## Berliner Colloquium für wissenschaftliche Visualisierung

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## **Symmetry in Scalar Fields**

## **Professor Vijay Natarajan**

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Several natural and man-made objects exhibit symmetry in different forms, both in their geometry and in the material distribution. The study of symmetry plays an important role in understanding both the structure of these objects and their physical properties. The notion of symmetry with respect to the geometry of an object or domain is well understood. In this talk, I will introduce the problem of symmetry detection in a sca-

lar field, a real-valued function defined on a spatial domain of interest. The goal is to identify regions within the domain of a scalar field that remain invariant under transformations of both domain geometry and the scalar values. Scientific data is often represented as a scalar field. Symmetry detection in scientific data is still a nascent area of research and



existing methods that detect symmetry are either not robust in the presence of noise or are computationally costly.

I will present recently developed methods that detect symmetry in, potentially noisy, 3D scalar fields. The key ingredient of each algorithm is a data structure that captures topological and geometric prop-

> erties of the scalar field. A notable property of all the algorithms is that they do not require explicit construction of the transformation that defines the symmetry. I will also demonstrate applications to symmetry-aware volume visualization, isosurface extraction, query-based exploration, linked selection and volume editing.









