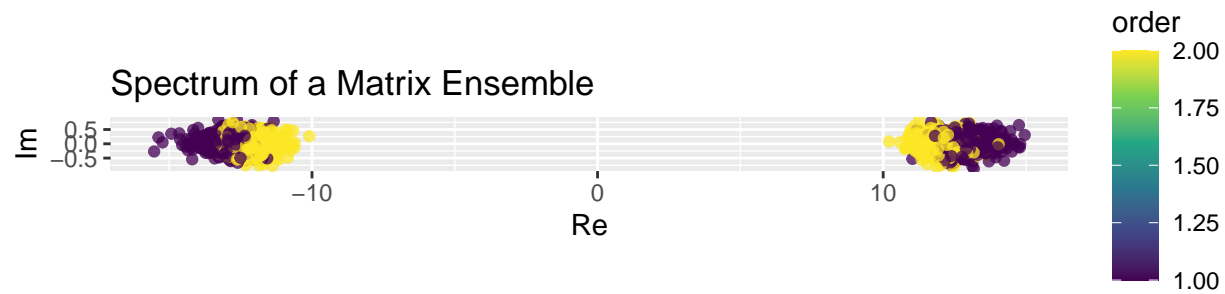


# Dispersion of 1st & 2nd Largest Eigenvalues

Taqi

## 25x25 Complex Hermitian Matrix

```
P <- RME_norm(N = 25, cplx = T, herm = T, size = 1000)
spec_P <- P %>% spectrum(order = 1:2, components = T)
spec_P %>% spectrum.scatterplot()
```

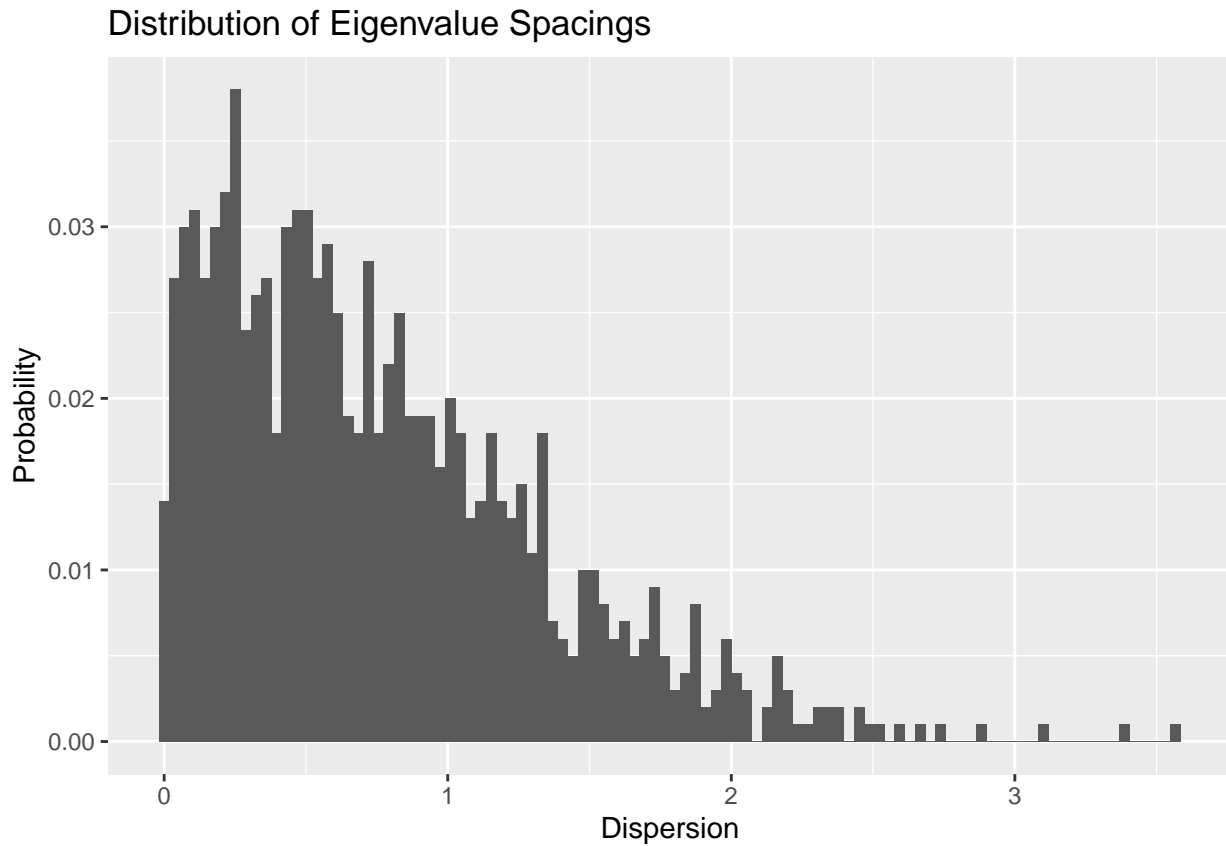


```
#.dispersion_matrix(P[[1]], diff_abs = T)
#.dispersion_matrix(P[[1]], diff_abs = F)
```

