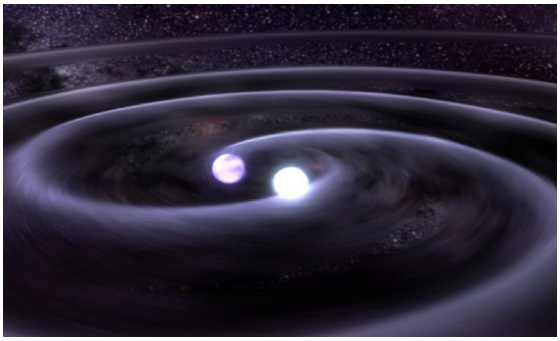
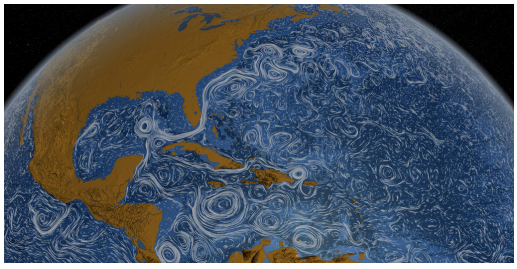
Differential Geometry and Mathematical Physics for Visualization and Analysis

Project Description



Differential geometry provides a powerful mathematical framework for describing physical processes from cosmology and general relativity to planet-scale fluid flow, such as large-scale eddies in the oceans or hurricanes, whether on Earth or on Jupiter. The combination of modern differential geometry, such as exterior calculus/differential forms [2] and Riemannian geometry [3], mathematical physics [4,5], and scientific visualization is a very exciting area where modern differential geometric methods can help achieve a very high degree of generality, for example generalizing and unifying flow analysis from flat Euclidean space to curved manifolds such as the Earth's surface.

Your Role in this Project



In this project, you will develop new visualization and analysis methods for physical phenomena built on powerful general concepts of modern differential geometry, applied to practical fields of very high importance to the environment, such as climate and weather modeling and oceanography, or even cosmological phenomena.

Requirements

You need to have:
- prior experience in MATLAB and C++ programming
- prior experience or strong interest in differential geometry or mathematical physics
- fluent English language skills
- openness for a multicultural environment

References

[1] Image by NASA/Goddard Space Flight Center Scientific Visualization Studio
[2] https://en.wikipedia.org/wiki/Differential_form
[3] https://en.wikipedia.org/wiki/Riemannian_geometry
[4] Theodore Frankel, The Geometry of Physics: An Introduction, 3rd Edition
[5] Fredric Schuller, Lectures on Geometrical Anatomy of Theoretical Physics, Erlangen-Nuremberg