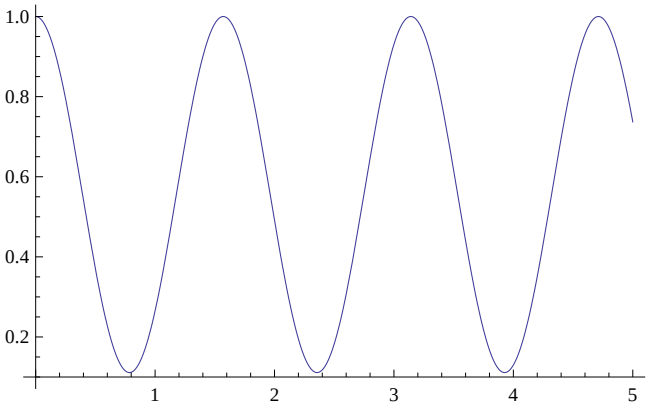
```
g1 := 1;
nenv := 1;
```

$$\text{ztot}[t\_] := \left(\text{Cos}[2 * g1 * t] + i * \left(\frac{1}{3} * \text{Sin}[2 * g1 * t]\right)\right)^{\text{nenv}}$$

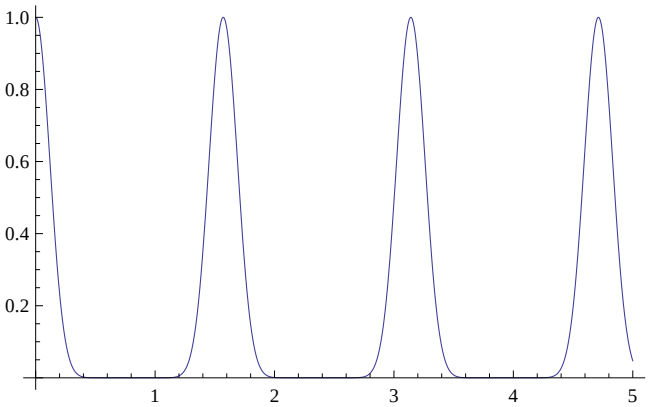
```
ztot[1] // N
```

$$-0.416147 + 0.303099\, i$$

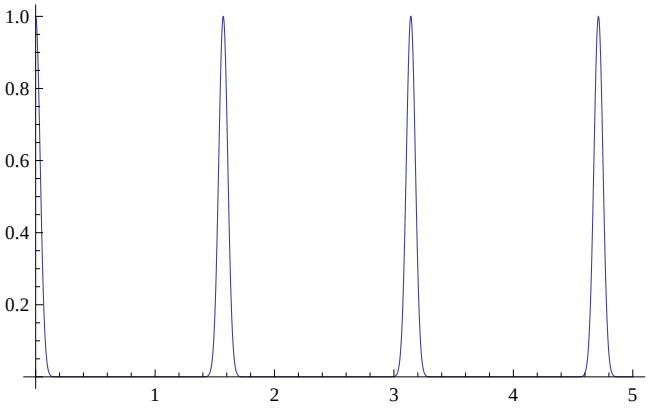
```
Plot[Abs[ztot[t]]^2, {t, 0, 5}, PlotRange -> All]
```



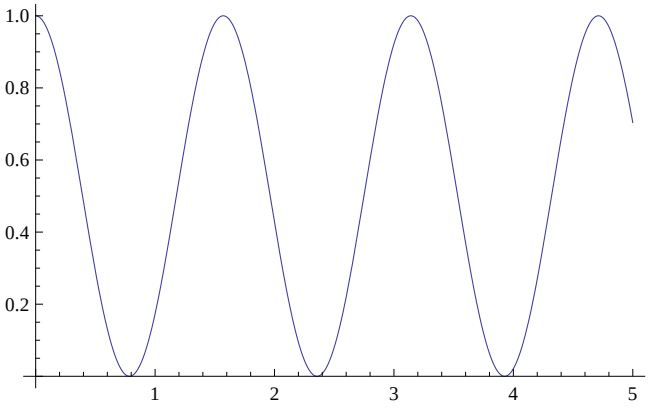

```
nenv := 10;
Plot[Abs[ztot[t]]^2, {t, 0, 5}, PlotRange -> All]
```



