

Science Café

Sunday, December 16, 2018 (2:00-3:30 P.M.)

Points, Lines and Infinitesimals

Issues with using geometry as a language to describe our Universe

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Meeting at Ijams Nature Center

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**Everyone is Invited!
Free to attend!**

**Kid's Café
provided**



**There will be a brief NOVA video presentation followed by an hour of
Questions and Discussion with refreshments**

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Points, Lines and Infinitesimals: Issues with using geometry as a language to describe our Universe.

- Jeff Baugher (Aiken SC)
- BSEE Wright State University
- PhD candidate Wright State University
 - Studied MEMS @ Air Force Institute of Technology WPAFB Dayton Ohio
 - Path of my research: MEMS>Study of elasticity>elasticity tensors>tensors in gravity>General Relativity>Cosmological Constant problem>history of geometry>axiomatic method to field equations

What are infinitesimals?

- Way too many definitions and concepts to cover in this presentation
- Going to cover just three new types that can vary!
- But what is the context....

Context for infinitesimals

- Einstein Field Equation (EFE) is best description of gravity currently known.
- EFE is now shown with another term within it, the Cosmological Constant, (CC).
- In 1998, the observed phenomenon now called Dark Energy was first observed.
- DETF states seems to be the best fit for observation of Dark Energy but could be evidence that General Relativity is incomplete or incorrect.

Context for infinitesimals

- The Dark Energy Task Force (DETF) was established by the Astronomy and Astrophysics Advisory Committee (AAAC) and the High Energy Physics Advisory Panel (HEPAP) as a joint sub-committee to advise the Department of Energy, the National Aeronautics and Space Administration, and the National Science Foundation on future dark energy research.
 - <https://arxiv.org/ftp/astro-ph/papers/0609/0609591.pdf>
- DETF states that the CC seems to be the best geometrical fit for observation of Dark Energy but could be evidence that General Relativity is incomplete or incorrect.

Context for infinitesimals

- The CC term Λ is understood to include the “metric” g as well as the *infinitesimal* terms dx or ∂x .

$$\Lambda g_{\mu\nu} \partial x_{\mu} \partial x_{\nu}$$

Context for infinitesimals

- EFE is derived from the concept of non-Euclidean geometry, which is derived from the concept of Euclidean geometry, plus "curvature" and non-curvature or curving and parallel lines.
- Euclidean geometry is derived from a set of primitive notions of points, lines and planes through the axiomatic method.

Context for infinitesimals

- Therefore the EFE, including the CC term, is made of the primitive notions.

Issue and Hypothesis development

- Issue: “An alternative explanation of the accelerating expansion of the Universe is that general relativity or the standard cosmological model is incorrect.”-DETF
- Hypothesis 1: General Relativity is founded upon the primitive notions of points, lines and planes. These primitive notions are not logically consistent.
- Hypothesis 2: Primitive notions of *locations* and *relative line segments* provide a logically consistent geometric foundation for a gravitational field equation.

Locations and relative line segments

- Can derive Euclidean geometry
- Can derive integral and differential calculus
- Gives three variable infinitesimals
 - New solutions to old geometric paradoxes (Torricelli's parallelogram and Zeno's)
 - Similar geometric structures to that of non-Euclidean geometry
 - Planar
 - Elliptical
 - Hyperbolic
 - Parabolic
 - Provides counterargument to "parallelism" and "curvature" with the concept of varying infinitesimal "area"

Locations and relative line segments

- Gives three variable infinitesimals
 - Philosophical Interpretations of three variable infinitesimals
 - an infinitesimal “length” of time or space (amount of time or spatial length)
 - an infinitesimal difference of the “length” of time or space (the difference of spacing between temporal or spatial events, clock tick amounts or wavelengths)
 - infinitesimal change of wavelength or clock ticking rate

2019 Goals

- Develop flow of energy theorem that has slightly different interpretation than that Noether's Theorem
- Publication in any major fundamental physics journal
- Pre-proposal for physical research to Breakout Labs