CON Data Analysis

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Libraries

This code loads in the required r libraries to streamline the data reduction process.

```
library(tidyverse)
library(googlesheets4)
library(ggplot2)
```

Data

In this section, I use the `googlesheets4` library to read in the tidy data from the Google Sheet.

```
# Read the data from the Google Sheet
df <- googlesheets4::read_sheet("https://docs.google.com/spreadsheets/d/1SOdDMR_2ekxp_qxyp4vmCBdVigUE3S
```

Data Cleaning

A new column of average masses from the three mass columns (`LogM_U`, `LogM_Leroy`, and `LogM_Other`) is made. A summary of the data is then printed to the console.

```
# Data Cleaning
df$LogM <- rowMeans(df[, c("LogM_U", "LogM_Leroy", "LogM_Other")], na.rm = TRUE)
summary(df)

df$L_Akylas <- df$`L_14-195keV_Akylas` * 1e42 / 3.826e33 / 1e11
df$type <- ifelse(df$CONS == TRUE, "CON", "LIRG")
df$type <- ifelse(df$CT_AGN_Akylas == TRUE, "CT_AGN", df$type)

df$L <- ifelse(!is.na(df$L_IR_Falstad), df$L_IR_Falstad, NA)
df$L <- ifelse(!is.na(df$L_Akylas), df$L_Akylas, df$L)


colnames(df)
df$BeamSize_Falstad
df$BeamSize_Falstad <- strsplit(df$BeamSize_Falstad, "x")
df$BeamSize_Falstad <- sapply(
        df$BeamSize_Falstad,
```
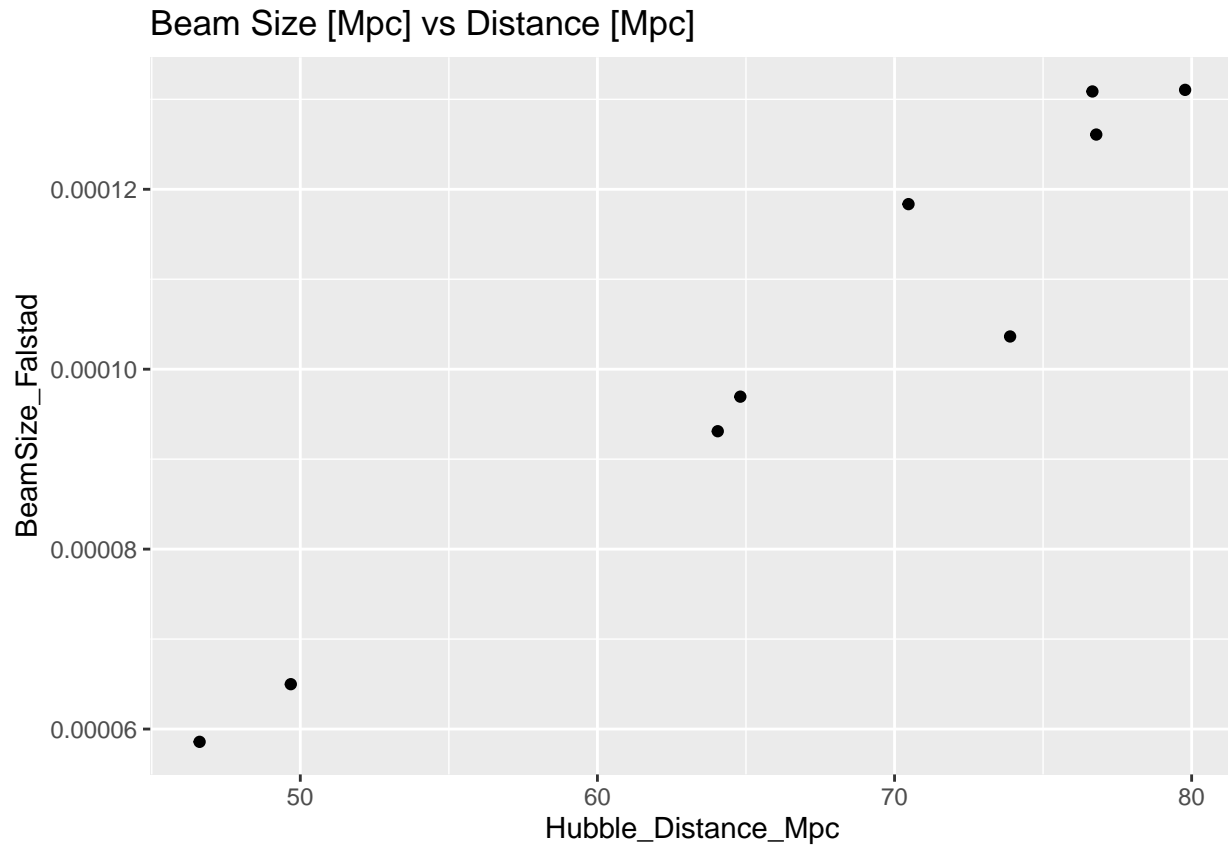
```
        function(x) as.numeric(x[1]) * as.numeric(x[2]))
df$BeamSize_Falstad <- sqrt(df$BeamSize_Falstad) * df$Hubble_Distance_Mpc / 206265
df$BeamSize_Falstad
```

