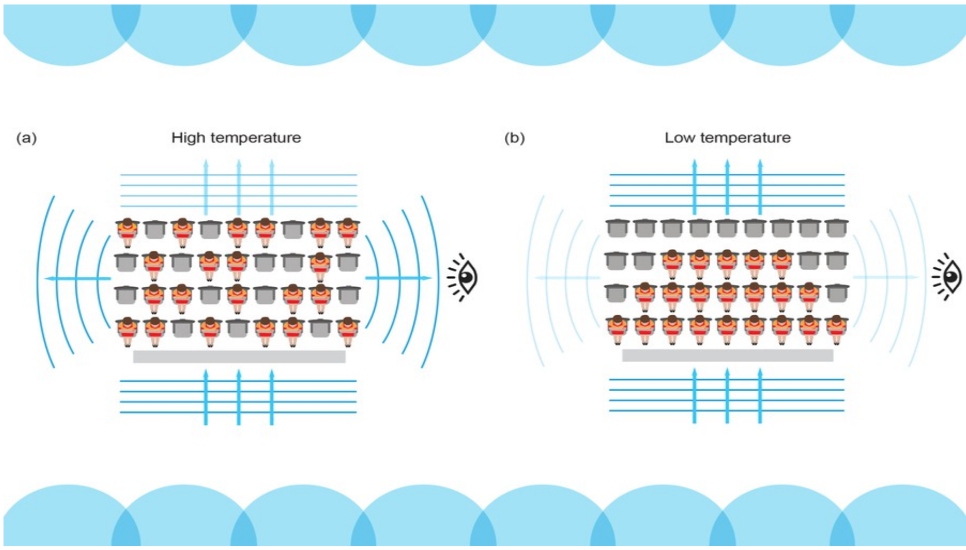
# PAULI BLOCKING
## AND
## ULTRACOLD INVISIBILITY

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MIT just reported yesterday that partial invisibility at ultralow temperatures has been achieved in a lab, supposedly confirming a prediction of this effect by David Pritchard about 30 years ago. Pritchard just happens to be the mentor of the lead author of this new paper Wolfgang Ketterle, so his promotion here is not without bias. That bias wouldn't concern me—since that is the way the world works—if Pritchard had just made a raw prediction. But he didn't. He predicted the effect was due to Pauli blocking, and I am here to show it isn't. Since the prediction of cause is what one might call outrageously wrong, it not only spoils his prediction, it also destroys the entire theory of Pauli blocking. Since Pauli blocking is an important extension of the Pauli Exclusion Principle, this is big news.

The author, Jennifer Chu of MIT News Office, tells us that "Pauli blocking in general has been proven", but that isn't true either. Certain effects have been cataloged, and they have been explained roughly with the PEP, but nothing has been proven. Given the current state of the story, it would be impossible to prove anything—except possibly that physics has been taken over by very bad theorists.

You can see this just by consulting the graphic under title, which I have taken straight from the announcement. This is the subtext printed with it:

**The principle of Pauli blocking can be illustrated by an analogy of people filling seats in an arena. Each person represents an atom, while each seat represents a quantum state. At high temperatures**

**(a), atoms are seated randomly, so every particle can scatter light. At low temperatures (b), atoms crowd together. Only those with more room near the edge can scatter light.**

What? Someone forgot to tell us why atoms crowded together can't scatter. Shouldn't they scatter better? In the article, this theory is glossed a second time like this:

**Normally, when photons of light penetrate a cloud of atoms, the photons and atoms can ping off each other like billiard balls, scattering light in every direction to radiate light, and thus make the cloud visible. However, the MIT team observed that when atoms are supercooled and ultrasqueezed, the Pauli effect kicks in and the particles effectively have less room to scatter light. The photons instead stream through, without being scattered.**

That is even worse, because it contradicts itself. Your first question should be, "why do atoms need 'room' to scatter? Isn't that upside down?" Your second question should be, "if the atoms are squeezed together, how do photons 'stream through'?" Shouldn't it be easier to stream through if the atoms are separated?

