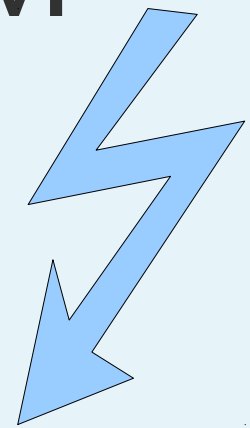
Consequence of Curling up a Spatial Dimension in Q.M



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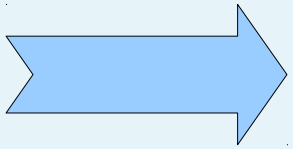
What does curling up mean??

Compactification of Spatial dimention

A way out to manifest extra dimension

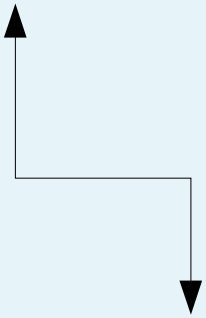
A free particle!!

Spatial part of wave function:
$f(\mathbf{r})=\exp(i\mathbf{p}.\mathbf{r})$



$f(x,y+2*pi*r)=f(x,y)$

Simplification

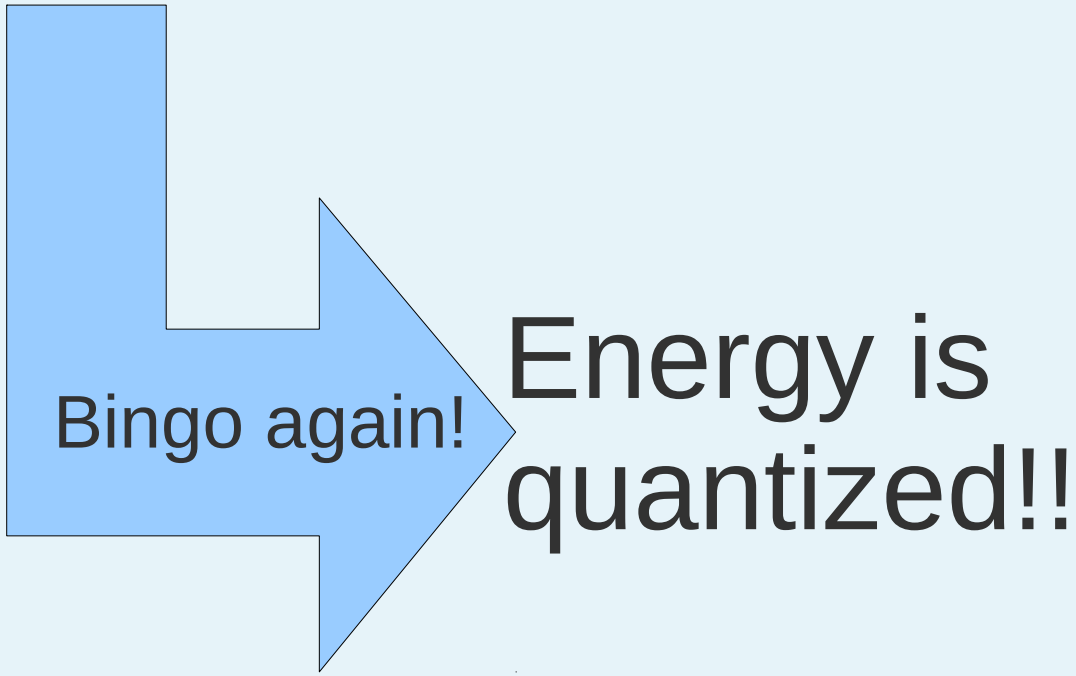


p.j = n/r

Amazing!!