## Within matrix

### Difference of Absolutes

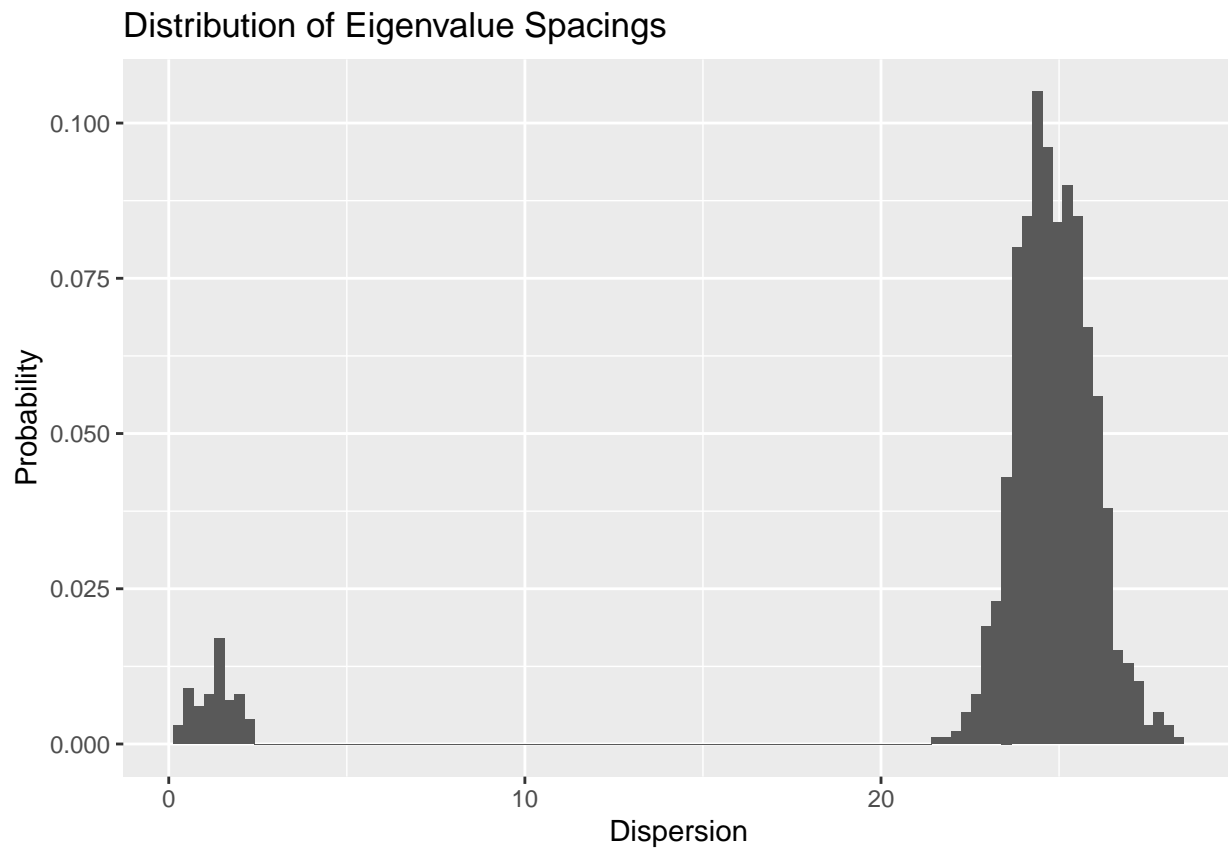
```
pairs_12 <- data.frame(i = 1, j = 2)
disps <- P %>% dispersion(diff_abs = T, components = F, norm = F, pairs = pairs_12)
disps %>% dispersion.histogram()
```