# Data Analysis

Bias Comparison

```
df %>% filter(!is.na(BeamSize_Falstad)) %>%
        ggplot(aes(x = Hubble_Distance_Mpc, y = BeamSize_Falstad)) +
        geom_point() +
        ggtitle("Beam Size [Mpc] vs Distance [Mpc]")
```


Beam Size [Mpc] vs Distance [Mpc]

```
df %>% ggplot(aes(x = Hubble_Distance_Mpc, y = L, color = type)) +
        geom_point(size = 3) +
        ggtitle("Luminosity (L) vs. Hubble Distance (Hubble_Distance_Mpc)")
```

Luminosity (L) vs. Hubble Distance (Hubble_Distance_Mpc)
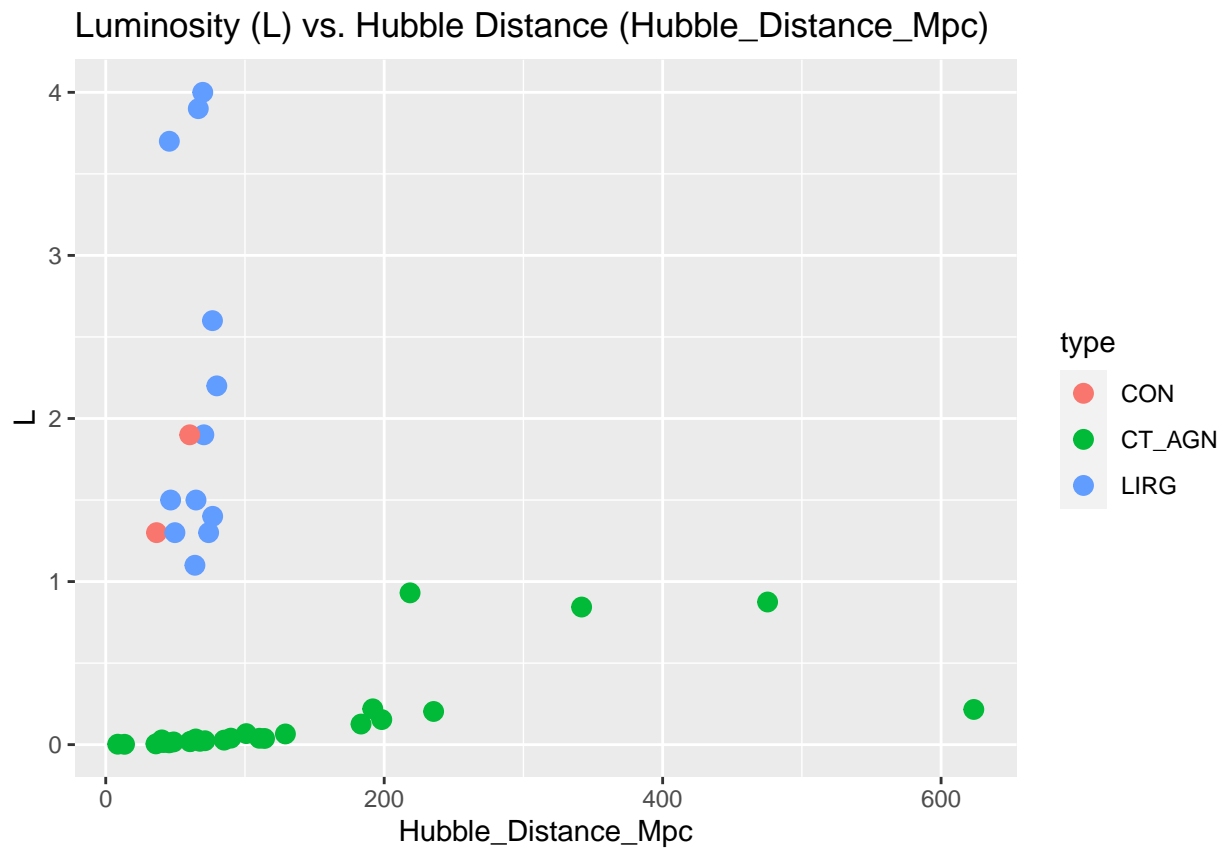

```
df %>% ggplot(aes(x = Hubble_Distance_Mpc, color = type, fill = type)) +
    # geom_histogram(alpha = 0.5) +
    geom_density(alpha = 0.5) +
    ggtitle("Hubble Distance Density Plot")
```

