Cosmic Topology

Gauss Bonnet Equation

$$kA = 2\pi \chi$$

In Euclidean Geometry, all the angles in a sum to 180° but not ~~se~~ ~~sp~~ in a spherical world.

By inferring the properties of geometry of the universe one can understand the shape of the universe.

Euclid's Postulates

1. One can draw a straight line from any point to any point
2. One can produce a finite straight line
3. One can describe a circle w/ any centre and radius.

4. All Right angles are equal

5. If a straight line falling on two straight line makes the interior angles on the same side less than two right angles, the two straight lines, if produced indefinitely, meet on that side on which the angles are less than two right angles.

The 5th one is called as the "parallel postulate"

Playfair's Axiom

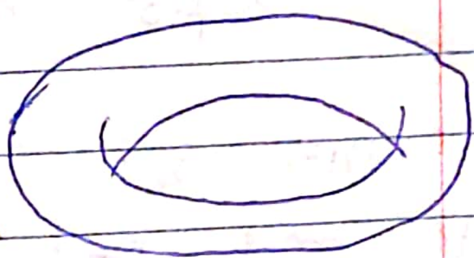
Given a line and a point on the line, there's exactly one line through the point that does not intersect the given line.

This axiom is commonly used to drive non-euclidean geometry.

One of the life time's work of János and Nikolai (independently) was the discovery that ~~the~~ a well-defined geometry is possible which the first four postulates hold, but fifth doesn't i.e. fifth postulate is not a necessary consequence of the first four.

Euclidean geometry is homogenous i.e. the local geometry of the plane is the same at all points.

An example for a non-homogenous space would be a three-dimensional donut.



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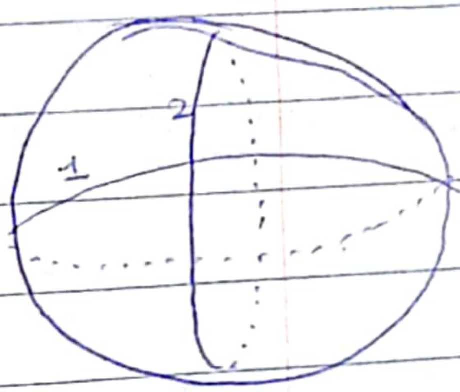
A triangle defined on any space consists of three points.

An Edge connecting point A to point B is drawn to represent the shortest path from A to B. Such a path is called as a geodesic.

On a sphere, geodesics follow great circles. A great circle is a circle drawn on the surface of the sphere whose center corresponds to centre of sphere.

1, 2 are great circles



In Euclidean space, it is a straight line.