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Two astronauts are gearing up for what may be the most challenging spacewalks in history.

NASA astronaut Andrew Morgan and Italian astronaut Luca Parmitano of the European Space Agency will take at least four spacewalks over the next few weeks to repair an ailing dark matter experiment outside the International Space Station. The spacewalk saga begins Friday morning (Nov. 15), when the duo will embark on the first 6.5-hour spacewalk. You can watch the spacewalk live here on Space.com, courtesy of NASA TV.

Called the Alpha Magnetic Spectrometer (AMS), the $2 billion experiment studies cosmic particles in space by using a huge, superconducting magnet to alter the particles' paths with its magnetic field. As the particles pass through this magnetic device, eight tiny particle detectors analyze their properties, looking for evidence of antimatter and dark matter.

NASA launched the AMS to the International Space Station in 2011 on the space shuttle Endeavour, and the experiment was designed to have a lifetime of 10 to 18 years. However, just three years after it became operational, one of its four cooling pumps failed. The four pumps are redundant, with the AMS only using one at a time for

periods of 3 to 4 months, so the experiment could continue despite the AMS being down a pump.

However, when a second pump failed just a few months later, "that was when we knew that we had a serious problem to deal with," Ken Bollweg, the AMS program manager, said in the news conference. "We knew we had to do something about it, especially since AMS was getting such compelling science," Bollweg said. "We knew we wanted to extend its life."

But AMS will be getting a lot more than just some new pumps. "It's not only replacing the pumps, it's replacing the accumulator, heat exchangers, heaters, valves — that whole pump package ... will be attached to the outside of AMS," Bollweg said, adding that the spacewalkers will be working to connect new power and data cables as well.

"It's a whole new package that's designed to extend the life [of AMS] until the end of the space station," Bollweg said. NASA is planning to end its space station operations in 2024, although Congress recently proposed an extension to 2030.

Not only will the astronauts be repairing the cooling system, but they're also going to upgrade it. "We'll actually improve the cooling significantly," Bollweg added. "As things are in space, with time they

degrade [and] the optical properties change, so the cooling isn't quite as efficient. This is actually going to improve it to the point where we're expecting the cooling to be even better than it was when we first started."

Astronauts began preparing the AMS for the repair job in 2017, when NASA astronauts Peggy Whitson and Jack Fischer installed a new data cable during a spacewalk together. This cable would feed data from the AMS cooling system to engineers who were planning the experiment's complicated repair work back on Earth.

While this repair job will be an arduous task for the astronauts, it has also been a tremendous challenge for NASA's ground teams to plan. "We usually have a standard set of EVA [extravehicular activity] tools that we design all of our space equipment to be able to interface with," Jochim said. "Unfortunately not all those would work with this activity, so we designed about 25 new space tools that we flew on a variety of missions this year" to be able to conduct this repair, she added. The most recent batch of AMS equipment just arrived at the space station two weeks ago on a Cygnus cargo spacecraft.

After Friday's spacewalk, NASA is planning to send both Parmitano and Morgan out for a second spacewalk on Nov. 22. The third will take place around Dec. 1-2, and the date for the fourth spacewalk has yet to be determined, Kenny Todd, NASA's space station operations integration manager, said in the news conference.

Depending on how smoothly these four spacewalks go, they may have to take additional spacewalks.