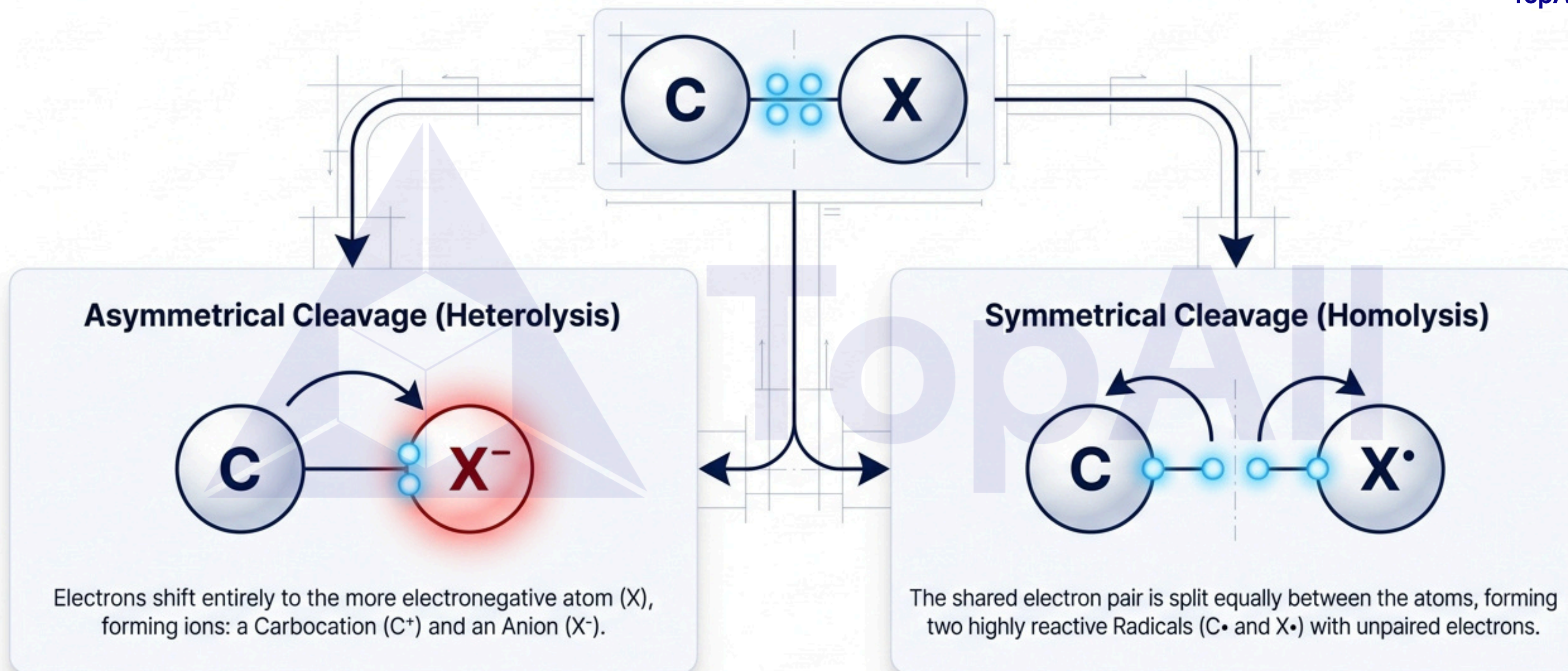
