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A Topological Approach to Magnetic Nulls[1] BEN ISRAELI, Princeton University, CHRIS SMIET, Princeton Plasma Physics Laboratory, Leiden University, AMITAVA BHATTACHARJEE, Princeton University, Princeton Plasma Physics Laboratory — The isotropes of a magnetic field, defined as the lines along which the direction of the magnetic field is constant, is introduced as a novel means to study the topology of magnetic fields. It is shown that the isotropes can be recovered as the stream lines of the isotropic field, which is defined via a geometric formula from the magnetic field. The behavior of the isotrope field in the vicinity of magnetic nulls resembles that of the electric field generated by point charges, and the index theorem for magnetic nulls can be reframed as a Gauss's Law on the isotrope field.

We demonstrate the isotrope field as a means of constraining the location of the nulls of a local magnetic field placed within a homogeneous guide field. Nulls will appear at the intersection of the surface where the local field's strength matches that of the guide field with the isotrope of the local field corresponding to a direction opposite the guide field. It is shown that, as the guide field is varied, nulls can form and annihilate in a fashion preserving topological index. The dipole field and Hopf field are used as example cases to demonstrate the behavior of the nulls formed when these fields are embedded in a static background field.

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Ben Israeli
Princeton University

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