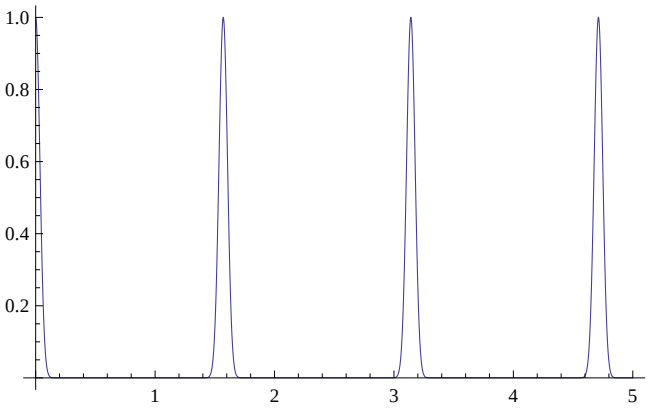
```
nenv := 100;
Plot[Abs[ztot[t]]^2, {t, 0, 5}, PlotRange -> All]
```




```
g1 := 1;

ztot[t_] := (Cos[2 * g1 * t] + i * (0 * Sin[2 * g1 * t]))^nenv

nenv := 1;

Plot[Abs[ztot[t]]^2, {t, 0, 5}, PlotRange -> All]
```

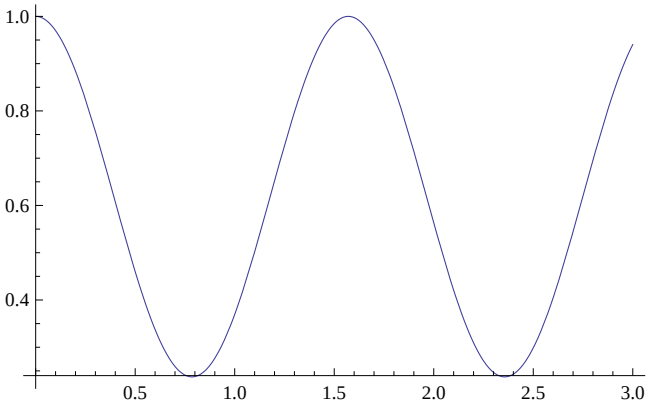


```
nenv := 100;

Plot[Abs[ztot[t]]^2, {t, 0, 5}, PlotRange -> All]
```

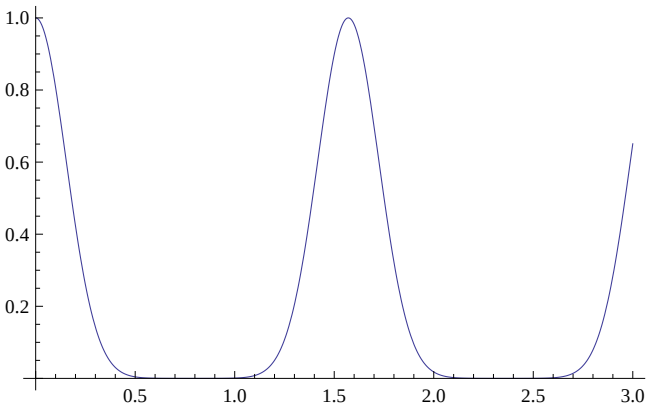



```
z[t_, k_] := (Cos[2 * g1 * t] + i * ((Cos[100 * k]^2 - Sin[100 * k]^2) Sin[2 * g1 * t]))

ztot[t_] := ∏_{k=1}^{nenv} z[t, k]
```