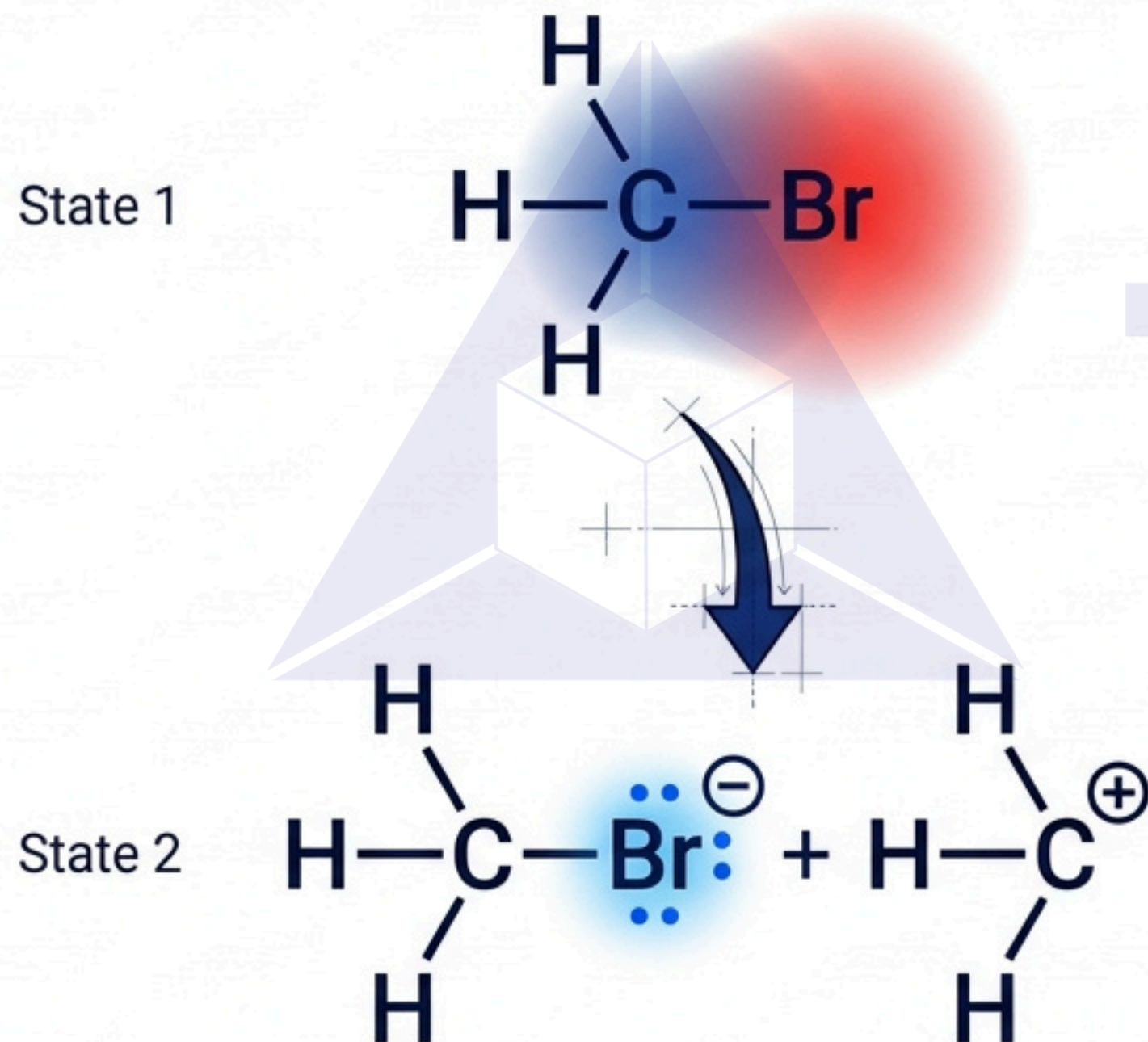


