



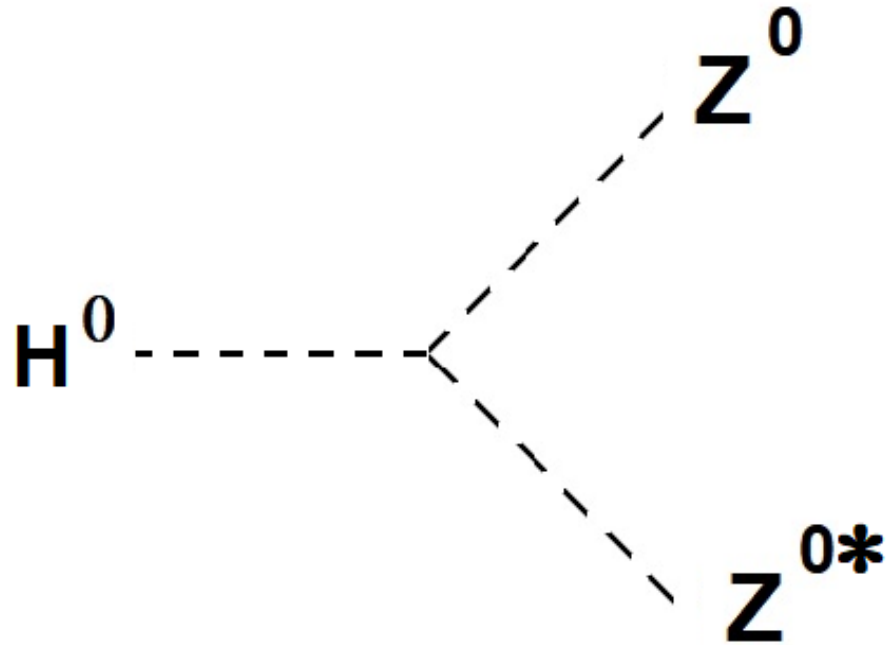
## **PARTICLE TRANSFORMATIONS**

# Zoo

of interesting and challenging interactions  
(some decays, some not)

# Feynman Diagram:

Decay Z-01



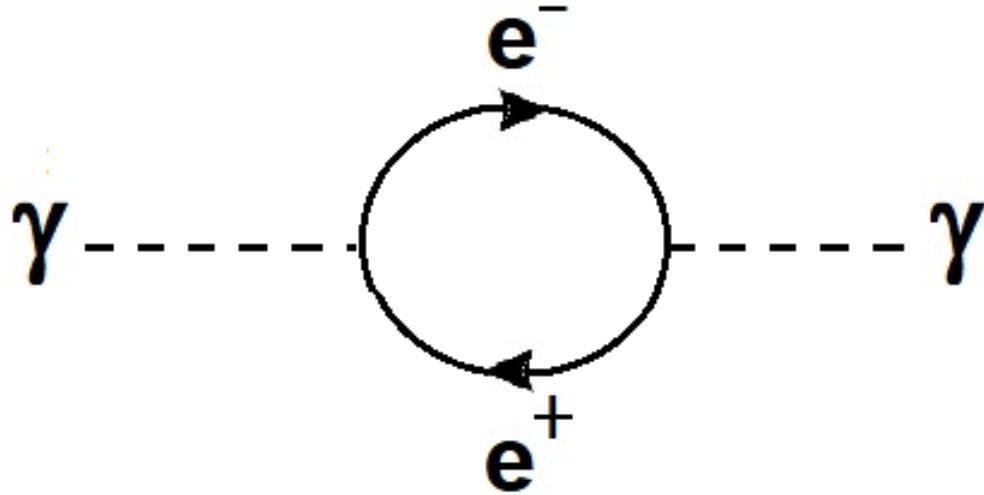
*A Higgs boson transforms into a Z boson and a "virtual" or "off-shell" Z boson (hence the \*) which is rare and has a smaller mass than usual for a very short time. Both Z bosons decay promptly.*