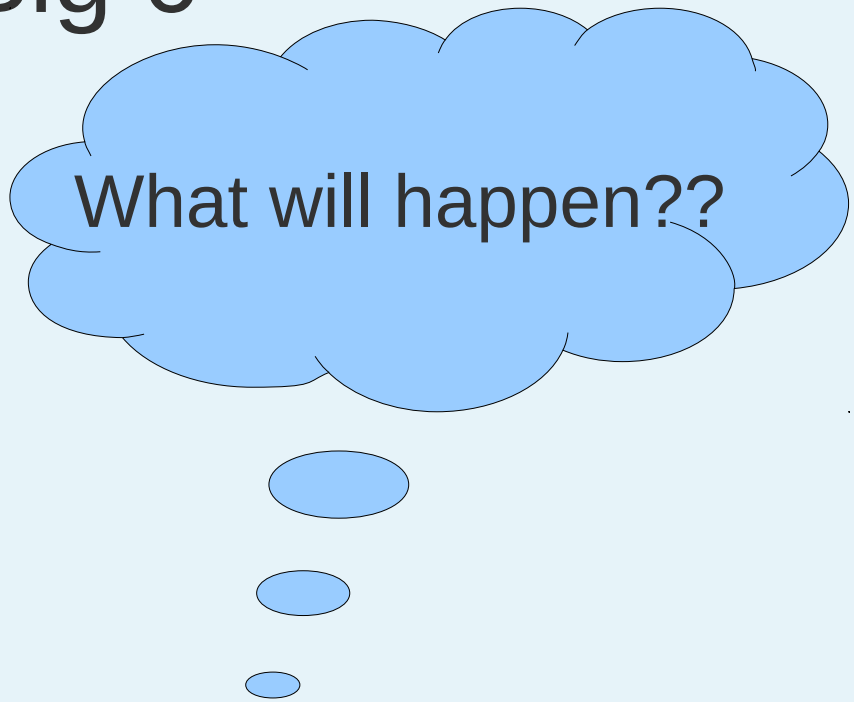
Momentum in Y direction is quantized,Bingo!!!!!!!!!!
Curling up space can quantize the momenta.