So we keep looking. Further down the page we find this:

**His [Pritchard's] idea, broadly speaking, was that if atoms were frozen to a near standstill and squeezed into a tight enough space, the atoms would behave like electrons in packed energy shells, with no room to shift their velocity, or position. If photons of light were to stream in, they wouldn't be able to scatter.**

**"An atom can only scatter a photon if it can absorb the force of its kick, by moving to another chair," explains Ketterle, invoking the arena seating analogy. "If all other chairs are occupied, it no longer has the ability to absorb the kick and scatter the photon. So, the atoms become transparent."**

Now it is the atoms failing to scatter, not the electrons, so technically this isn't the PEP. PEP applies to electrons. We see Pauli blocking applied to the atoms themselves, which aren't leptons or even fermions* and would have no reason to exclude one another or to block one another out of a spot. But even if we give them that, the mechanism still doesn't work: it doesn't explain why tightly packed atoms wouldn't scatter *better*, being more likely to take a hit.

And Ketterle's explanation is even squishier and less rational than Pritchard's, as you see. Why can an atom only scatter if it can absorb the force of the photon's kick, and what does moving to another position have to do with it? Ketterle is obviously just pulling stuff out of his shorts, and doesn't seem to care if it makes any sense. No other mainstream theory makes sense, so what's the difference?

They want you to think these atoms need slots to move into, as in the auditorium chairs, but it isn't true in any case and is especially not true in the case of supercold. The reason atoms move together in supercold is that the charge field has been attenuated: it isn't holding them apart. But the nuclear channels haven't been closed. Incoming photons can still channel through, and in fact are *more likely* to do so. This is the real case of the phenomenon, as we are about to see.

So the whole visualization is wrong. There has never been any evidence atoms behave this, requiring room to move into or needing open space to scatter, and these experiments also do not act as proof of indication of it. It is upside down to data and logic in every way.

These newer uses of the PEP are incredibly sloppy, since they fail to take into account that Pauli proposed them as exclusions of quantum states, not just of positions, as with chairs in a theater. And he proposed them for orbiting electrons, not for entire atoms. Atoms in a lattice don't have quantum states like bound electrons do, since the particles obey different rules. As just one example, electrons need free space because they are thought to have high velocities: they are in orbitals. Atoms aren't in orbitals and have no velocity of that sort.

But even if that weren't true, this chairs-in-a-theater visualization is worthless because it is completely naive and diversionary. Because it focuses on position, it stops you from remembering that an atom can change in other ways that position, or even velocity. It can change in spin, for example, requiring no change of position at all.

I have already blown this chairs-in-a-theater proposal to shreds in my paper on P-N junctions, if you are interested. Also see my paper on Anderson Localization, where I embarrass similar theorists. But you can't really see how ugly these theories are without looking at them side-by-side with the right one. I have shown that at very low temperatures, it is the charge field that becomes torpid. Under normal circumstances, every nucleus is recycling a strong charge field, and the normal profile of that field is in-at-the-poles and out-at-the-equator. The nucleus is releasing charge in all directions, but heaviest at the equator and least at the poles. Just like the Earth. As a spinning body, it becomes a charge engine, due to differences in angular momentum at the poles and equator. All spherical and semi-spherical bodies will do this, including electrons and galaxies. All are recycling and living off the charge field.

Some atoms also have a strong pole-to-pole profile. What is charge? It is a real wind of real photons, though the photons are not visible. In many cases they are infrared, but in supercold conditions the local charge field is anemic, being made not only of fewer photons, but of smaller photons. You will say these researchers aren't seeing anything like that, but they aren't *looking* for anything like that, so they never find it. They "see" individual photons in the current experiment, but that is because they are tagged. They are large photons that they introduced themselves, so of course they are going to be able to spot them.

