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Falsification of dark energy by fluid mechanics

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The 2011 Nobel Prize in Physics was awarded for the discovery of accelerating supernovae dimness, suggesting a remarkable reversal in the expansion rate of the Universe from a decrease to an increase, driven by anti-gravity forces of a mysterious dark energy material comprising 70% of the Universe mass-energy. Fluid mechanics and Herschel-Planck-Spitzer-Hubble etc. space telescope observations falsify both the accelerating expansion rate and dark energy concepts. Kinematic viscosity is neglected in models of self-gravitational structure formation. Large plasma photon viscosity predicts protosuperclustervoid fragmentation early in the plasma epoch and protogalaxies at the end. At the plasma-gas transition, the gas protogalaxies fragment into Earth-mass rogue planets in highly persistent, trillion–planet clumps (proto-globular-star-cluster PGCs). PGC planets freeze to form the dark matter of galaxies and merge to form their stars, giving the hydrogen triple-point (14 K) infrared emissions observed. Dark energy is a systematic dimming error for Supernovae Ia caused by partially evaporated planets feeding hot white dwarf stars at the Chandrasekhar carbon limit. Planet atmospheres may or may not dim light from SNe–Ia events depending on the line of sight.

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1. Introduction

For any physical theory to be useful it must be falsifiable; that is, it must be subject to testing by observations that could render it false. The 2011 Nobel Prize in Physics has been awarded to Perlmutter, Reiss and Schmidt for their very careful and independent observations of distant supernovae, apparently showing the rate of expansion of the Universe ceased to decrease after the big bang, and is now increasing. It is not. The purpose of the present paper is to show the attribution of supernovae dimness to anti-gravitational dark energy is falsified by planets in clumps as the dominant galaxy dark matter, or missing mass, as predicted from basic fluid mechanics, Gibson (1996, 2000) and independently observed and claimed from quasar microlensing, Schild (1996). New space telescope observations are discussed that confirm the falsification. An alternative fluid mechanically based cosmology is proposed.

The standard (concordance) model of cosmology (CC) is $\Lambda CDMHC$, where Λ represents dark energy material driving the accelerating expansion rate of the Universe by

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anti-gravitational forces. Einstein introduced Λ to permit a static universe in general relativity, but set $\Lambda = 0$ when expansion was observed. CDM is Cold Dark Matter, an unknown and at least equally massive (and equally questionable) cosmological material that condenses by hierarchical clustering HC. CC cosmology and CDM dynamics are discussed in the following §2 about Theory. The fatal flaw of the CC model is its assumption that most of the fluid mechanics in cosmology can be ignored by simplifications, Jeans (1902).

Numerous attempts have been made to include basic fluid mechanical improvements to the CC model starting with Gibson (1996); that is, to include turbulence, kinematic viscosity, diffusivity, stratified fossil turbulence and turbulent mixing. An initial finding was that the dark matter of galaxies must be Earth-mass primordial gas planets in dense Jeans-mass clumps. This prediction of Gibson (1996) was independently confirmed by Schild (1996) from his 15 year study of quasar microlensing by a galaxy on the line of sight. Schild inferred from the twinkling frequency and brightness of the quasar images that the missing mass and dominant point mass objects of the galaxy must be small planets in clumps, not stars. The improved CC cosmology is termed hydro-gravitational-dynamics, or HGD, cosmology, Gibson (2012a,b). HGD predicts 3×10^7 planets per star in a galaxy, as observed, Schild (1996), not 8 as presently assumed (wrongly) for the Sun.

A hot big bang event at Planck scales is overwhelmingly accepted as the simplest explanation of observations from modern telescopes in the context of Einstein's general relativity theory and quantum mechanics, Peacock (2000). However, gravitational accelerations of 10^{51} g must be overcome at the small Planck length scale 10^{-35} m, Gibson (2005). Gravitational pressures of 10^{113} Pa are required, and are matched by negative stresses of big bang turbulence vortex stretching, Gibson, Schild & Wickramasinghe (2011). Anti-gravity Λ is not needed. Spin from big bang turbulence fossils, Gibson (2004), is preserved at 10^{25} m length scales, Schild & Gibson (2011), 10% of the present horizon scale $L_H = ct$.