Hubble Distance Density Plot
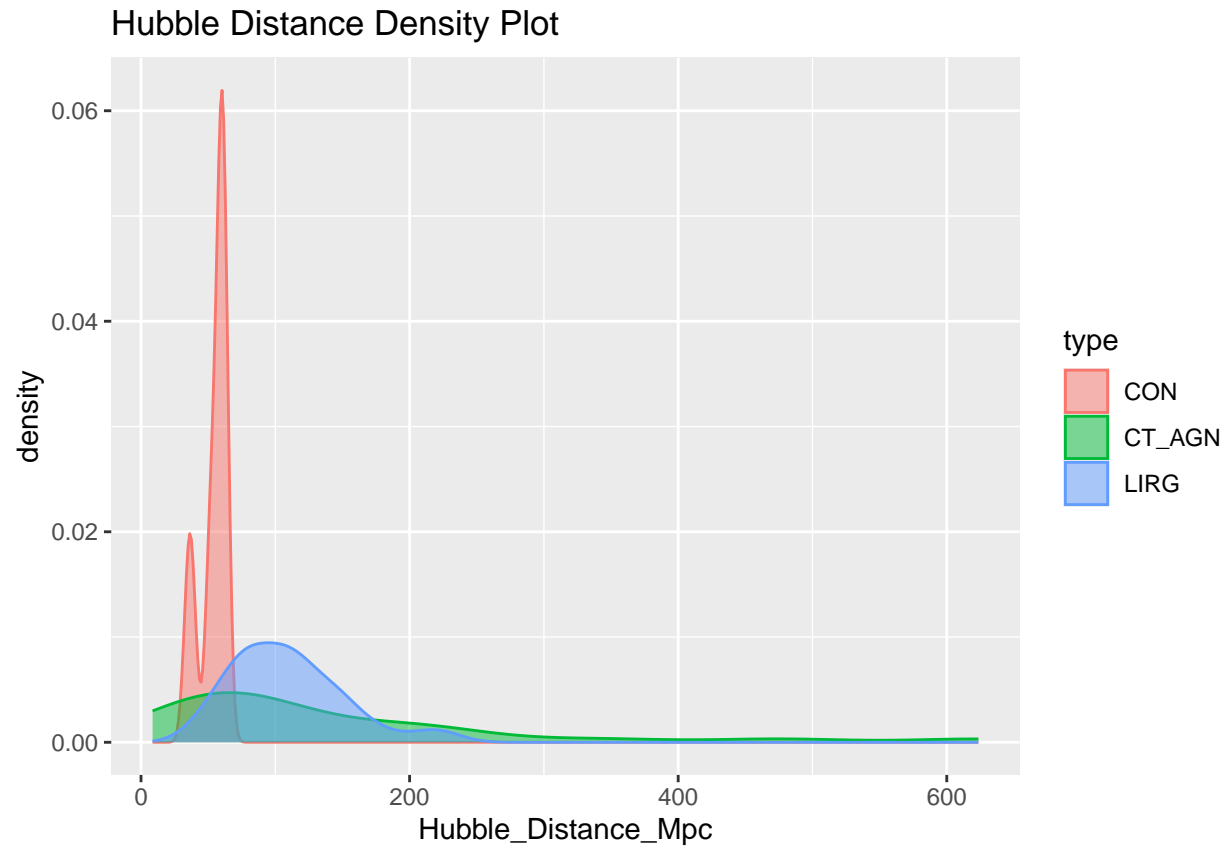

```r
df %>% ggplot(aes(x = L, color = type, fill = type)) +
    # geom_histogram(alpha = 0.5) +
    geom_density(alpha = 0.5) +
    ggtitle("Luminosity Density Plot") +
    coord_trans(x = "log10")
```

Luminosity Density Plot