Unsolved problems : Cosmology, and general relativity

from:- ***http://en.wikipedia.org/wiki/List_of_unsolved_problems_in_physics***

Cosmic inflation : Is the theory of cosmic inflation correct, and, if so, what are the details of this epoch? What is the hypothetical inflaton field giving rise to inflation? If inflation happened at one point, is it self-sustaining through inflation of quantum-mechanical fluctuations, and thus ongoing in some extremely distant place?

Horizon problem : Why is the distant universe so homogeneous when the Big Bang theory seems to predict larger measurable anisotropies of the night sky than those observed? Cosmological inflation is generally accepted as the solution, but are other possible explanations such as a variable speed of light more appropriate?

Electroweak horizon problem : Why aren't there obvious large-scale discontinuities in the electroweak vacuum if distant parts of the observable universe were causally separate when the electroweak epoch ended? Standard cosmological inflation models have inflation cease well before electroweak symmetry breaking occurs, so it is not at all clear how inflation could prevent such discontinuities.

Future of the universe : Is the universe heading towards a Big Freeze, a Big Rip, a Big Crunch, or a Big Bounce? Or is it part of an infinitely recurring cyclic model?

Gravitational wave : Can gravitational waves be directly detected?

Baryon asymmetry : Why is there far more matter than antimatter in the observable universe?

Cosmological constant problem : Why does the zero-point energy of the vacuum not cause a large cosmological constant? What cancels it out?

Dark matter : What is the identity of dark matter? Is it a particle? Is it the lightest superpartner (LSP)? Do the phenomena attributed to dark matter point not to some form of matter but actually to an extension of gravity?

Dark energy : What is the cause of the observed accelerated expansion (de Sitter phase) of the Universe? Why is the energy density of the dark energy component of the same magnitude as the density of matter at present when the two evolve quite differently over time; could it be simply that we are observing at exactly the right time? Is dark energy a pure cosmological constant or are models of quintessence such as phantom energy applicable?

Dark flow : Is a non-spherically symmetric gravitational pull from outside the observable Universe responsible for some of the observed motion of large objects such as galactic clusters in the universe?

Ecliptic alignment of CMB anisotropy : Some large features of the microwave sky at distances of over 13 billion light years appear to be aligned with both the motion and orientation of the solar system. Is this due to systematic errors in processing, contamination of results by local effects, or an unexplained violation of the Copernican principle?

Shape of the Universe : What is the 3-manifold of comoving space, i.e. of a comoving spatial section of the Universe, informally called the "shape" of the Universe? Neither the curvature nor the topology is presently known, though the curvature is known to be "close" to zero on observable scales. The cosmic inflation hypothesis suggests that the shape of the Universe may be unmeasurable, but, since 2003, Jean-Pierre Luminet, et al., and other groups have suggested that the shape of the Universe may be the Poincaré dodecahedral space. Is the shape unmeasurable; the Poincaré space; or another 3-manifold?

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