CDM hierarchical clustering HC has been recently falsified by Kroupa et al. (2010) from observations showing the required numbers of small clusters of stars (Local Groups) do not exist in the Milky Way galaxy. This finding falsifies dark energy Λ by removing its theoretical basis. Small dark matter gas planets are ruled out by $CDMHC$ cosmology. Thus, every small gas planet detected falsifies Λ. HGD cosmology predicts a rapid $\sim t^3$ formation of galactic central black holes, Nieuwenhuizen (2011). Quasars observed at redshifts $5 \geqslant z \geqslant 10$ therefore support HGD and falsify both $CDMHC$ and Λ. Because gravitational instability is absolutely unstable and nonlinear, like turbulence, HGD cosmology cannot be solved simply by mathematical analysis and proofs, Gibson (2012a). Kolmogorovian universal similarity laws are required, limited by appropriate hydrodynamic phase diagrams and relevant forces, Gibson (1986, 1991).

2. Theory

Concordance CC cosmology rejects basic fluid mechanics as unnecessary. Flows are assumed to be ideal, resulting from gradients in a velocity potential, and collisionless. Gravitational structure formation is based on the Jeans analysis of 1902. Table 1 presents the alternative HGD scenario. Proto-galaxies form at the end of the plasma epoch with Nomura scale (L_N) and morphology and evolve on fossil vorticity turbulence vortex lines stretched by the expansion of the universe, Gibson & Schild (2010a) and Gibson & Schild (2010b). Both the Nomura and Planck scales reflect Kolmogorovian similarity at Kolmogorov length scales $L_K = (\nu^3/\varepsilon)^{1/4}$ and time scales $T_K = (\nu/\varepsilon)^{1/2}$, where ν is the kinematic viscosity and ε is the viscous dissipation rate.

Jeans (1902) reduced the Navier Stokes equations to acoustics by neglecting viscosity (Euler's equation), neglecting density (Jeans swindle), neglecting non-linearity by the application of linear perturbation stability analysis (no turbulence), and neglecting diffusion of weakly interacting massive particles (no neutrinos). Self gravitational structure formation is permitted only for length scales $L_H \geqslant L \geqslant L_J = V_S \tau_g$, where V_S is the speed of sound, $\tau_g = (\rho G)^{-1/2}$ is the gravitational free fall time, ρ is density, G is Newton's gravitational constant, the horizon scale $L_H = ct$ is the scale of causal connection, c is light speed, and t is time since the big bang.

Without fluid mechanics, cold dark matter (CDM) is needed to explain structure formation during the plasma epoch $10^{11} \leqslant t \leqslant 10^{13}$ seconds because $L_J \geqslant L_H$ for the plasma during this period. Cooling the non-baryons gives $L_{JCDM} \leqslant L_H$ and NBDM Jeans instability. With fluid mechanics, it is only necessary to recognize that the low densities and high temperatures of the early $H - He^4$ plasma and gas Universe give large kinematic viscosity ν values that dominate self-gravitational structure formation, contrary to Jeans (1902) and all CDM cosmology models. In the plasma epoch, photons transport momentum by elastic collisions with electrons (Thomson scattering), which communicate it to the ions. Protosupercluster fragmentation occurs at 10^{12} s when $L_H \geqslant L_{SV}$. CDM is not needed to make structure in the plasma, and if it existed, it would not.

Most of the dark matter of the Universe is non-baryonic (not composed of protons and neutrons). Whatever its particles are, they must be nearly collisionless, like neutrinos, or they would have been detected. It was assumed by CC cosmology that somehow non-baryonic dark matter NBDM material would have a smaller Jeans scale if it were cold, so it could condense by the Jeans 1902 criterion. These small condensate seeds would then clump together (HC) to make massive halos into which the baryonic dark matter BDM would fall and condense as stars, galaxies and galaxy clusters (in this order). Such assumptions are fluid mechanically untenable for such a viscous fluid ($\nu = 4 \times 10^{26} m^2 s^{-1}$), and completely lack observational support. No NBDM halo has been detected, and neither has the CDM particle.

Consider a clump of perfectly cold non-baryonic dark matter (NBDM), or a cluster of smaller clumps termed a halo. The initially motionless particles immediately start to move toward the center of gravity of the halo. No matter how small the collision cross section of CDM particles is assumed to be, a density will be reached (in a free fall time) large enough for the collisionless assumption to fail, so the halo simply diffuses away. The size of CDM halos is found by matching the diffusion velocity to the gravitational velocity at the Schwarz diffusive length scale $L_{SD} = (D^2 \rho G)^{1/4}$, where D is the diffusivity. From fluid mechanics, $D = (n/\sigma) v_p$, n is the particle number density, σ is the particle collision cross section and v_p is the particle velocity. No CDM structure formation is possible during the plasma epoch because $L_{SD} \geqslant L_H$ during this period, Gibson (1996).