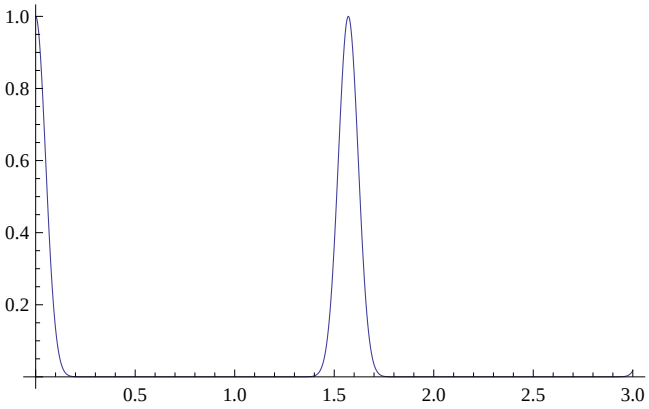
```
nenv := 1;
Plot[Abs[ztot[t]]^2, {t, 0, 3}, PlotRange -> All]
```




```
nenv := 10;
Plot[Abs[ztot[t]]^2, {t, 0, 3}, PlotRange -> All]
```



```
nenv := 100;
Plot[Abs[ztot[t]]^2, {t, 0, 3}, PlotRange -> All]
```

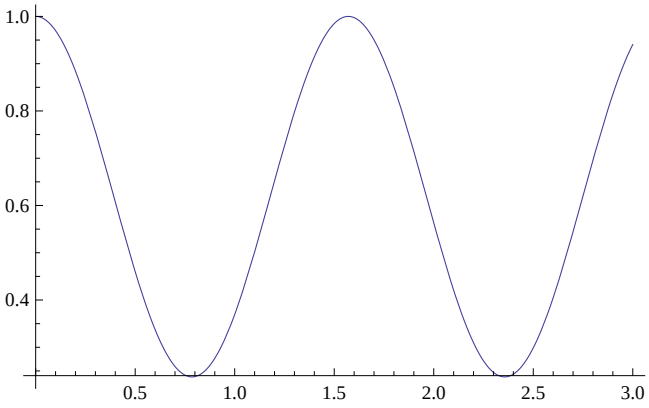



```
(*now the general case...varying coupling, and random spin...*)
```

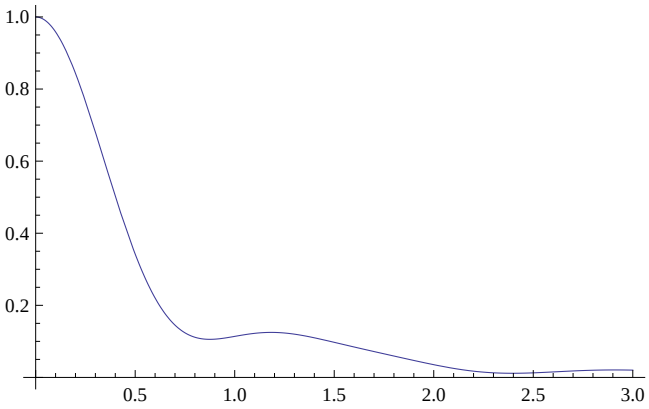
$$z[t\_, k\_] := \left(\text{Cos}\left[2 * \frac{g1}{k} * t\right] + i * \left((\text{Cos}[100 * k]^2 - \text{Sin}[100 * k]^2)\, \text{Sin}\left[2 * \frac{g1}{k} * t\right]\right)\right)$$

