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## Earth's laws still apply in distant Universe

The laws of nature are the same in the distant Universe as they are here on Earth, according to new research conducted by an international team of astronomers.

The research, published today in *Science*, found that one of the most important numbers in physics theory, the proton-electron mass ratio, is almost exactly the same in a galaxy 6 billion light years away as it is in Earth's laboratories – approximately 1836.15.

According to Swinburne astrophysicist and lead author of the study, Dr Michael Murphy, it is an important finding, as many scientists debate whether the laws of nature may change at different times and in different places in the Universe.

"We have been able to show that the laws of physics are the same in this galaxy half way across the visible Universe as they are here on Earth," he said.

The astronomers determined this by effectively looking back in time at a distant quasar. The quasar's light, which took 7.5 billion years to reach us, was partially absorbed by ammonia gas in an intervening galaxy.

"Not only is ammonia useful in most bathroom cleaning products, it is also an ideal molecule to test our understanding of physics in the distant Universe. The wavelengths at which ammonia absorbs radio energy from the quasar are sensitive to this special nuclear physics number, the proton-electron mass ratio.

"By comparing the ammonia absorption with that of other molecules, we were able to determine the value of the proton-electron mass ratio in this galaxy, and confirm that it is the same as it is on Earth," said Murphy.

The astronomers' aim is to continue testing the laws of nature in as many different places and times in the Universe as possible.

"We want to see how well the laws of nature stand up in untested situations, by looking well beyond our little portion of space and time."

In order to do this, the astronomers will need to locate more absorbing galaxies. "The galaxy we studied is the only known one of its kind in the Universe. We know there must be many more out there; we just don't have the technology to find them."

According to Murphy, this problem could be overcome with the proposed Square Kilometre Array (SKA) telescope project. "The SKA is the largest, most ambitious international telescope project ever conceived. When completed it will have an enormous collecting area, and will allow us to search for more absorbing galaxies."

The location of the SKA, which has been short-listed to Western Australia and South Africa, will be announced within the next two years.

By continuing their research into the forces of nature, the astronomers also hope to find a window into the extra dimensions of space that many theoretical physicists think may exist.

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**ENDS**

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