One step ahead

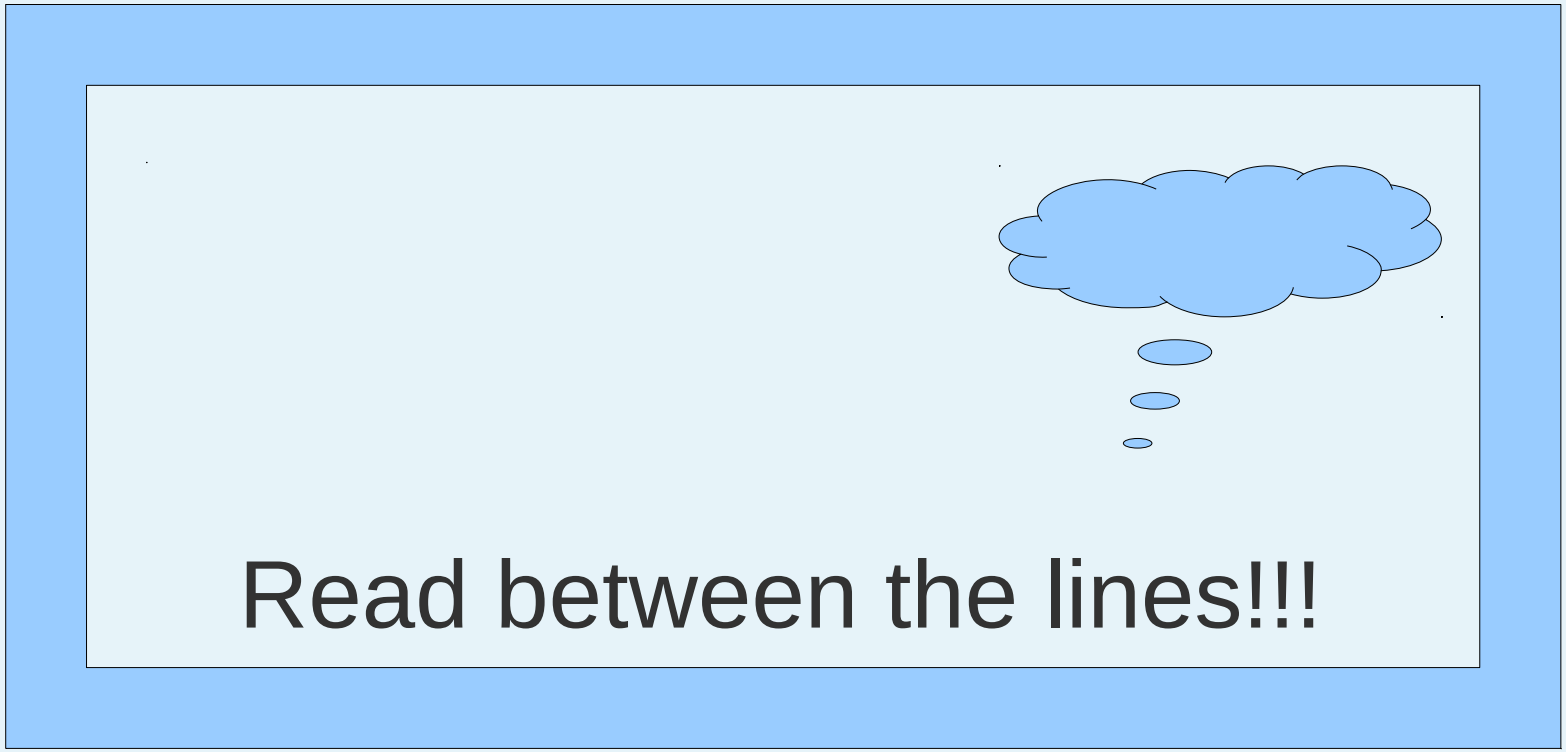


$$M^2=m^2+(n/r)^2+(\mathbf{p.i})^2$$

Let compactification radius tends to Big 0

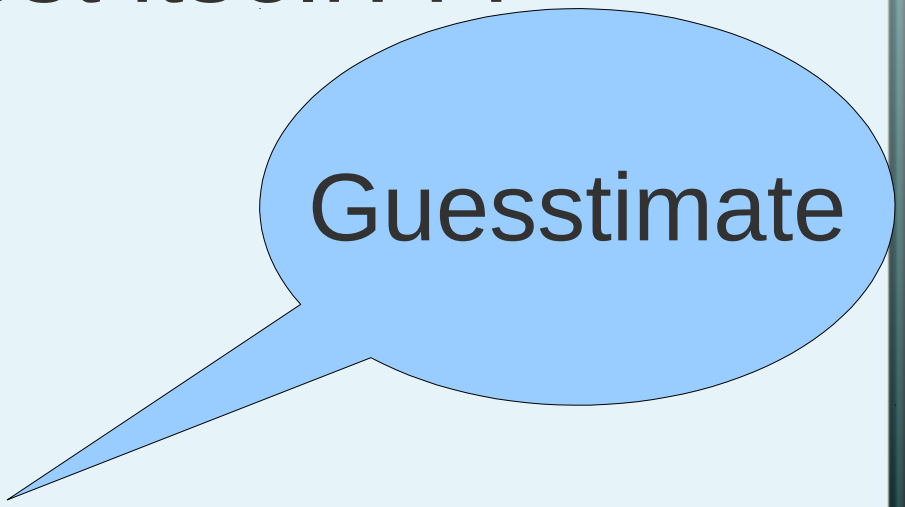


Energy blows up.All it implies That infinite amount of energy is required to squeeze any dimension!!!



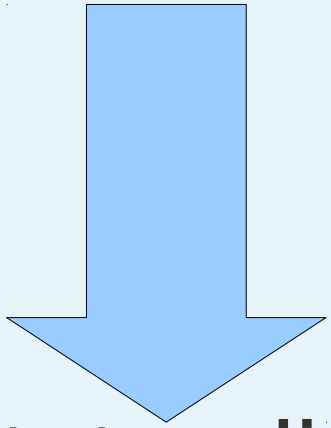
What will happen if we cant detect the extra dimension?

If we cant detect how will (n/r)^2 energy manifest itself???



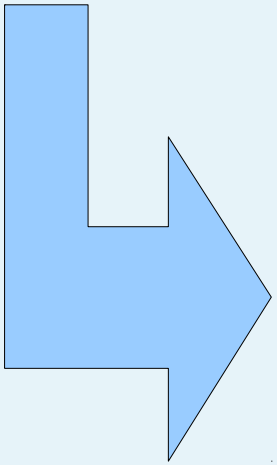
It will show up as a state of massive particle with rest mass M'^2=m^2+(n/r)^2

CONCLUSION



A massless state dimensional in the higher dimensional theory will show up in lower dimensional theory as a tower of particles!!! WEIRD!!!BUT ITS WHAT REALITY!!

Application



Search for new particles
In collider experiment!!

Unification of forces!!

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