The impact of a collaboration can have a number of facets, not only in relation to the research being undertaken but also in terms of the outputs achieved by those involved, this includes:

- A large number of papers and journal entries being produced every year through the collaborative process
- Financial backing can be obtained as part of the work carried out by the collaboration
- New prototypes and technology developments can arise.

Collaborations allow the UK to be involved with the most exciting scientific projects happening across the world. The number reported to us is recognition of the UK's scientific community and the knowledge that they have to offer ground-breaking research.
The Dark Energy Survey Consortium

One of the most exciting challenges facing physics today is the mystery of why the expansion of the Universe is speeding up. This conflicts with Einstein’s Theory of General Relativity, which suggests gravity should lead to a slowing in expansion. Many scientists believe this speeding up is being caused by dark energy, an enigmatic force. To find out more about dark energy and its effect on the Universe a group of more than 120 scientists from 23 institutions, including 6 from the UK (full list here), have collaborated to form the Dark Energy Survey (DES). DES, which began in September 2012, is due to continue for five years.

STFC is supporting researchers from the UK with their participation in the work being carried out. Observations are currently being undertaken at the Victor M. Blanco telescope in Chile, where the DES team have mounted a specialised 570-megapixel camera specifically designed to be sensitive to the redshifted light from distant galaxies and stars. This is producing an extensive array of images for scientists to study.

As reported to us via ResearchFish, UK researchers have contributed to the scientific theory and leadership of the project, helped prepare scientific simulations, contributed to publications and provided a PhD student to help with operations in Chile. Parts of the dark energy camera were also manufactured and assembled at University College London (UCL), with funding provided by STFC.

The Einstein Telescope

As part of Einstein’s Theory of General Relativity, the existence of gravitational waves was predicted. These are ripples in the curvature of spacetime, caused by the acceleration of massive objects in space; such as binary stars or binary black holes (stars/black holes that are in orbit around each other). By examining these waves, scientists will be able to discover information about the source of the waves. This will help to better understand the origins of the Universe - including how stars, supernovae, neutron stars and black holes evolve. Detecting gravitational waves is very tricky. Their interaction with particles is weak and they only produce tiny distortions in spacetime. A European collaboration has been set up to design and realise a new third generation gravitational wave detector, known as the Einstein Telescope (full list of collaborators). The aim of this detector is to reach a sensitivity for gravitational waves to a factor of 10 better than any of the current detectors. To reduce the effect of external interference and allow for better sensitivity, the team are proposing to locate the telescope underground. Researchers from the University of Birmingham, University of Glasgow and Cardiff University have been involved in the design phase and have provided experimental and modelling expertise to the group. Those involved from the UK will also carry out studies and simulations of sensing and control issues for the Einstein Telescope. Work on the proposed detector is ongoing, with four working groups within the collaboration structured to look at specific areas, including site identification and astrophysics issues.

For more information on STFC and Researchfish please visit: www.stfc.ac.uk/1846.aspx