### Absolute Difference

#### Without Resolving Components

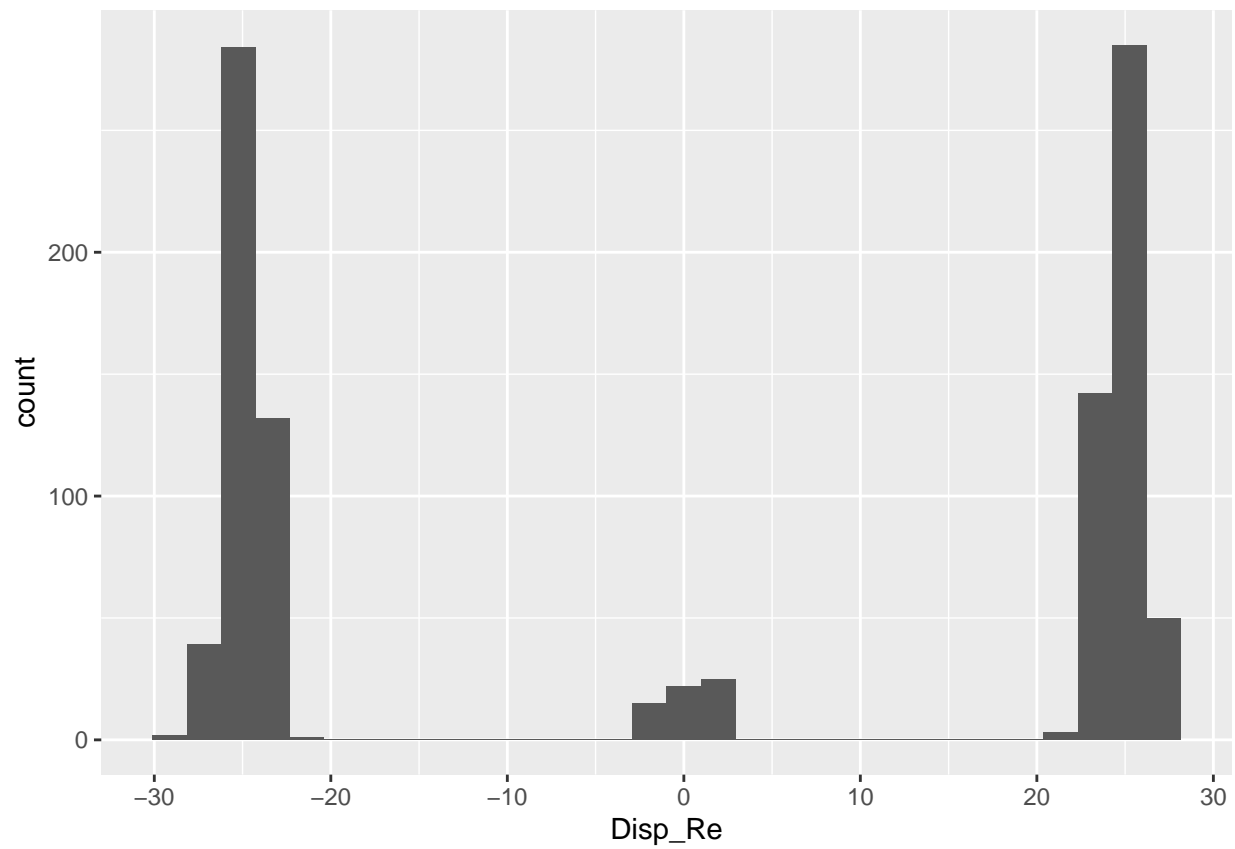
```
pairs_12 <- data.frame(i = 1, j = 2)
disps <- P %>% dispersion(diff_abs = F, components = F, pairs = pairs_12)
disps %>% dispersion.histogram()
```



### Resolving Components

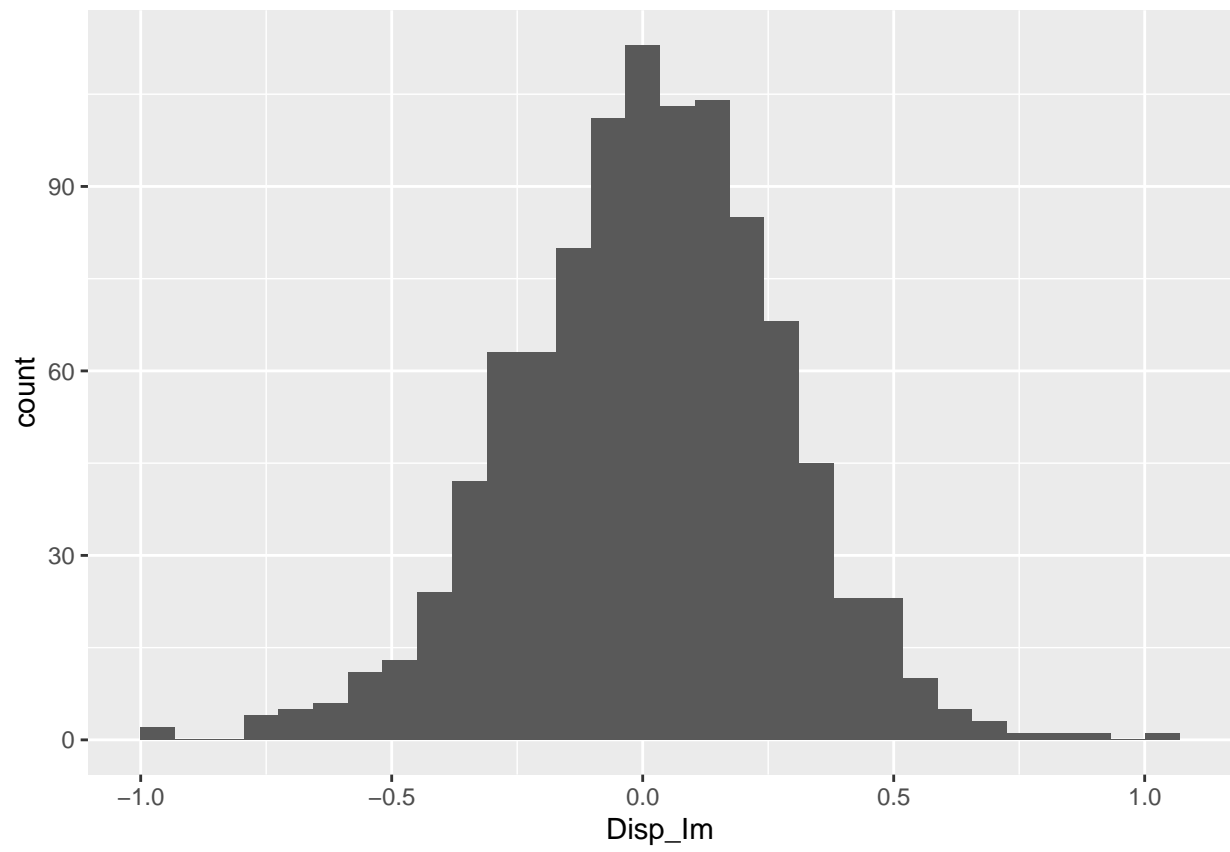
```
disps <- P %>% dispersion(diff_abs = F, components = T, norm = F, pairs = pairs_12)
disps %>%
  ggplot(aes(x = Disp_Re)) +
  geom_histogram()

## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



```
disps %>%  
  ggplot(aes(x = Disp_Im)) +  
  geom_histogram()
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



## Within ensemble

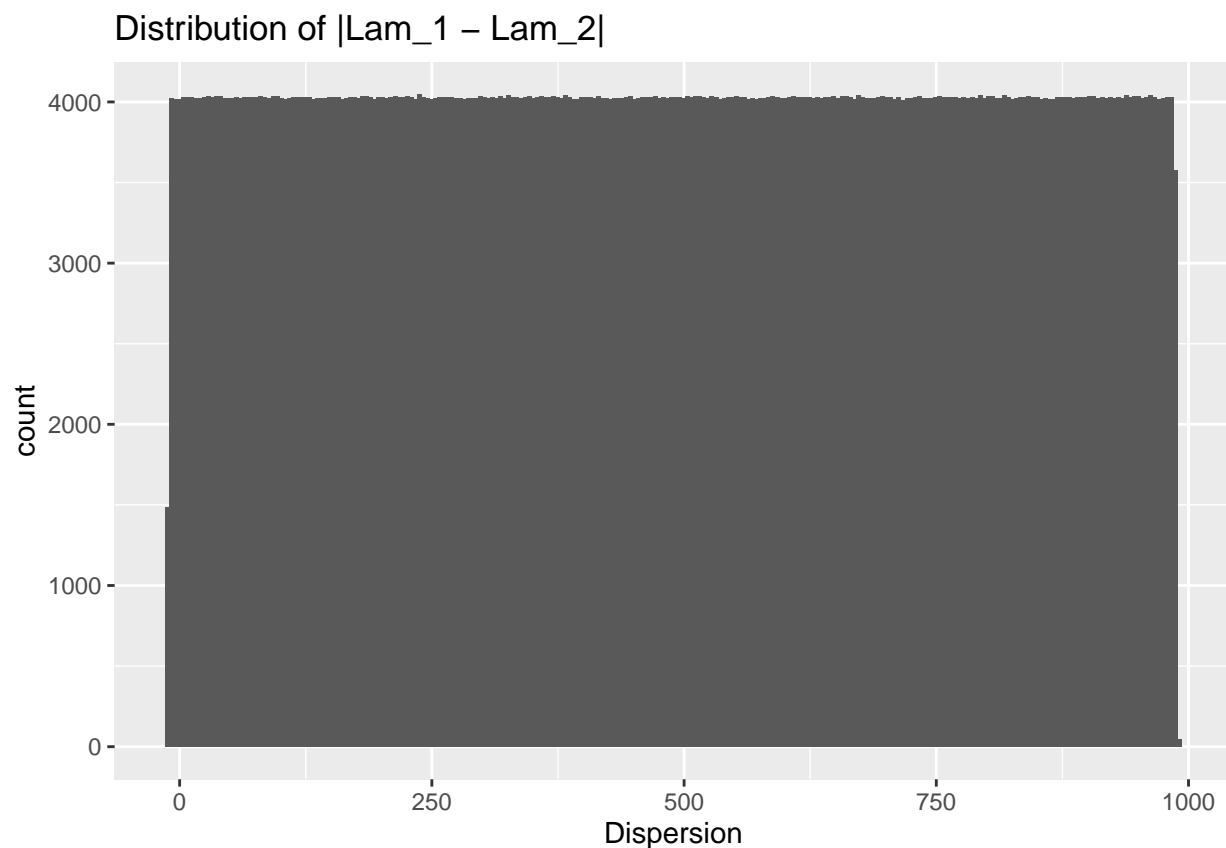
```
specP <- P %>% spectrum()
```

### Difference of Absolutes

```
spec1 <- (specP %>% filter(Order == 1))$Norm  
spec2 <- (specP %>% filter(Order == 2))$Norm
```

```
disps_cross <- data.frame(Dispersion = do.call("c",map(seq_along(spec1), function(x){x - spec2})))
```

```
disps_cross %>%  
  ggplot(mapping = aes(Dispersion)) +  
  geom_histogram(bins = 250) +  
  labs(title = "Distribution of |Lam_1 - Lam_2|")
```



### Absolute Difference

```
specP <- P %>% spectrum(components = F)
```

```
spec1 <- (specP %>% filter(Order == 1))$Eigenvalue  
spec2 <- (specP %>% filter(Order == 2))$Eigenvalue
```

```
disps_cross2 <- data.frame(Dispersion = do.call("c",map(seq_along(spec1), function(x){abs(x - spec2)})))
```

```
disps_cross2 %>%  
  ggplot(mapping = aes(Dispersion)) +
```

```
geom_histogram(bins = 250)
```

