\approx 10\%$ accuracy (Harris et al. 2007) by trigonometric parallax, giving a Helix distance 219 pc with HST pixel $3.3 \times 10^{12}$ m, the size of PFPs identified as the smallest light and dark objects. Such PFPs are not detected closer than $\approx 5 \times 10^{15}$ m from the binary central star (Fig. 4) because they have been evaporated by its radiation and plasma beam.
Fig. 12.— Electron density spectral estimates near Earth (within $\approx 10^{19-20}$ m) interpreted using HGD. The remarkable agreement along all lines of sight with the same universal Kolmogorov-Corrsin-Obukov spectral forms reflects the highly uniform behavior of baryonic PCG-PFP dark matter with primordial origin in response to SNe II and their pulsars as radio frequency standard candles. From HGD the large stars, supernovae IIab, and neutron-star pulsars of the Galaxy disk require pulsar scintillations in dense, previously turbulent, JPP planet atmospheres with fossil electron density turbulence. Dissipation rates implied are large, indicating rapid evaporation of the frozen gas planets.
Table 1. Length scales of self-gravitational structure formation

| Length scale name            | Symbol | Definition$^a$ | Physical significance$^b$ |
|-----------------------------|--------|----------------|---------------------------|
| Jeans Acoustic              | $L_J$  | $V_S/\sqrt{\rho G}$ | Ideal gas pressure equilibration |
| Jeans Hydrostatic           | $L_{JHS}$ | $\left[p/\rho^2 G\right]^{1/2}$ | Hydrostatic pressure equilibration |
| Schwarz Diffusive           | $L_{SD}$ | $\left[D^2/\rho G\right]^{1/4}$ | $V_D$ balances $V_G$ |
| Schwarz Viscous             | $L_{SV}$ | $\left[\gamma \nu/\rho G\right]^{1/2}$ | Viscous force balances gravitational force |
| Schwarz Turbulent           | $L_{ST}$ | $\varepsilon^{1/2}/\sqrt{\rho G}$ | Turbulence force balances gravitational force |
| Kolmogorov Viscous          | $L_K$  | $\left[\nu^3/\varepsilon\right]^{1/4}$ | Turbulence force balances viscous force |
| Nomura Protogalaxy          | $L_N$  | $\left[L_{ST}\right]_{CMB}$ | $10^{20}$ m proto-galaxy fragmentation-shape scale |
| Ozmidov Buoyancy            | $L_R$  | $\left[\varepsilon/N^3\right]^{1/2}$ | Buoyancy force balances turbulence force |
| Gibson Flamelet             | $L_G$  | $v_f \gamma^{-1}$ | Thickness of flames in turbulent combustion |
| Particle Collision          | $L_C$  | $m \sigma^{-1} \rho^{-1}$ | Distance between particle collisions |
| Hubble Horizon              | $L_H$  | $ct$ | Maximum scale of causal connection |

$^a$ $V_S$ is sound speed, $\rho$ is density, $G$ is Newton’s constant, $D$ is the diffusivity, $V_D \equiv D/L$ is the diffusive velocity at scale $L$, $V_G \equiv L[\rho G]^{1/2}$ is the gravitational velocity, $\gamma$ is the strain rate, $\nu$ is the kinematic viscosity, $\varepsilon$ is the viscous dissipation rate, $N \equiv [g \rho^{-1} \partial \rho/\partial z]^{1/2}$ is the stratification frequency, $g$ is self-gravitational acceleration, $z$ is in the opposite direction (up), $v_f$ is the laminar flame velocity, $m$ is the particle mass, $\sigma$ is the collision cross section, $c$ is light speed, $t$ is the age of universe.

$^b$ Magnetic and other forces (besides viscous and turbulence) are negligible for the epoch of primordial self-gravitational structure formation (Gibson 1996).
Table 2. Acronyms

| Acronym  | Meaning                              | Physical significance                                      |
|----------|--------------------------------------|------------------------------------------------------------|
| BDM      | Baryonic Dark Matter                 | PGC clumps of JPPs from HGD                                |
| CDM      | Cold Dark Matter                     | Questioned concept                                          |
| CMB      | Cosmic Microwave Background          | Plasma transition to gas after big bang                    |
| HCC      | Hierarchical Clustering Cosmology    | Questioned CDM concept                                      |
| HCG      | Hickson Compact Galaxy Cluster      | Stephan’s Quintet (SQ=HGC 92)                              |
| HGD      | Hydro-Gravitational-Dynamics         | Corrects Jeans 1902 theory                                 |
| ISM      | Inter-Stellar Medium                 | Mostly PFPs and gas from JPPs                              |
| JPP      | Jovian PFP Planet                    | H-He planet formed by PFP accretion                        |
| ACDMHCC  | Dark-Energy CDM HCC                  | Three questioned concepts                                  |
| NBDM     | Non-Baryonic Dark Matter             | Includes (and may be mostly) neutrinos                     |
| OGC      | Old Globular star Cluster            | PGC that formed stars at $t \approx 10^6$ yr               |
| PFP      | Primordial Fog Particle              | Earth-mass BDM primordial planet                           |
| PGC      | Proto-Globular star Cluster          | Jeans-mass protogalaxy fragment                             |
| SSC      | Super-Star Cluster                   | A cluster of YGCs                                          |
| YGC      | Young Globular star Cluster          | PGC forms stars at $t \approx \text{now}$                  |