

A GLOSSARY OF MAGNETIC TOPOLOGY

Boundary null: Any **null** having two distinct **spine sources**. The **fan surface** of a boundary null is a **separatrix**. A null which is not a boundary null an **internal null**.

Broken fan: A **fan surface** whose field lines connect to two or more distinct **fan sources**. The fan is therefore broken into **fan sectors** separated by **separators**. A fan which is not broken is an **unbroken fan**.

Domain: A volume containing field lines all having the same **sources** at their ends. Any field line can be continuously deformed into any other field line in the same domain. Denoted \mathcal{D}_r .

Chord:[†] One of the edges from the **chord set** of a graph. Each chord in a set corresponds to a unique **circuit**. In a **domain graph**, chords along with their corresponding **domain circuits** are given a roman index i or j .

Chord set:[†] A set of edges of a graph whose removal reduce the graph to a **tree**. For a graph with N_S vertices and N_d edges a chord set will contain $N_d - N_S + 1$ elements: its **chords**.

Circuit:[†] A closed sequence of edges in a graph. No edge is repeated within a circuit.

Circuit vector:[†] A column vector corresponding to one **circuit** of a graph. It has one element for each edge of the graph edge. Element $\vec{C}_{si} \neq 0$ if edge $s \in$ circuit i .

Coronal domain: A **domain** lying entirely above the photospheric plane of reflectional symmetry, in the $z > 0$ half-space. A coronal domain has no **footprint**.

Coronal null: A null point located above the photospheric plane of reflectional symmetry, in the $z > 0$ half-space.

Domain circuit: A **circuit** of edges (**domains**) in the **domain graph**. Each domain circuit is given a roman index i or j according to its corresponding **chord**.

Domain graph: A schematic depiction of a field's connectivity. Its vertices are **sources** and its edges are **domains**.

Fan: see **Fan surface**.

Fan sector: A contiguous portion of a **fan surface** all of whose field lines end at the same **source**.

Fan source: The **source** lying at the other end of a fan field line from the **null**.

Fan surface: The surface of field lines connected to a null. Fan field lines originate at a positive null and terminate at a negative null.

Fan trace: The curve formed from the intersection of a *fan surface* with the photospheric plane of reflectional symmetry $z = 0$. Fan traces form the edges of **footprints**.

Flux tube: An open curve connecting a **source** to infinity. Omitting these curves from the volume permits a single-valued vector potential such that $\nabla \times \mathbf{A} = \mathbf{B}$.

Footprint: The two-dimensional regions formed by the intersection of a **domain** with the photospheric plane of reflectional symmetry $z = 0$. The edges of a footprint are **spines** and **fan traces**.

Incidence matrix:[†] A matrix M_{ar} corresponding to a graph. It has a row for each edge and a column for each vertex. $M_{ar} \neq 0$ if edge r is incident on vertex a .

Internal null: A null point for which both **spine sources** are the same. The **fan surface** of an internal null is *not* a *separatrix*. A null which is not internal is a **boundary null**.

Isolating loop: A closed curve in space which links only one **domain circuit** exactly once. Each isolating loop consists of **separators** which compose a **circuit** in the **null graph**.

Null: A point at which all three components of the magnetic field vanish. A null is either positive or negative depending on the sign of the determinant $\det(-\partial B_i / \partial x_j)$. A positive (negative) null is denoted with a greek index: B_β (A_α).

Null graph: A schematic depiction of a field's **nulls** and **separators**. Its vertices are nulls, its edges are separators.

Photospheric null: A null located within the plane of reflectional symmetry $z = 0$. A null which is not photospheric is a **coronal null** or the mirror image of one.

Prone null: A **photospheric null** whose spine lies in the photosphere. A photospheric null which is not prone is an **upright null**.

Sector: see **Fan sector**.

Separator: The intersection of **separatrix** surfaces. A separator field line begins at a **positive null** and ends at a **negative null**. Denoted S_σ .

Separatrix: A surface lying at the interface of two **domains**. In a potential field each separatrix is the **fan surface** of a **boundary null**.

Skeleton: The ensemble of a field's **nulls**, **sources**, **separatrices** and **separators**. Excluded from the skeleton are **internal nulls** and their **fan surfaces** and **unbroken fans** and their nulls.

Source: A volume from which magnetic field lines originate. A source is enclosed by a **source skin** on which B_n is entirely positive or entirely negative. Denoted by roman suffix a, b or c .

Source skin: The closed surface surrounding a **source**.

Spine: One of the two field lines entering a null point perpendicular to the **fan** surface. Spine field lines terminate at positive nulls and originate at negative nulls.

Spine source: The **source** at the end of a **spine** opposite to the **null point**. Each null point has two spine sources.

Tree:[†] A graph consisting of N_S vertices and $N_S - 1$ edges. There is one and only one path of edges connecting any pair of vertices. *A tree contains no circuits.*

Unbroken fan: A fan surface for which every field line connects to the same **fan source**. This fan is not broken into **sectors** and is not part of the field's **skeleton**. The **null** from which the fan originates is connected to no **separators** and is not part of the skeleton either.

Upright null: A **photospheric null** whose **spine** is \hat{z} . Symmetry dictates that upright nulls are always **internal nulls**. A photospheric null which is not upright is a **prone null**.

[†] Denotes a term which is standard in the area of graph theory.