$$\text{ztot}[t\_] := \prod_{k=1}^{\text{nenv}} z[t, k]$$

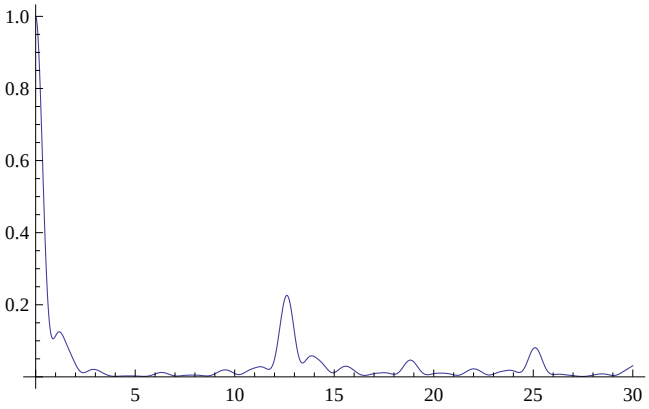
```
nenv := 1;
Plot[Abs[ztot[t]]^2, {t, 0, 3}, PlotRange -> All]
```



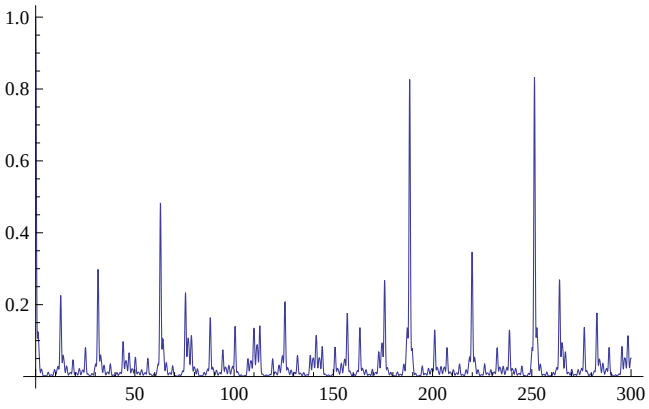

```
nenv := 10;
Plot[Abs[ztot[t]]^2, {t, 0, 3}, PlotRange -> All]
```



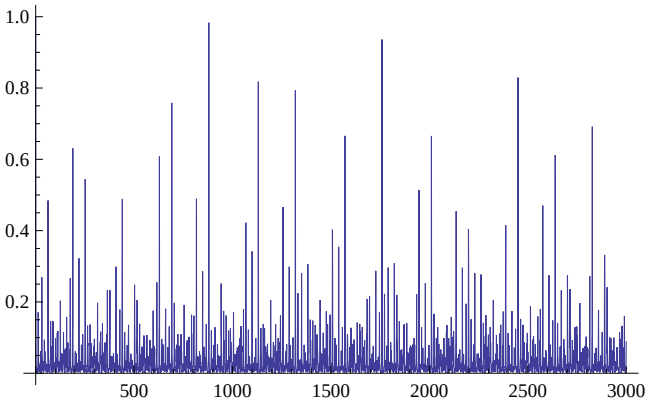
```
nenv := 10;
Plot[Abs[ztot[t]]^2, {t, 0, 30}, PlotRange -> All]
```




```
nenv := 10;
Plot[Abs[ztot[t]]^2, {t, 0, 300}, PlotRange -> All]
```




```
nenv := 10;
Plot[Abs[ztot[t]]^2, {t, 0, 3000}, PlotRange -> All]
```

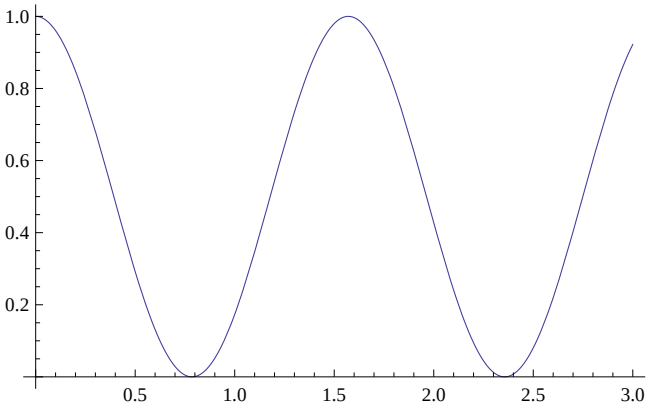



```
(*note, indeed the random spin is not necessary...*)
```

