Lect. 42

I Zecken's guest lecture on the Bell inequalities

II Real time ~~demo~~ experimental demonstration of entanglement

III Vote on Completion days

IV Cafe forms

V More detailed course feedback

Using an optical setup they are able to create states of the form

$$|\Psi\rangle = \alpha\,|H\rangle|_{sp}M_1\rangle + e^{i\phi}\,\beta\,|V\rangle|_{sp}M_2\rangle$$

(That's a $|V\rangle$)

α: polarization of light — quite analogous to spin; $\frac{1}{\sqrt{2}}(|H\rangle + |V\rangle)$ would give horizontal pol 50% and vertical 50%

$|_{sp}M_1\rangle$, $|_{sp}M_2\rangle$: spatial mode of the light — classically the intensity profile in space, as well as orbital angular momentum.

I see notes.

II I want to tell you a little about a beautiful experiment done by Fickler, Krenn, Lapkiewicz, Ramelow and Zeilinger.

Here α, β and ϕ are real.

By projecting the first photon on a particular ~~spatial mode~~ polarization and measuring it we can control the superposition of $|_{sp}M_1\rangle$ and $|_{sp}M_2\rangle$ and demonstrate entanglement.

They use Hegnere-Gauss modes

and are able to see how the space mode superposition changes ~~when they~~ "in a spooky" way when they change the polarization projection.

See youtube video "Real-time imaging of quantum entanglement."

2. Continue regular classes and use them as an extended review session.

3. Discontinue class, but hold additional office hours at a different time (or the same time)

III Completion days options

1. Continue regular classes and explore density matrices (i.e. what happens when you ignore half of an entangled pair?)

IV CaFEs

V See next page for feedback questions.

Q1: How has the pace of the course been for you? (0 too slow, 5 just right, 10 too fast).

Q2: Specific suggestions that you have for improving the course?

Q3: Specific suggestions for improving the teaching?

Q: What would it take for you to say that this was the best physics course you ever took? Best course of your college career?

Q4: Do you have suggestions for someone considering taking more physics?

Q5: Open comments: