AUDIENCE: [INAUDIBLE] the solar system itself.

MARK HARTMAN: OK. It's much larger than the solar system. That was interesting, because why? Did you expect it to be smaller?

AUDIENCE: Yeah. I expected it to be smaller because when I looked at the visual, it was much smaller.

MARK HARTMAN: When you looked at the visual.

AUDIENCE: [INAUDIBLE]

MARK HARTMAN: It's hard to tell. When you're looking at stuff that's way out in space, you can't tell if it's big or little, right? OK.

What about another really important observation? Because that's-- before the CAI, you didn't know how to do this. So if somebody showed you a picture of a supernova remnant-- can we have everybody turn their monitors off please? So before CAI, you could look at that picture and say, I don't know how big that is.

But now you can compare that to something and see, does that make sense or not? What was another important observation that we made? Steve?

AUDIENCE: [INAUDIBLE] image, it produced extra and the [INAUDIBLE].

MARK HARTMAN: OK. In the center of the object there was a point that was producing lots of x-rays. There was high flux. And what did we see when we looked at it invisible?

AUDIENCE: Nothing.

AUDIENCE: It's not there.

MARK HARTMAN: It's not there. What does that mean in terms of what's happening with that object?

AUDIENCE: [INAUDIBLE].

MARK HARTMAN: OK. So there's something there in the middle that's producing X-ray light, but not producing visible light. Anybody have an-- go ahead, Nikki.

AUDIENCE: In our [INAUDIBLE], what we did for the visible light, you could see some of it, but only at the very top of the curve from the remnants. It could produce some visible light, but not the whole thing. So there could be some extra visible light [INAUDIBLE].

MARK HARTMAN: OK. That was a great sentence. So there was that part at the top where we saw high flux in our false color X-ray image, but we also saw high flux in our false color visible image. But the bottom part of the supernova remnant didn't show that. What's going on there?

That must mean there's part of it that's giving off both x-rays and visible light, and part that's only giving off x-rays. Juan? Go ahead.

AUDIENCE: We could determine the true color x-ray where the high photons-- where--

MARK HARTMAN: Take your time.

AUDIENCE: Where the high photons [INAUDIBLE].

MARK HARTMAN: Take your time.

AUDIENCE: Where is this part of the supernova that is giving high photons plots. No, wait.

MARK HARTMAN: No, that sounded good.

AUDIENCE: Like, because you can see at the right hand side, it was blue. So we all know that blue is high [INAUDIBLE]-- high energy.

MARK HARTMAN: High energy photons we colored blue.

AUDIENCE: And where it's red, you know that it's low energy. So with the true color image, we can determine where are the high intensity and low intensity.

MARK HARTMAN: That was actually very, very good. By looking at that true color image, we could tell in some regions the light being given off was different, just like we saw up there. If we look back over there, there's some places where there's lots of blue light in the middle. Why is that colored blue? Because there's high-- that indicates high energy photons.

So we saw that from our supernova remnant, one side was kind of blue, one side was kind of red. There were different-- other parts that were green. Go ahead, Nikki.

AUDIENCE: And there's a big part, kind of at the edge in ours, that there's a light. So they could be all colors combined equally [INAUDIBLE].

MARK HARTMAN: Exactly. And if we see a big white part, that means we're getting an equal amount of the high, medium, and low energy photons from that region.

AUDIENCE: [INAUDIBLE].

MARK HARTMAN: OK.

AUDIENCE: [INAUDIBLE]

MARK HARTMAN: I don't know if you guys made quite the observations that we made, but-- and that's interesting. Remember at lunch Mike was talking about different teams of people are working on different parts of the object. So yeah.

It could be that these guys noticed one thing, but you didn't. And until you got together at your conference and you talked about what you saw, and you wouldn't know if what you saw was real or not. Maybe you made a mistake.

We found a couple of mistakes in our math here, because we transferred knowledge and talked back and forth a little bit. So this is a really good start. And what I'm hoping that it does is by going through this first analysis, it gives you a chance to ask a few more questions about what you think is going on, right? Because we've identified two more important things, actually three more important things.

We have identified-- so let's just say this is important points from the analysis. And I'm going to go ahead and move this. The color is not the same everywhere. That's what we saw even before.

That was one of our observations about those different supernova remnants. What that means is light of different energy is being produced in different places. We | saw that not all parts of the supernova remnant produce visible light.

Now that give us a clue as to the production mechanism of light, right? We're looking at X-ray objects. We're looking at-- well, we're looking at objects that give off lots of X-ray light, not things that give off a lot of visible light.

Now in general, we could say that things that give off x-rays are typically hotter. Does it make sense that this object is really hot? Why?

AUDIENCE: [INAUDIBLE] X-rays affect the whole supernova remnant. But with the visible light, you can hardly see anything [INAUDIBLE].

MARK HARTMAN: So that's our observation that lets us know this, but connect that to the model. What did the supernova remnant used to be?

AUDIENCE: A sun-- star.

MARK HARTMAN: Used to be a star. And then what happened to it?

AUDIENCE: [INAUDIBLE].

MARK HARTMAN: OK. Steve?

AUDIENCE: I have a question.

MARK HARTMAN: Yeah.

AUDIENCE: If it's [INAUDIBLE] to produce X-rays, [INAUDIBLE], won't it be producing visible light, then?

MARK HARTMAN: OK. So if you have a regular-- like a black body, right, if you turn the temperature way up it's going to have more x-rays that it gives out. But you're also saying, wouldn't it also give out visible light?

AUDIENCE: Yeah.

MARK HARTMAN: OK. So maybe this isn't quite what we're thinking. Maybe it's not just that it's really hot, OK? We're going to find out that there's definitely some non-thermal processes that are happening inside the supernova remnant.

OK. Juan? Another question?

AUDIENCE: What about if you-- there's like a spaceship goes to outer space, and they can see the stuff in the way. If there's not visible light, how they can detect there's stuff in the way that's going to be danger for the space ship?

MARK HARTMAN: OK. So you're talking about like the dust in space that's close to Earth versus the stuff that's way out there?

AUDIENCE: Yeah.

MARK HARTMAN: Well, you kind of look at it with different tools. Juan's saying if we go out into space, we need to know about things that are out there. Remember, we're looking at this really, really tiny spot that's near the sun, but here we're looking at Cas A. This is already a really far distance. This is 10,000 light years-- we haven't talked about light years yet, but it's the amount of distance that light would travel in one year.

So this is really far away. So we're looking at different kinds of things. The dust in the solar system is kind of different from the dust that we'd see in between the stars.

AUDIENCE: OK.

MARK HARTMAN: OK.