Anyway, under these supercold conditions, the nucleus spins down. The ambient charge field is very weak, and the spin of the nucleus is a function of it. Without that spin, the pole-to-equator profile starts to fail, since it relies on angular momentum. So the nucleus begins releasing far less charge equatorially, out the carousel level. All charge moves to the pole-to-pole profile, increasing conduction, since conduction is pole-to-pole charge. In that case, the only place the nucleus would be expected to scatter visible light strongly is on the north pole, where the charge is coming *out.*

In that case, the visible light isn't scattering off the nucleus itself, it is scattering off the charge field coming out of the nucleus.

But before we move on, let's simplify this as much as possible. Experiments concerning the charge field tend to arrange themselves into default positions, without the scientists even realizing it. So we may assume these scientists aren't dealing with the north pole of the nucleus. Atoms like to accept charge—and therefore incoming light of any kind—on their south poles. If they can, they will turn to make that happen. That is the basic recycling profile, and you can see it even at the macrolevel and the Earth, which turns to accept charge at its south pole preferentially. We have seen this is the cause of various tilts and wobbles that were previously unexplainable. What that means here is that the scientists are monitoring scattering off the atomic south pole. But what they don't understand is that in supercold conditions, polar channeling becomes far *easier*, for the reason I just gave above. Not only has the pole-to-equator channel mostly failed, but Brownian motion has been suppressed due to low charge levels. So any introduced photons will slip right into the south pole as if it were greased. Hence superconduction. All introduced charge or light goes right in the south pole and out the north, in a straight line, with no loss. SO OF COURSE SCATTERING WILL GO TO ZERO. Scattering is photons that MISS the south pole and reflect off an alpha on the edge of the nucleus. And that is the whole explanation of why superconduction goes hand in hand with invisibility. The photons are all in the polar channels, so only that channel would be visible, and only if you were at the end of it.

That is the basic mechanism, but let us continue looking at other details. With a normal emission profile, incoming visible light can be scattered across a wide array of angles, in 3D. But in supercold, with charge only releasing at the north pole of the nucleus, that emission is reduced to narrow band. And so we would expect angle to matter here. And guess what, *it does.* They admit that in the paper. Where? Right here:

**The researchers then shone another laser beam into the cloud, which they carefully calibrated so that its photons would not heat up the ultracold atoms or alter their density as the light passed through. Finally, they used a lens and camera to capture and count the photons that managed to scatter away.**

They had to “carefully calibrate” these introduced photons so as not to re-heat the substance. Calibrate how? They don't say, but I can tell you. The only way they could introduce new photons without re-heating the substance was by limiting their numbers and introducing them on the south pole, as above. As long as the photons slip right through, their potential heat will also channel through, transferring very little to the substance.

So, how do I explain why closely packed atoms don't scatter more than loosely packed ones. I called them on that, so I should have to address it myself. It is because, as I just showed you, scattering here isn't a function of atom density, it is a function of charge field strength and angle to that field. No matter how densely you pack atoms, photons can still move through and around them, so it hardly matters in that respect. The reason the density of the atoms matters at all here is as a function of nuclear spin. The pressure aligns the atoms, pointing all their poles in the same direction and thereby increasing the conductivity of the substance. But if the poles are aligned, so are the equators, and with enough density the equatorial charge emission streams can start interfering with one another. Adjacent atoms start spinning eachother down, and we have a further suppression of spin, multiplying the effect due to cold. So although in most cases you would expect compression to add heat, in this case it does the opposite. In most cases, heat is a function of charge density, but most charge has already been removed here by the supercold. So there is almost nothing to compress in that regard. But the compression can act to further depress the nuclear spin.

On the way out, notice one final thing. I have predicted that there appears to be one angle they didn't find, where scattering might still be great. If they were able to introduce their light right at the north pole of the Lithium atoms, they might still find considerable scattering there. That would be a sort of magnetic reconnection.

*Yes, odd mass number atoms like Lithium are lumped in with fermions, as if they are single particles, but that theory is more fudge, tacked on later to allow slipshod theories like the one we are pulling apart here.