## Scratchpad:

| Before decay | After decay |
|--------------|-------------|
|              |             |

# Feynman Diagram:

Decay Z-02



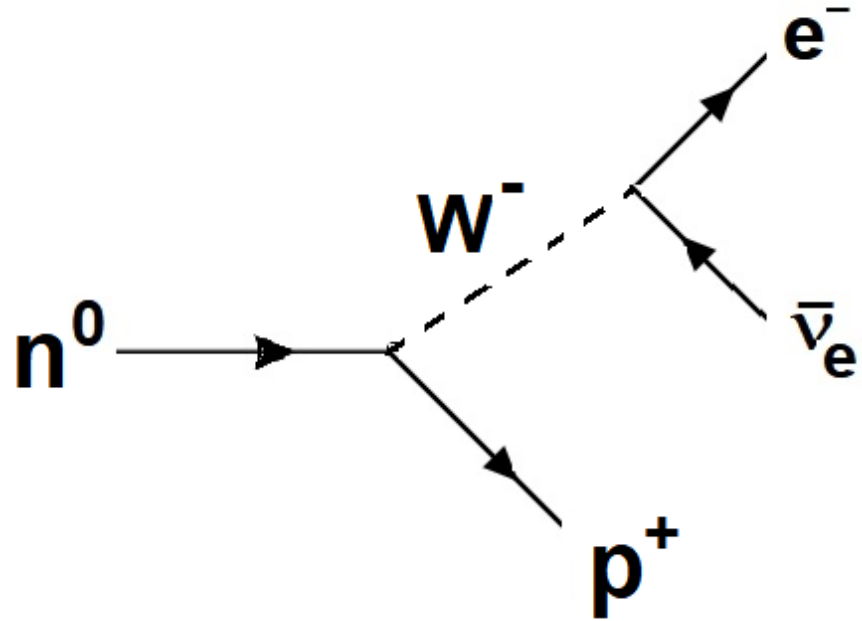
*A photon transforms very briefly into an electron-positron pair which promptly comes back together as a photon.*

## Scratchpad:

| Before decay | After decay |
|--------------|-------------|
|              |             |

# Feynman Diagram:

Decay Z-03



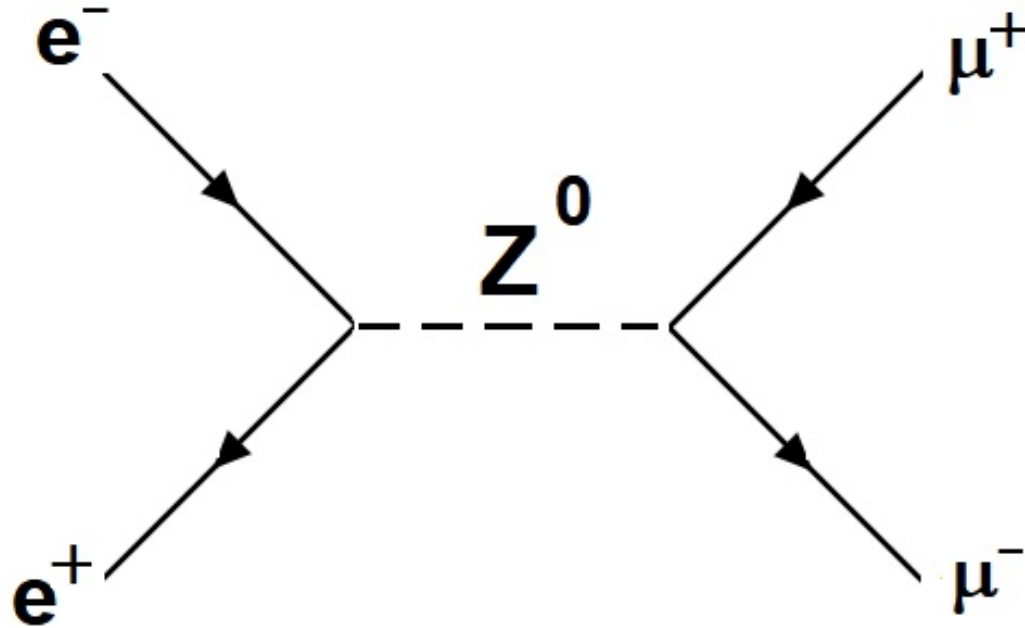
*Beta decay. Look it up.*

## Scratchpad:

| Before decay | After decay |
|--------------|-------------|
|              |             |

