Quantum entanglements

A very tangled web.

Eyes barely open, his overnight bag hanging over his shoulder and a giant paper cup of coffee in his shaky hand, Bob shuffled into the quantum optics laboratory at 10:15 a.m., looking for Eve. Nothing had gone right last night, but all he muttered as he slumped into his chair was: "Damned airlines."

"You poor thing," Eve said, walking from the massive black optical table to kiss him and further rumple his hair.

"My sinuses are killing me," he moaned. "I missed the last direct flight so they routed me through Washington and Atlanta. Up and down, up and down. I can't think straight."

"You don't need to. I have our end of the quantum-entanglement experiment ready. Alice said everything was okay on her end yesterday afternoon. Just monitor your receiver." She smiled.

"Thanks." He was glad somebody was in a good mood. Alice had been in a nasty one last night, anxious that something might go wrong manipulating photons that were entangled so they communicated instantaneously through 400 kilometres of dedicated dark fibre. His head still ached from her philosophical questions about causality. "Do you have any aspirin, Eve?"

"Of course, lover", Eve said, reaching into a drawer. "It's great to have your slow-light fibre in Alice's set-up. Now we can test what happens if she delays her measurement until after ours." She squeezed his hand as she put two aspirin into it.

Bob put the pills into his mouth and gulped them down with coffee. With the lights dimmed to reduce interference with the optical measurements, his eyelids drifted shut in the quiet lab. His mind moved at the snail's pace of light in his slow-light fibre. Alice would generate entangled pairs of photons, and route one to his lab and the other through the slow-light fibre to her own equipment. "What test are you running this morning?"

"Alice thinks that if she makes measurements after we receive the photons, they will cancel out our measurements, so we don't receive the encryption key and can't read her encoded message that follows the key. I think we might pick up something else in the background, but I'm not sure what."

Bob nodded. His hangover hurt more than his sinuses. "Maybe signals leaking from another universe?" he joked. "I really don't know."

"That will make you a better observer," Eve said. "We quantum mechanics don't want biased observers affecting our experiments."

Bob savoured the warm coffee. Watching Eve walk back to the table, he thought of Alice in her tight black pants.

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The aspirin was starting to work.

"Twenty minutes until the first photons arrive. Time for our checks."

Bob pushed himself up from his chair. "What are the protocols?"

"Alice transmits entangled photons for two intervals; the first time I leave them alone, the second time I tap the signal. Then we receive and decode her messages, and repeat the tests two more times."

"So what happens if the slow-light fibres are in place, and the entangled photons get to us before Alice measures them?"

"That's what Alice and I want to find out."

Bob nodded and walked to his receiver. Eve had already switched it on, so he needed only a couple of minutes to calibrate it. As he waited for the photons, he listened to the hum of lab equipment and wondered what Alice was thinking.

The instrument clock beeped at the start of the detection cycle. Photons arrived one at a time, randomly spaced; the detector noted their polarization and recorded the data. The signals were weaker than Bob expected for single photons, but intensity didn't affect the data so he just turned up the gain.

The cycle ended, and Bob looked up to see Eve waving to confirm that her instruments had collected data. He had five minutes to reset the receiver for the next run, which she would be tapping. That signal, too, was weak. They were preparing for the second pair of runs when the lab phone rang.

Bob answered and heard Alice's voice turn icy when she heard his. "We've had a power failure down here."

"We got the first two sets of entangled photons."

"You couldn't have. Everything here has been down since we lost power at 9:30, and we can't get the back-up power running."

"But we got data."

"You've screwed up again Bob. I'll call Eve when I'm back online," Alice said, and clicked off.

Bob sighed. Last night Alice had said she wouldn't sleep with him if he were the last man in the Universe. Now she was still mad, and the experiment was down.

"That was Alice," he told Eve. "She had a power failure." Eve's printer whirred. "Whatever you get won't make sense."

Eve emerged from behind the screen, clutching a sheet of paper and looking very upset. "I don't know about that!" she said, thrusting the paper in front of Bob's eyes. He saw two blocks of type. The top was labelled 'NO TAP' and was nonsense. The bottom was labelled 'TAPPED SIGNAL' and read: "Hi, Honey. You were great last night. Let's do it again soon. Love Alice."

"Err…" Bob stammered. "It can't be from this Universe."

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