Every Organic Reaction Begins with Bond Fission



The physical reality of how a shared electron pair divides dictates the entire architecture of the resulting intermediates.

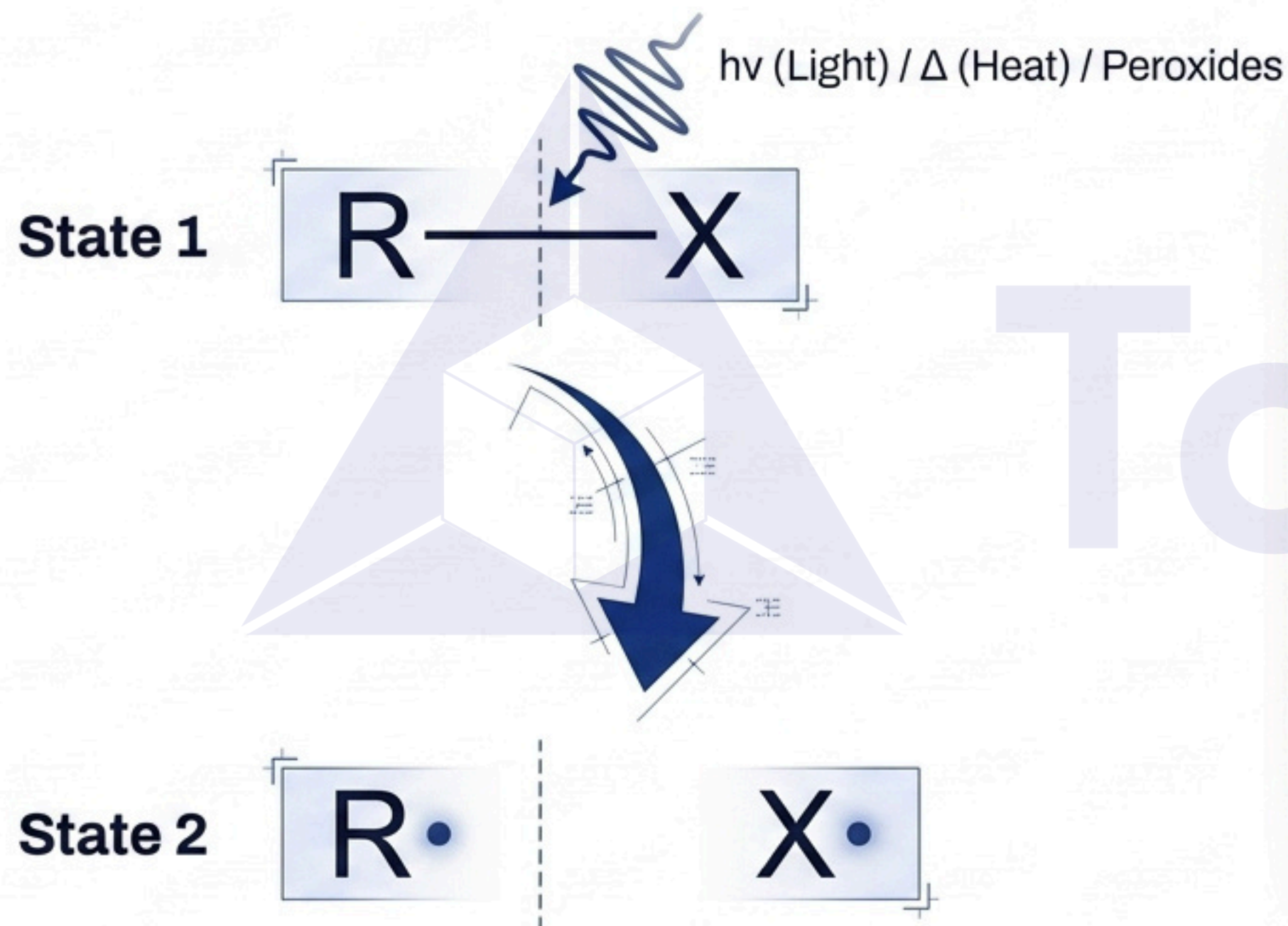
Heterolysis: The Asymmetrical Cleavage



Reaction Specifications

- ❖ **Resulting Species:** Cation (positive) and Anion (negative)
- ❖ **Key Driver:** High electronegativity difference
- ❖ **Nature:** Heteropolar / Ionic intermediates

Homolysis: The Symmetrical Cleavage



Reaction Specifications

-  **Resulting Species:** Free Radicals (neutral, odd-electron)
-  **Key Driver:** External energy (heat/light) in non-polar bonds
-  **Nature:** Highly reactive, uncharged intermediates



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Mapping Electron Pairs: The Full Curved Arrow



The Tail (Source)

MUST originate precisely at an electron pair.

The Curve (Path)

Maps the physical displacement of the electron pair.

The Head (Sink)

MUST point to the exact destination nucleus or new bond location.