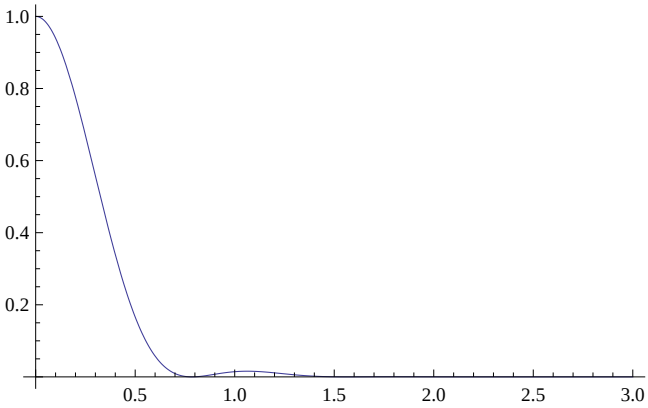
$$z[t\_, k\_] := \left(\text{Cos}\left[2 * \frac{g1}{k} * t\right] + i * \left(0 * \text{Sin}\left[2 * \frac{g1}{k} * t\right]\right)\right)$$

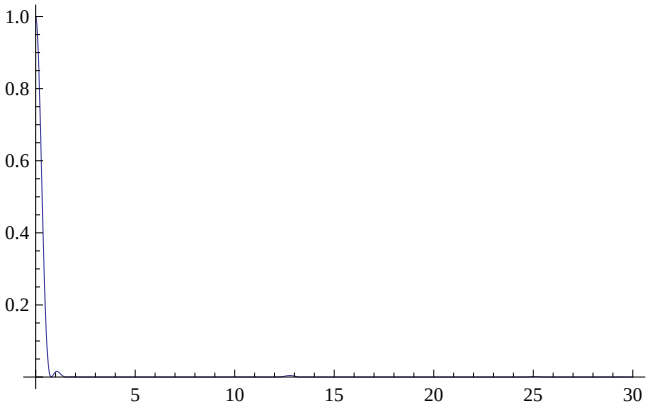
$$\text{ztot}[t\_] := \prod_{k=1}^{\text{nenv}} z[t, k]$$

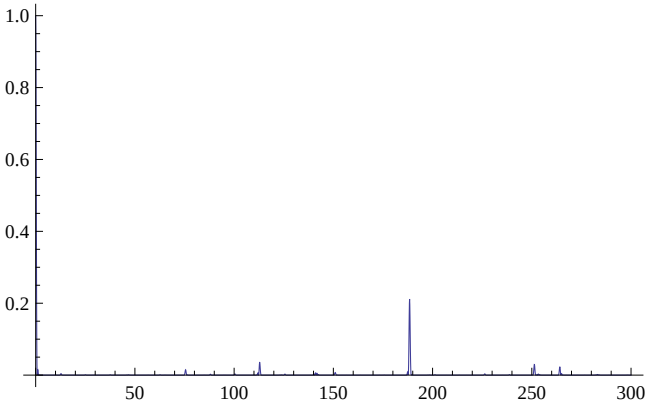
```
nenv := 1;
Plot[Abs[ztot[t]]^2, {t, 0, 3}, PlotRange -> All]
```