Viscous forces balance self-gravitational forces at the Schwarz viscous scale $L_{SV} = (\gamma \nu / \rho G)^{1/2}$, where γ is the rate of strain and ν is the kinematic viscosity. Viscous forces were small in the beginning instant of the big bang event $T_P = T_K = 10^{-43}$ s because the Planck length scale $L_P = L_K = 10^{-35}$ m for collisions of Planck particles was the only one available at Planck temperatures 10^{32} K. Viscous and inertial vortex forces matched at the Kolmogorov scale L_K, Gibson (2005), so the Schwarz turbulence scale $L_{ST} = (\varepsilon / [\rho G]^{3/2})^{1/2}$ remained larger than the Planck scale and Schwarz viscous L_{SV} scale during the big bang turbulence event until quenched by gluon-viscosity at the strong force freeze out temperature 10^{28} K. Viscous dissipation rates ε of 10^{60} W homogenize small scales of the turbulence. Negative gluon-viscous stresses power anti-gravitational inflation of the fossilizing turbulent fireball to meter scales preserving Planck density, Gibson (2004).

t, seconds	*event*
10^{11}	mass exceeds energy, plasma epoch begins, $L_H \leqslant L_{SV}$
10^{12}	protosupercluster fragmentation occurs when $L_H \geqslant L_{SV}$, 10^5 K
10^{13}	$L_N = 10^{20}$ m plasma protogalaxy fragmentation on vortex lines
10^{13}	$\nu_{plasma} = 10^{26} m^2\ s^{-1}$ (photon viscosity), $\nu_{gas} = 10^{13} m^2\ s^{-1}$
10^{13}	gas epoch begins, 3000 K, $\rho = \rho_0 = 4 \times 10^{-17} kg\ m^{-3}$
$10^{13} + 10^{12}$	planets fragment in Jeans mass clumps (protoglobularstarclusters)
$10^{13} + 10^{12}$	first stars appear as gas planets merge (no 10^{16} s dark age)
$10^{13} + 10^{12}$	first chemicals form in stars and supernovae, exploding stars seed planets
$10^{13} + 10^{12}$	iron cores condense as planets merge, oxides are reduced to metals and water
10^{14}	oceans condense at critical water temperature 647 K, life begins everywhere

Table 1. HGD cosmology plasma to gas transition events → the biological big bang

A 10^{25} m diameter fossil big bang turbulence vortex line persists as the axis of evil (a preferred direction on the sky), Schild & Gibson (2011). Such a preferred direction on large scales falsifies the intrinsically scalar aspect of the dark energy concept Λ. Turbulence effects indicated on the cosmic microwave background (studies of Sreenivasan and Bershadski) have been discussed (Gibson (2010), fig.5).

3. Observations

Figure 1 illustrates falsification of dark energy by the fluid mechanics of HGD cosmology. Hubble Space Telescope optical observations of the Helix planetary nebula (bottom) are compared to Supernovae Ia dimness observations (top) as a function of redshift z (Gibson (2010), fig 8). Further discussion is found in the reference.

The dark energy proposition is falsified because it does not take into consideration the possibility that the atmospheres of evaporated dark matter planets (Table 1) may randomly dim or not dim the light of Sne Ia events depending on the line of sight.

Error bars on the dimness data points (top fig. 1) are smaller than the scatter, and cannot be explained as "uniform grey dust". Solid ovals support a "nonlinear grey dust" explanation of a systematic dimming by planet atmospheres on the line of sight, and open circles support a "no dark energy" interpretation where the Sne Ia events are unobscured. The same systematic error is seen (bottom left) in Sne Ia estimates of the age of the Universe, which also falsify Dark Energy and confirm HGD cosmology and fluid mechanics.

Figure 2 illustrates dark energy falsification by HGD fluid mechanics from the Herschel space observatory, Wilcock et al. (2011). The wide range of frequencies permit detection of low temperatures and high densities of dense core regions with star formation. The core densities closely match the high density of first fragmentation ρ_0 expected from HGD cosmology (Table 1). Core temperatures 14 K match the triple point temperature of hydrogen (13.8 K), attributed to evaporating planets merging to form stars. Black dots circling the core at 10^{16} m represent large gas planets evaporating at Oort cloud distances. Such planets are shown (bottom right insert fig. 1) in Helix. Their size $\geqslant 3 \times 10^{13}$ m indicates previous dark matter planet mergers from Earth mass to form Jupiters.

