This classical model of bonding is able to describe H₂, but it fails to describe H₂⁺ because it treats electrons as particles and does not take into account their wave behavior.

\( Y \)

\( A \)-amplitude

\( \lambda \)-wavelength

\( \phi \)-phase

same \( A, \lambda, \phi \)

constructive interference

Same \( A, \lambda \)

opposite \( \phi \)

deconstructive interference
This orbital is an **antibond** because the energy is **higher** than if the atoms had not interacted.

This orbital is an **bond** because the energy is **lower** than if the atoms had not interacted.

LCAO - linear combination of atomic orbitals. Atomic orbitals are added and subtracted to produce a new set of molecular orbitals (MO).

\[
\begin{align*}
\text{bond} & \quad \text{antibond} \\
\text{H}_2 & \quad \text{He}_2
\end{align*}
\]

Bond order = \# of bonding e^- - \# of antibond e^- / 2

Each antibonding e^- causes a destabilization (increase in energy) that negates the stabilization (decrease in energy) provided by a bonding electron.
The atomic orbitals of carbon cannot directly be used to describe the molecule methane since the geometry of the orbitals is incorrect and energy of the orbitals is not the same. To describe methane, a set of hybrid orbitals is created by adding and subtracting atomic orbitals on the same atom (LCAO).