Ripples in The Higgs Field Superfluid

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Michel #1 Monday at 5:36 PM

In Superfluid vacuum theory the vacuum is viewed as a Superfluid or as a Bose–Einstein condensate.

My question is, when creating Higgs Bosons or any other matter would these events give rise to some smaller ripples within this superfluid? And how far/long could these waves travel and how fast? Would normal matter (Electrons, Protons) traveling through this Superfluid give rise to any vibrations? Are there some references for this kind of action in 'normal' superfluids?

A follow up question is related to Bosenova events in BEC where matter *"implodes and shrinks beyond detection and then suddenly explode"* when the magnetic field in which the BEC is located is changed.

My question here is if Ultra-high-energy cosmic ray's might be something like a Bosenova ... an event in the Higgs Field Superfluid whereby a High-energy cosmic ray collision causes an energetic disturbance within the Superfluid that triggers a wider disruption of a whole atom or molecule ... in the sense of shaking a group of protons apart with one initial blast, ripples that travel within the Higgs Field Superfluid and shake nearby protons apart: shockwave.

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DrDu #2 Today at 10:48 AM

I think these ripples are called "second sound" in BEC's.

Michel #3 15 minutes ago

> DrDu said: ↑
>
> *I think these ripples are called "second sound" in BEC's.*

Hey that's a great lead, thanks!

After a quick search it turns out that the speed of sound in a BEC is $c_s = 2.2 \times 10^{-3}$m/s
http://arxiv.org/pdf/1205.4774v1.pdf

It also help me find an interesting comment:

> *The speed of sound largely depends on the absolute temperature of the gas, and not so much due to the enhancement of quantum mechanical effects. According to the same article, http://en.wikipedia.org/wiki/Speed_of_sound, the speed of sound varies proportionally to the square root of the absolute temperature. Now, the Bose-Einstein condensates currently being studied occur at temperatures very near absolute zero, around 50-150 nano-kelvin in the lab I work in. Compared to the 300K air we breath, sound is goi move very slowly in a BEC. I actually calculated the speed for the BEC using s=k*sqrt(T), solved for k using the outside air case, and got an answer of 0.0019 m/s for the speed of sound in a BEC. Basically, sound is the overall movement of density variations in a gas. If the gas is really cold, like in a BEC, it takes longer for the atoms bump into each other and collectively move across a space.*

Depending on the scale of the shockwave, a large fraction of the atoms could be excited into higher energy states through atomic collisions followed by a large emission of photons. If a shockwave is repeated on resonance, the gas will eventually gain too much energy, and no longer be a condensate. If the gas gets too hot, the atoms may even escape the optical or magnetic trap they were confined in.

As far as explosions go, the atoms comprising a BEC are still very cold and even after a shockwave you would expect a relatively slow thermal expansion of the atoms. The way the atoms expansion would be similar to glass shattering into tiny pieces and expanding radially outward, but only very slowly.

http://www.reddit.com/r/askscience/comments/1ouy4b/why_does_sound_move_so_slowly_in_a_boseeinstein/

... and also this paper: A Tale of Two Sounds

Anyway it's interesting to see how one describes that there's a limit to the energy of sound waves, as above an energy threshold they will turn BEC matter into Atoms, or simply 'dead atoms' back into 'Live atoms'.

Makes me wonder if we could have a single shockwave from an initial collision bringing multiple new particles to live, possibly due to superposition with other waves. And with this in mind a follow up question, do researchers also look at data 'seconds later' particle collisions for particles to show, as possible (secondary) waves in the Higgs Field Superfluid would travel much slower such as the 0.0022m/s in BEC?

Last edited: 1 minute ago

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