Figure 3 shows the Small Magellanic Cloud galaxy (left and top) and a nearby Proto-PlanetaryNebula (right bottom), Fig. 4 Gibson (2012a). Proto-Planetary-Nebula clumps of planets appear as red dots (top left). Cold cores shown in Fig. 2 are formed by a PGC

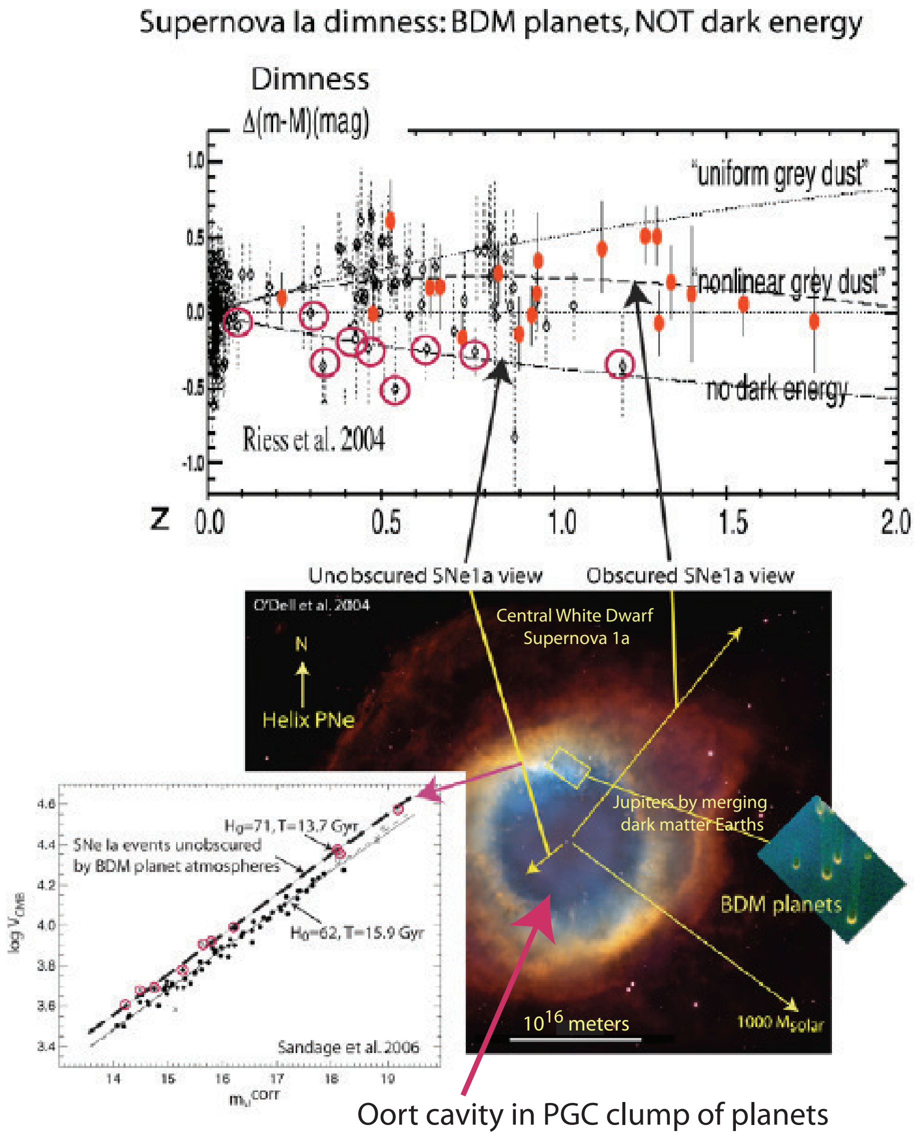

FIGURE 1. Dark energy is a systematic dimming error due to baryonic dark matter *BDM* planet atmospheres surrounding dying stars such as the White Dwarf in Helix (Gibson (2010), fig. 8).

center of gravity (bottom right) as it triggers planet mergers and larger planet and star formation along its path.

4. Conclusions

The accelerating expansion rate of the Universe and Dark Energy concepts rewarded by the 2011 Nobel Prize in Physics are falsified by fluid mechanics. The standard (Concordance Cosmology) $\Lambda CDMHC$ model of cosmology should be replaced by *HGD* cosmology and its fluid mechanical improvements. Predictions of HGD cosmology and turbulence theory Gibson (2012a,b) are supported by the Herschel-Planck-Spitzer-Hubble space telescope images and data of Figures 1–3.