# Feynman Diagram:

Decay Z-04



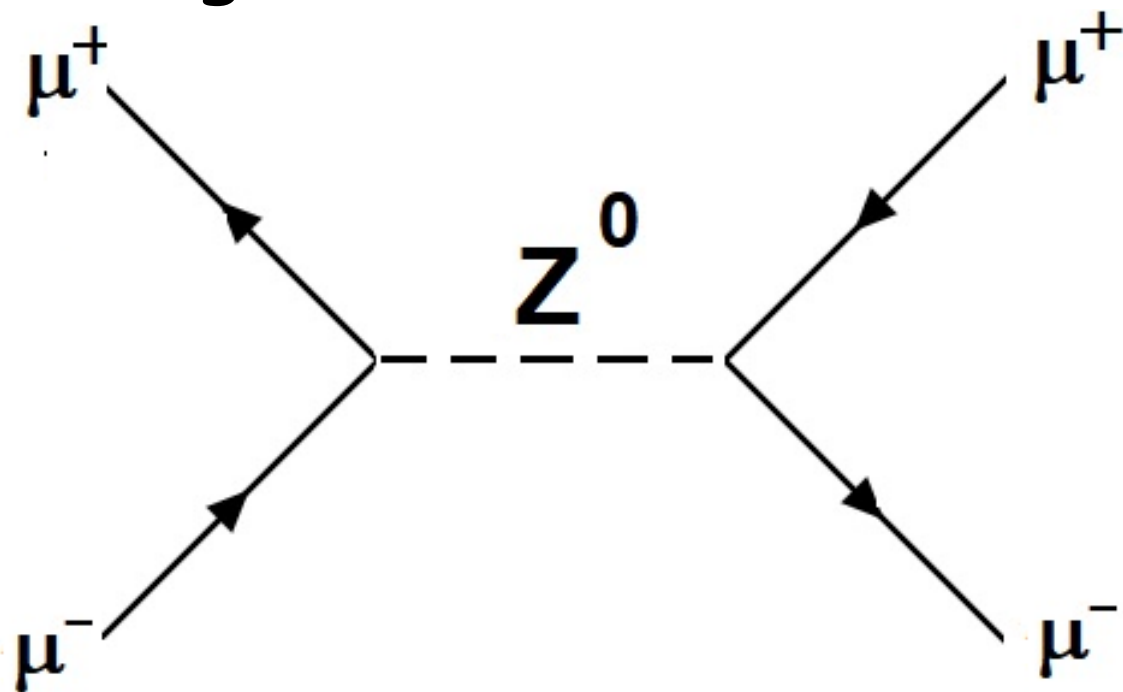
*In the International Linear Collider, during its test run, an electron and a positron collide to form a Z boson, which decays into an antimuon and a muon.*

## Scratchpad:

| Before decay | After decay |
|--------------|-------------|
|              |             |