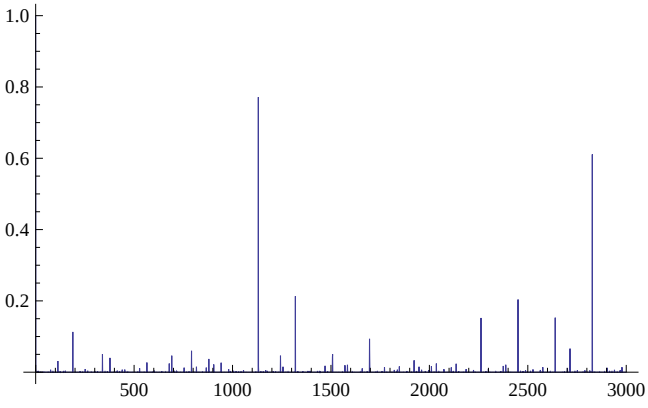


```
nenv := 10;
Plot[Abs[ztot[t]]^2, {t, 0, 3}, PlotRange -> All]
Plot[Abs[ztot[t]]^2, {t, 0, 30}, PlotRange -> All]
Plot[Abs[ztot[t]]^2, {t, 0, 300}, PlotRange -> All]
Plot[Abs[ztot[t]]^2, {t, 0, 3000}, PlotRange -> All]
```



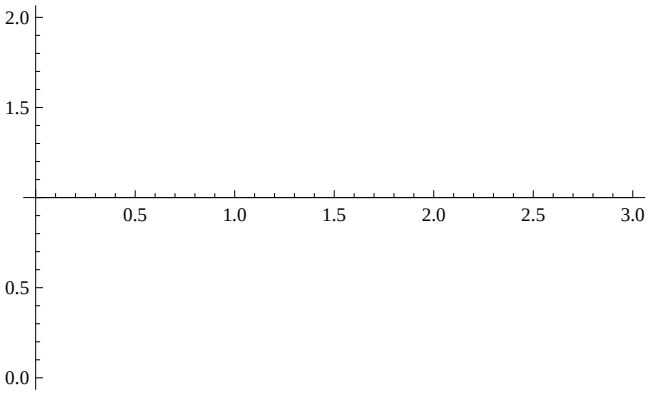



```
(*obviusoly, there is one case in which is all
```

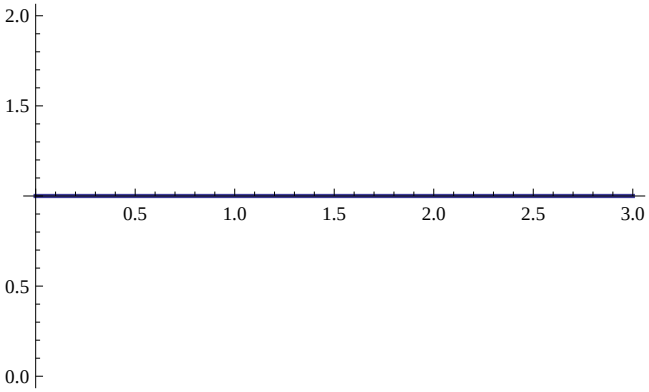
$$z[t\_, k\_] := \left(\text{Cos}\left[2 * \frac{g1}{k} * t\right] + i * \left(\text{Sin}\left[2 * \frac{g1}{k} * t\right]\right)\right)$$

$$ztot[t\_] := \prod_{k=1}^{nenv} z[t, k]$$

```
nenv := 10;

Plot[Abs[ztot[t]]^2, {t, 0, 3}, PlotRange -> All]
```



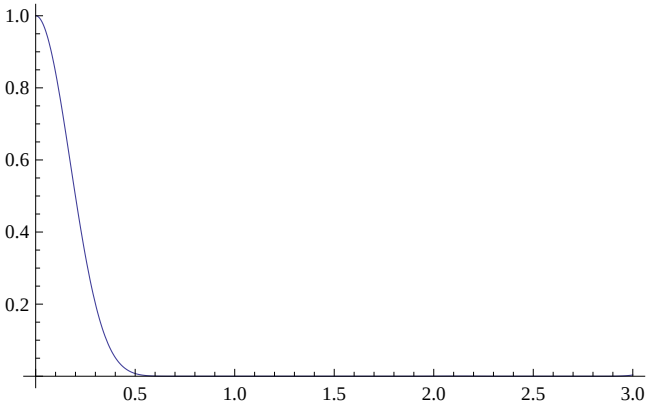

```
Plot[Abs[ztot[t]]^2, {t, 0, 3}, PlotStyle →
  Directive[Hue[0.67, 0.6, 0.6], Opacity[1.], AbsoluteThickness[2.]], PlotRange → All]
```

