

Project Suggestions

Most of these are broad topic areas in which you would need to determine a more specific topic of manageable scope for your project. Also, proposals for projects on topics not listed here are certainly welcome.

1. The universal principal G -bundle $EG \rightarrow BG$; identification of isomorphism classes of principal bundles over B with homotopy classes of maps $B \rightarrow BG$.
2. The only spheres that have Lie group structures are S^1 and S^3 .
3. Compact 3-manifolds that are fiber bundles over S^1 in infinitely many ways.
4. Symmetric spaces (as examples of G/H with G -invariant Riemannian metric)
5. The space of connections on a given principal G -bundle (for G compact) as an “infinite-dimensional symplectic manifold” with the Atiyah-Bott form.
6. Holomorphic structures on vector bundles over complex manifolds; equivalent descriptions as $\bar{\partial}$ operator on sections, or by holomorphic local trivialization.
7. Symmetric spaces (as examples of G/H with G -invariant Riemannian metric).
8. Classification of compact simple Lie groups.
9. De Rham cohomology of a compact Lie group.
10. On a 3-manifold, every homotopy class of rank-2 distributions contains an integrable one (Thurston).
11. Existence of sphere eversions.
12. Seifert fiber spaces.

Version history: This is the first public version of this document, released on February 21, 2019.