Mapping Single Electrons: The Fish-Hook Arrow

The Syntax



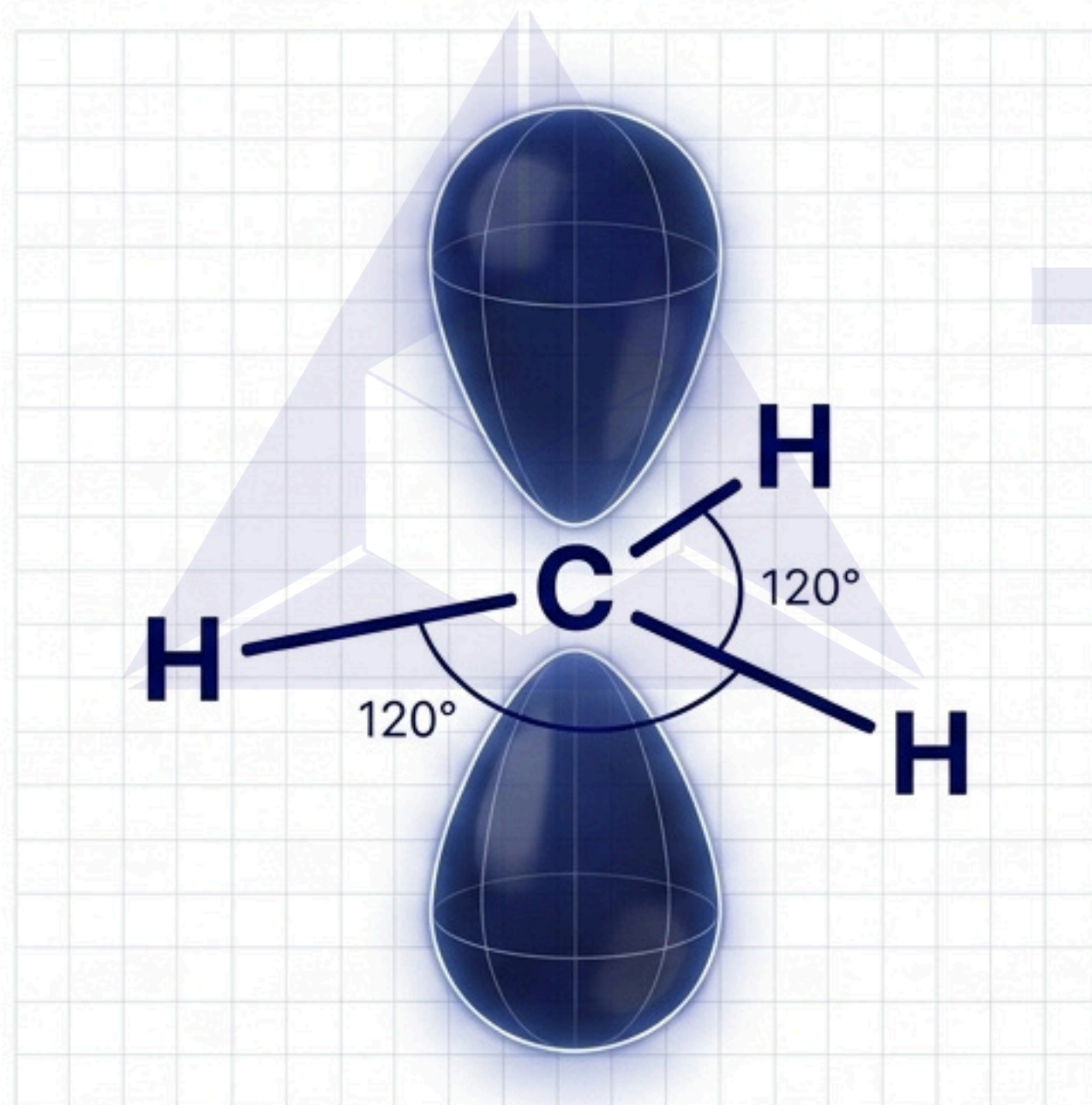
Indicates the movement of exactly **ONE** electron.

The Application



Exclusive to radical chemistry. Two fish-hook arrows are required to map the symmetrical cleavage of a single covalent bond.

Architecture of Electron Deficiency: The Carbocation



Valence Electrons: $6e^-$
(Electron deficient / Electrophile)