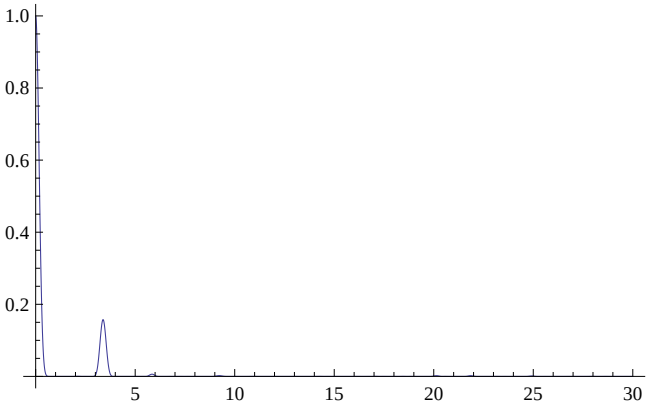


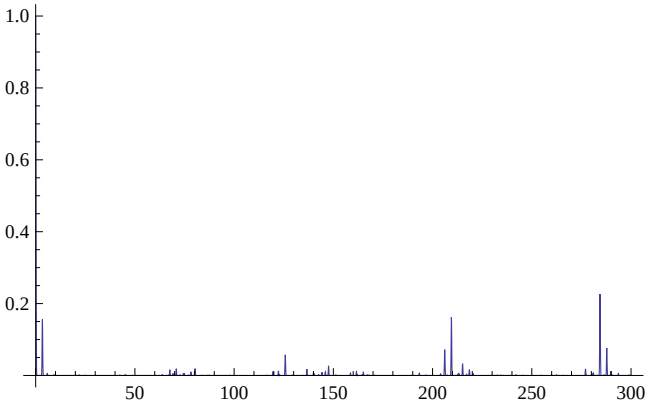

```
z[t_, k_] := (Cos[2 * g1 * Cos[100 * k] t])
```

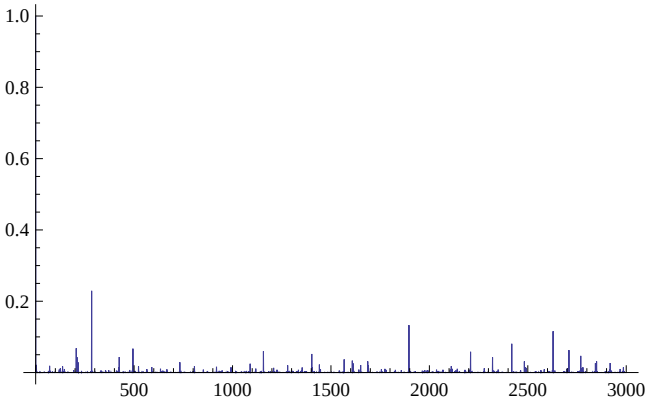
$$ztot[t\_] := \prod_{k=1}^{nenv} z[t, k]$$

```
nenv := 10;

Plot[Abs[ztot[t]]^2, {t, 0, 3}, PlotRange -> All]
Plot[Abs[ztot[t]]^2, {t, 0, 30}, PlotRange -> All]
Plot[Abs[ztot[t]]^2, {t, 0, 300}, PlotRange -> All]
Plot[Abs[ztot[t]]^2, {t, 0, 3000}, PlotRange -> All]
```




**Clearly, if you use 10^23 particles ... the system will never go back for any reasonable time we can think of. Link to entropy.**