

# Difference Between Normal and Anomalous Zeeman Effect

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## Key Difference – Normal vs Anomalous Zeeman Effect

In 1896, the Dutch physicists Pieter Zeeman observed the splitting of spectral lines emitted by [atoms](#) in [sodium chloride](#), when it was kept in a strong [magnetic field](#). The simplest form of this phenomenon was introduced as normal Zeeman effect. The effect was well understood later with the introduction of the theory of electron developed by H.A. Lorentz. The anomalous Zeeman effect was discovered after that with the discovery of the spin of the electron in 1925. The splitting of the spectral line emitted by atoms placed in a magnetic field is generally called Zeeman effect. **In normal Zeeman effect, the line is split into three lines, whereas in anomalous Zeeman effect, the splitting is more complex.** This is the key difference between normal and anomalous Zeeman effect.

### What is Normal Zeeman Effect?

Normal Zeeman effect is the phenomenon that explains the splitting of a spectral line into three components in a magnetic field when observed in a direction perpendicular to the applied magnetic field. This effect is explained by the basis of classical physics. In normal Zeeman effect, only orbital angular momentum is considered. The spin angular momentum, in this case, is zero. Normal Zeeman effect is only valid for transitions between singlet states in atoms. The elements that give the normal Zeeman effect include He, Zn, Cd, Hg, etc.

### What is Anomalous Zeeman Effect?

Anomalous Zeeman effect is the phenomenon that explains the splitting of a spectral line into four or more components in a magnetic field when viewed in a direction perpendicular to the magnetic field. This effect is more complex unlike normal Zeeman effect; thus, it can be explained by basis of [quantum mechanics](#). The atoms with spin angular momentum show the anomalous Zeeman effect. Na, Cr, etc., are elemental sources that show this effect.

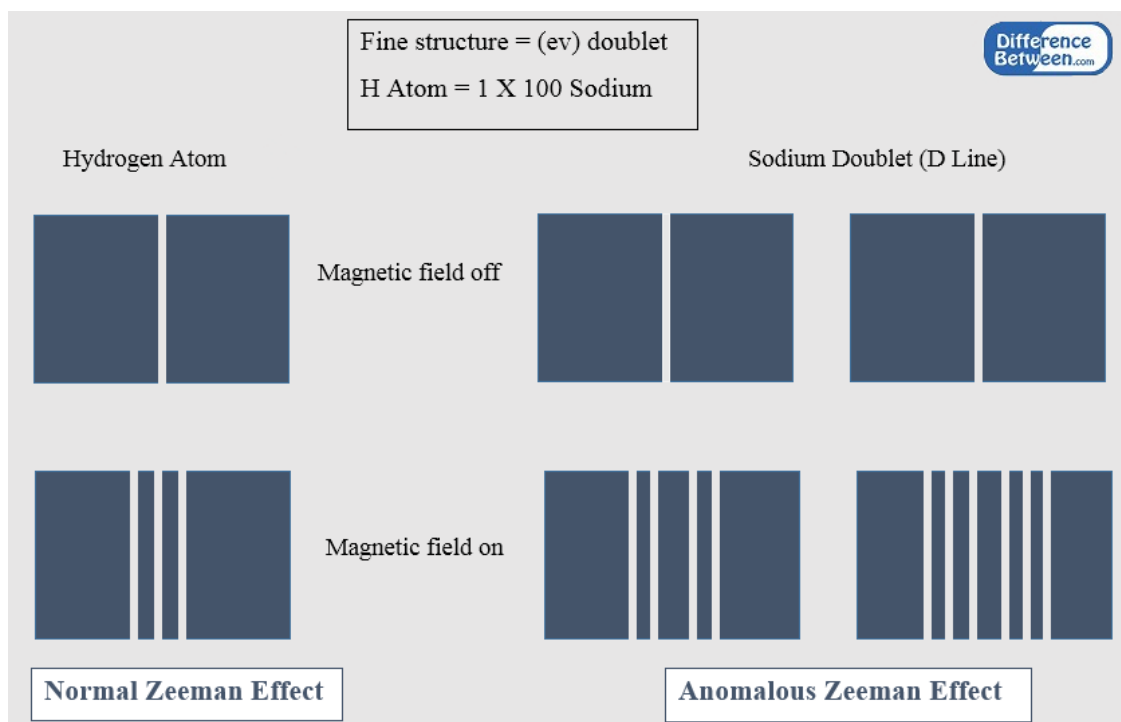


Figure 01: Normal and Anomalous Zeeman Effect

## What is the difference between Normal and Anomalous Zeeman Effect?

### Normal vs Anomalous Zeeman Effect

The splitting of a spectral line of an atom into three lines in a magnetic field is called normal Zeeman effect.

The splitting of a spectral line of an atom into four or more line in a magnetic field is called anomalous Zeeman effect.

#### Basis

This is explained by the basis of classical physics.

This is understood by the basis of quantum mechanics.

#### Magnetic Momentum

Magnetic moment is due to orbital angular momentum.

Magnetic moment is due to both orbital and nonzero spin angular momentum

#### Elements

Calcium, copper, zinc, and cadmium are some elements that show this effect.

Sodium and chromium are two elements that show this effect.

## Summary – Normal and Anomalous Zeeman Effect

Normal Zeeman effect and anomalous Zeeman effect are two phenomena that explain why spectral lines of atoms are split in a magnetic field. The Zeeman effect was first introduced by Pieter Zeeman in 1896. The normal Zeeman effect is due to only orbital angular momentum which split the spectral line into three lines. The anomalous Zeeman effect is due to nonzero spin angular momentum, creating four or more spectral line splitting. Hence, it can be concluded that anomalous Zeeman effect is really a normal Zeeman effect with the addition of spin singular momentum, apart from the orbital angular momentum. Thus, there is only a slight difference between normal and anomalous Zeeman effect.

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### How to Cite this Article?

**APA:** Difference Between Normal and Anomalous Zeeman Effect. (2017, August 11). Retrieved (date), from <http://differencebetween.com/difference-between-normal-and-vs-anomalous-zeeman-effect/>

**MLA:** "Difference Between Normal and Anomalous Zeeman Effect" *Difference Between.Com*. 11 August 2017. Web.

**Chicago:** "Difference Between Normal and Anomalous Zeeman Effect." *Difference Between.Com*. <http://differencebetween.com/difference-between-normal-and-vs-anomalous-zeeman-effect/> accessed (accessed [date]).



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