# Feynman Diagram:

Decay Z-05



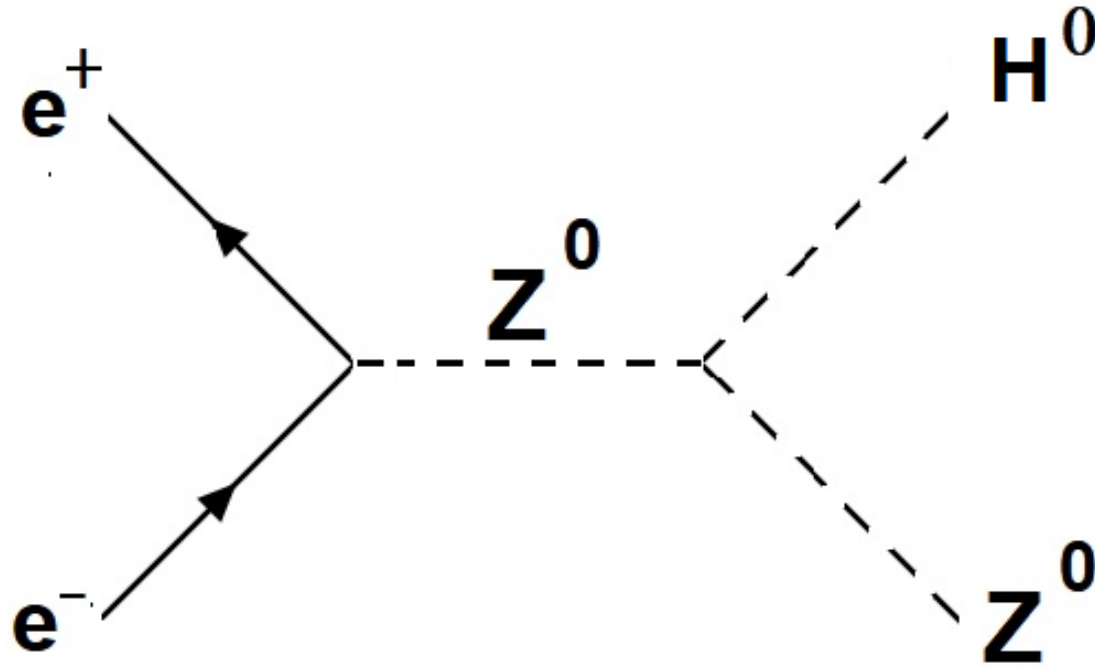
*Weak neutral current.*

## Scratchpad:

| Before decay | After decay |
|--------------|-------------|
|              |             |

# Feynman Diagram:

Decay Z-06



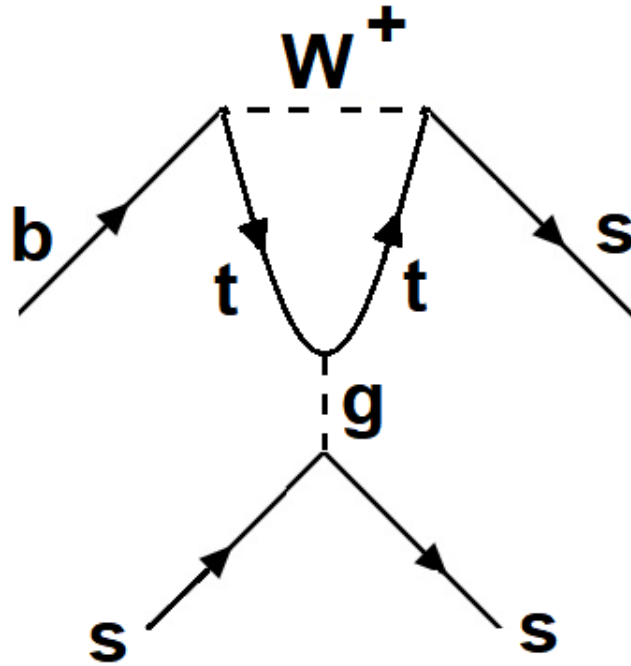
*The expected main mechanism for making a Higgs boson in the International Linear Collider is creation of an energized Z boson which promptly radiates a Higgs. Think about what would be observed in this case.*

Scratchpad:

| Before decay | After decay |
|--------------|-------------|
|              |             |

# Feynman Diagram:

Decay Z-06



*Super-challenge: the Penguin diagram. In short, a strange quark has a strong interaction with a bottom quark changing into a strange quark via the weak interaction through a mediating top quark. Learn more at*

<https://www.symmetrymagazine.org/article/june-2013/the-march-of-the-penguin-diagrams>.

## Scratchpad:

| Before decay | After decay |
|--------------|-------------|
|              |             |