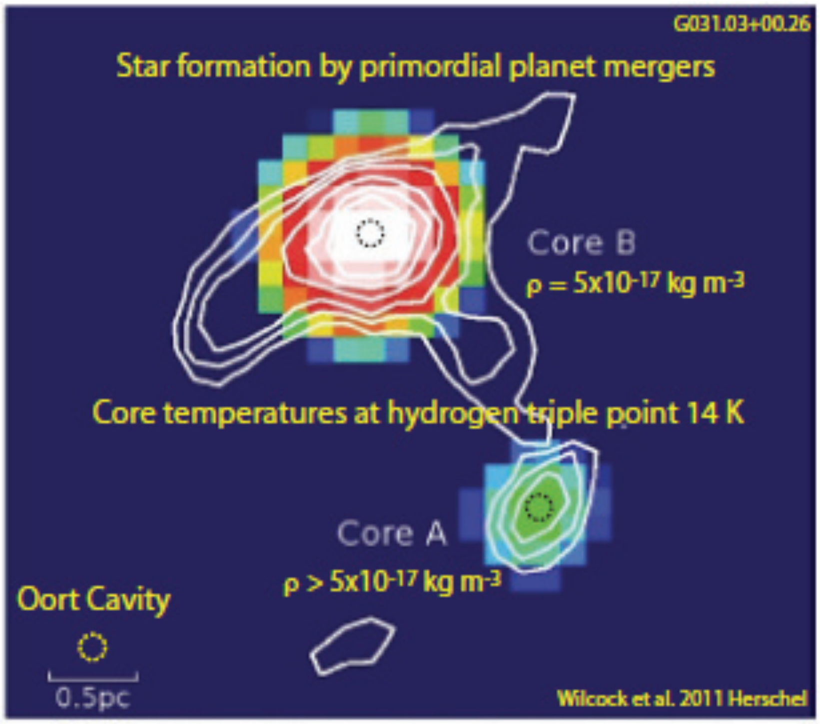

FIGURE 2. Herschel space telescope study of dense cores, Wilcock et al. (2011), showing evidence of star formation by frozen primordial planet mergers. Both Core A and Core B have densities matching $\rho_0 = 4 \times 10^{-17} kg\ m^{-3}$ existing at the time of first fragmentation 10^{12} seconds, and merging temperatures expected for evaporating planets at the triple point of hydrogen 14 K.

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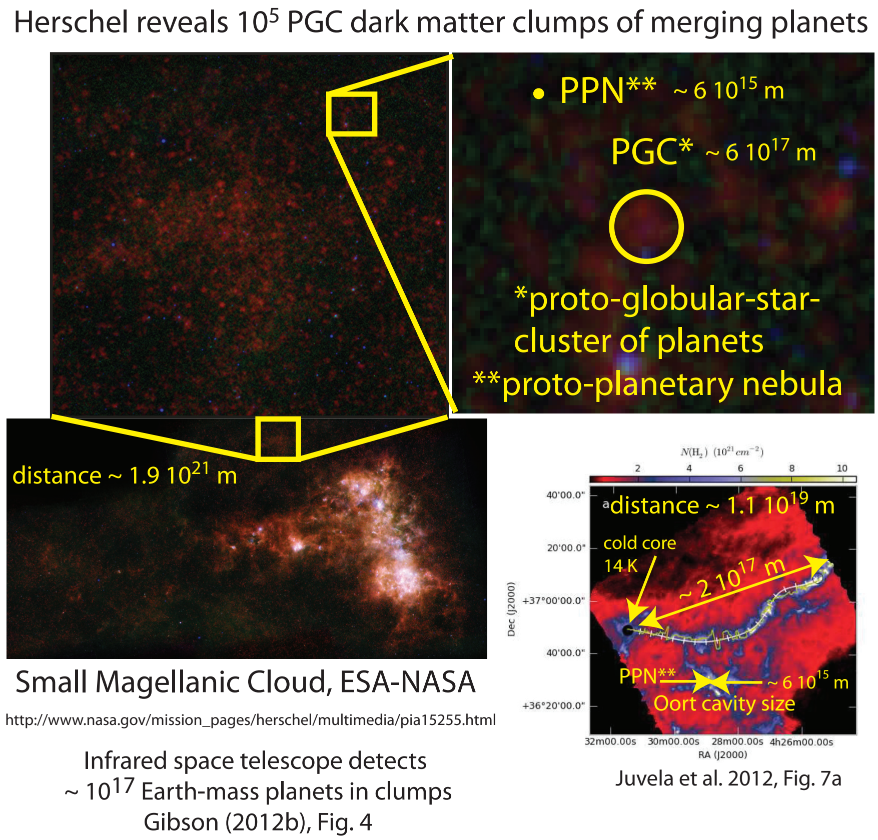

FIGURE 3. Herschel space telescope study of dense cores, Wilcock et al. (2011), showing evidence of star formation by frozen primordial planet mergers in the Small Magellanic Cloud.

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