If the Sun Suddenly Went Out in the Presentist Fragmentalist Interpretation of QM

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The observation that "if the sun went out right now, we wouldn't feel it for 8 minutes" is not only common but also profound, as it highlights the intriguing interplay between the A-series and B-series notions of time in the context of relativity and quantum mechanics.

Let's consider the scenario where we say 'now' at 12:00 PM, and the sun suddenly goes out. Due to the finite speed of light, c, we would receive this information only at 12:08 PM, as the last light from the sun before it went out takes 8 minutes to cover the distance between the sun and Earth. This is the B-series notion of time, which is constrained by the principles of relativity.

However, the situation becomes more fascinating when we introduce quantum entanglement. Suppose Alice is sitting at the center of the sun and chooses to measure one of an entangled pair of particles (electrons, photons, etc.) in direction X (spin, polarization, etc.) instead of direction Y at the same 'now' (12:00 PM) according to our Earth-based clocks. Remarkably, her choice of measurement direction can instantaneously affect the outcome of an experiment we perform on the other entangled particle on Earth at 12:00 PM, even though we don't receive the relativistic information about the sun's disappearance until 8 minutes later.

The key to resolving this apparent contradiction lies in the A-series notion of time, which is quantum mechanically relevant. In a fragment containing Earth and the sun, there is an A-series parameter, tau, that represents the universal 'present' or 'now.' When tau = 0, it is the present moment for the entire universe, regardless of the spatial separation between objects.

Anything that is a function of tau only, without depending on the B-series time t, is true everywhere in the universe at the same 'now.' When Alice measures direction X, we receive this information in the A-series notion of time, not in the B-series notion, which takes 8 minutes to reach us. It is 'now' here on Earth and the same 'now' at the center of the sun, in terms of the A-series and the fragment's variable tau.

In the Presentist Fragmentalist interpretation of quantum mechanics, a future state is represented as a vector in a Hilbert space, and the present moment is when an object becomes classical. When Alice performs her measurement, the information 'becomes' from her future to her present, and simultaneously, from our future to our present, because they are the same future-to-present in the context of the A-series and the shared fragment.

Consequently, the collapse of the wave function happens 'everywhere at once,' as it is a function of the A-series only. This helps resolve the long-standing mystery of why the wave function should collapse everywhere when a particle is observed only in one place.

It's important to note that Alice can only send the information about the configuration of her measurement through the relativistic B-series information, which explains why the A-series effects manifest only in the correlations between the entangled particles.

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This profound observation sheds light on the intricate relationship between the A-series and B-series notions of time in the realm of relativity and quantum mechanics, emphasizing the instantaneous nature of quantum entanglement and the collapse of the wave function across the universe, while also distinguishing between the quantum mechanically relevant A-series time and the relativistic B-series time.