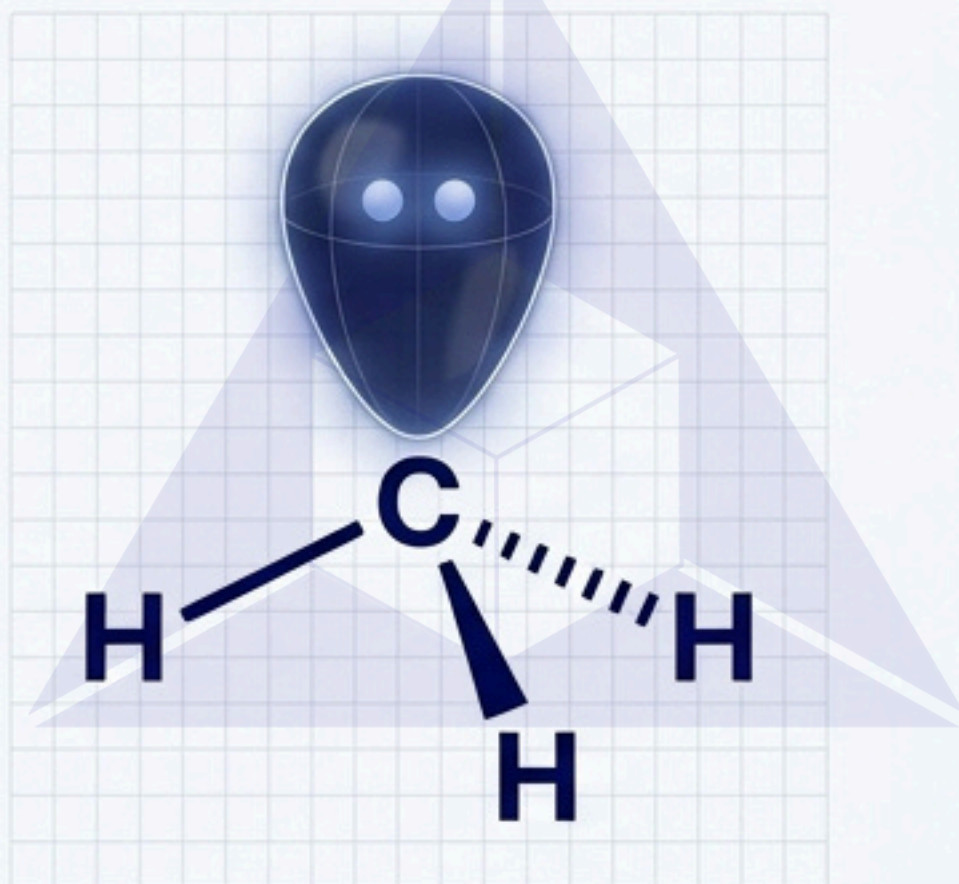
Hybridization: sp^2

Geometry:
Trigonal Planar
(Bond angle 120°)

Stability Trend:
 $3^\circ > 2^\circ > 1^\circ > ^+\text{CH}_3$
(Stabilized by +I effect and hyperconjugation)

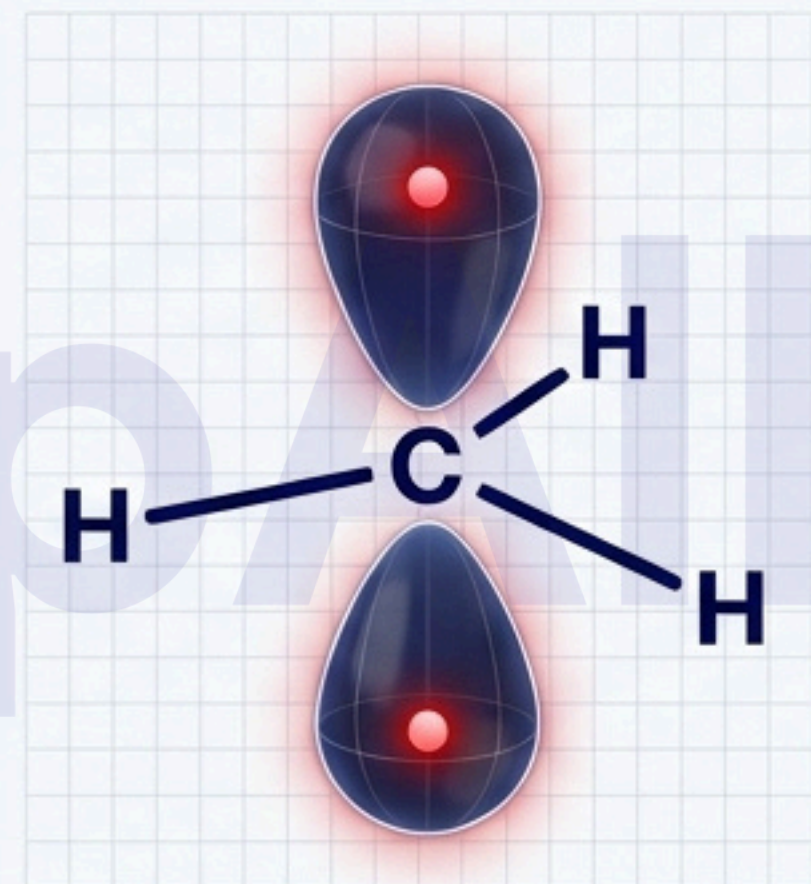
Architectures of Excess and Radicals

The Carbanion (CH_3^-)



8 valence electrons
Nucleophile
 sp^3 hybridized
Pyramidal shape

The Free Radical ($\text{CH}_3\cdot$)



7 valence electrons
Neutral but highly reactive
Odd-electron species
Stability mirrors carbocations ($3^\circ > 2^\circ > 1^\circ$)

The Reaction Intermediate Synthesis Matrix



	Origin Cleavage	Required Syntax	Valence Shell	Hybridization & Shape	Chemical Role
Carbocation (C^+)	Heterolysis	Full Curved Arrow	6e-	sp^2 Planar	Electrophile
Carbanion (C^-)	Heterolysis	Full Curved Arrow	8e-	sp^3 Pyramidal	Nucleophile
Free Radical ($C^\bullet$)	Homolysis	Fish-hook Arrow	7e-	Planar	Radical Intermediate

This matrix represents the foundational vocabulary of organic reaction mechanisms. Master these architectures to predict reaction pathways.



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