The current cosmological picture has been remarkably successful, but contains a number of apparently unnatural features. This Standard Model of Cosmology [1] has received further support from the analysis of the 3-year WMAP data, combined with information from other cosmological probes [2]. Some of the necessary ingredients of the SMC have caused cosmologists to respond with adjectives such as ‘epicyclic’, ‘ugly’, ‘baroque’ or ‘preposterous’, and with questions such as ‘who ordered that?’

In particular, the Universe appears to be dominated by a form of ‘Dark Energy’, as well as containing considerably more Dark Matter than ordinary baryons. Much is often made of the so-called ‘Cosmic Coincidence’ problem, namely that we live at the epoch where $\Omega_{\text{DM}} \sim \Omega_{\text{DE}}$, despite the fact that the ratio varies dramatically with time [3]. Another version of the same coincidence is that we live close to the epoch when the Universe is transitioning from deceleration to acceleration. But in practice these ‘coincidences’ are no better than the factor $\sim 2$ level (in fact $\Omega_{\text{DE}}/\Omega_{\text{DM}} \simeq 3.8$ and $\sigma_{\text{jerk}} \simeq 0.8$), perhaps significant on an astronomical scale, but hardly impressive in human terms [4].

However, there is another version of this same ‘Dark Conspiracy’ that appears even more bizarre – the current best-buy cosmology has values of $H_0$ and $t_0$ which, within their uncertainties, are consistent with $H_0 t_0 = 1$. This is counter to the prevailing wisdom of the end of the 20th century, when it was expected that $H_0 t_0 \approx 2/3$, with unity being considered the upper limit.

The new results from WMAP data alone, specifically for a flat $\Lambda$CDM model, give [2]:

$$H_0 t_0 = 1.03 \pm 0.04.$$ (1)

In other words, we seem to live exactly at (or at least within $1\sigma$ of) the epoch when $t_0 \equiv H_0^{-1}$. This would seem to be a conspiracy, designed to make the Universe deceptively simple to explain!

When cosmologists teach introductory material about the Universe, the following 2 concepts are often discussed: (1) the overall curvature of the Universe could be negative, positive or zero [5], therefore we are trying to determine what it is; and (2) if we run the clock backwards in time we end up with everything in the same place at $t_0 = H_0^{-1}$, provided that the expansion rate has been constant. But in today’s precision cosmology reality, we are forced to explain that the curvature appears to be consistent with zero, so you can ignore that non-Euclidean stuff, and that $t_0 = H_0^{-1}$, even although the expansion rate slowed down for a while and recently speeded up again [6].

This value for $H_0 t_0$ is only natural in a completely empty universe, otherwise known as the Milne model [8]. Even string theorists would typically agree that there is empirical evidence for matter in the Universe. Hence it seems unlikely that the scale factor $a \propto t$, except as an average over all cosmic time. In fact, the current suite of cosmological data requires not only $\Omega_M > 0$, but $\Omega_{\text{DE}} > 0$, as well as independent constraints on 4 other parameter combinations – a 6 parameter construction that has been referred to as the new Milne model [8].

If this were the only odd factor in the SMC, then one might imagine that the present-day Universe came about through sheer happenstance. But there are a large number of other apparent cosmological coincidences [10], not all of which are stressed very often. Could it be that, out of all the possibilities in the Multiverse [11], we live in a peculiar universe, with very precisely crafted properties? Is it possible that the Landscape is trying to tell us something?

A search for such conspicuous irregularities [12] might turn up some of the following:

- $\Omega_{\text{DM}} = 5\Omega_{\Lambda}$: where does this value come from?
- $\Omega_A = 5\Omega_M$: somewhat increased recently
- $\Omega_\nu \simeq \Omega_{\text{stars}}$: neutrino mass density similar to that in stars
- $\Omega_M \simeq Y_p$: relationship between matter and helium

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*Electronic address: docslugtoast@phas.ubc.ca
†Electronic address: afrolop@phas.ubc.ca
• $t_0 = 3t_\odot$: 13.8 versus 4.6 Gyr

• $t_0 - t_{\text{jerk}} \simeq t_\odot$: Solar System formed at the Cosmic Jerk

• $z_{B\gamma} \simeq z_{\text{ls}}$: baryon-photon equality at epoch of last-scattering surface

• $h^2 = 1/2$: dimensionless Hubble constant

• $\Delta_R^2 \sim n_B/n_\gamma$: fluctuation power comparable to baryon-to-photon ratio

• $\Omega_{\text{tot}} = n = -w = 1$: the conspiracy of unities

• $T_0 = $ triple point of water $\div 100$ [13]

• $\ell_{\text{peak}} = $ Sunyaev-Zel’dovich null in GHz

• Stephen Hawking’s initials in the WMAP temperature image [14]

• The letters ‘C.O.’ in the WMAP synchrotron polarization pattern [15]

Which of these turn out to be complete coincidence remains to be seen. But perhaps one of them will be the ‘smoking grail’ that cosmologists have been looking for to lead us beyond vanilla ΛCDM into a whole new ice-cream parlour of models.

[1] Scott D., 2006, to appear in proceedings of ‘Theory Canada 1’, astro-ph/0510731.
[2] Spergel D.N., et al., 2006, submitted to ApJ, astro-ph/0603449.
[3] E.g. Carroll S.M., 2001, Living Rev. Rel., 4, 1, astro-ph/0004075.
[4] E.g. ‘That was a close race, my horse only lapped your horse once!’ or ‘Amazing, your birthday’s in October and mine is in July!’
[5] Using the Markov Chain kindly provided by the WMAP team; it is also odd that in dimensionful units the value is $1006 \pm 38$ km s$^{-1}$ Mpc$^{-1}$ Gyr, i.e. very close to 1000.
[6] Usually followed by much hand-waving, mumbling about analogies with spheres whose surfaces you’re trapped on and saddles which don’t really work in 3-dimensions anyway.
[7] Perhaps the Universe just hates us; this is known as the Misanthropic Principle.
[8] Milne E.A., 1934, Q.J. Math. Oxford, 5, 64; reprinted 2000, GReGr, 32, 1949.
[9] Milne A.A., 1927, ‘Now we are Six’, Methuen, London; reprinted 1999, Methuen, London; I am grateful to Max Tegmark for pointing out this early cosmological treatise.
[10] e.g. Carter B., 1974, in ‘Confrontation of Cosmological Theories with Observational Data’, Reidel, Dordrecht, p. 291; Aguirre A., Tegmark M., astro-ph/0409072; Rees M.J., astro-ph/0401241; Bousso R., Polchinski J., 2000, JHEP, 0006, 006; Shemi-zadeh V.E., gr-0206064; Martin B., 1998, Skept. Inq., Vol. 22, No. 5, p. 23.
[11] Moorcock M., 1963, ‘The Blood Red Game’, Sci. Fict. Adv., Vol. 6, No. 32, p. 54.
[12] In Scotland, such a search is called ‘hunt-the-gowk’.
[13] I thank Mark Halpern for pointing this out; see also www.astro.ubc.ca/people/scott/whochosetemp.html
[14] Which survive in the 3-year maps.
[15] Page L., 2006, submitted to ApJ, astro-ph/0603450, left panel of Fig. 8; suggestions for the significance of these initials should be sent to the second author, Dr. Frolop.