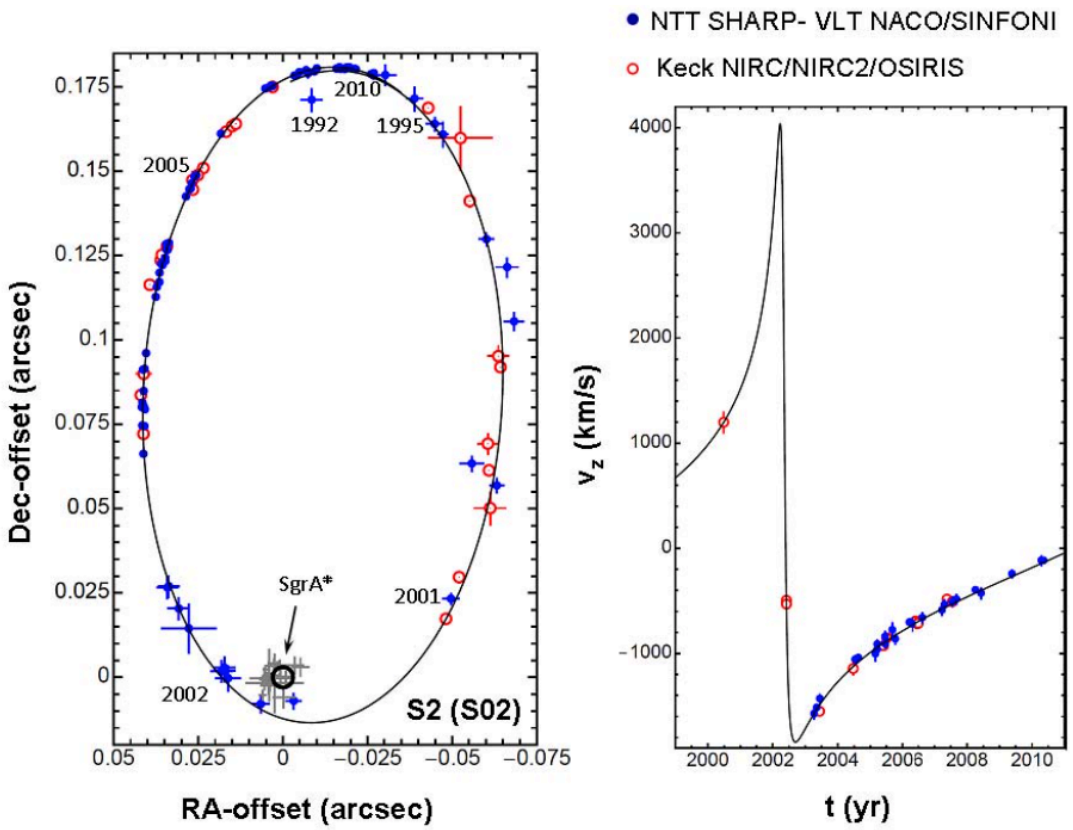

Figure 8. *Orbit of the star S2 (S02) on the sky (left panel) and in radial velocity (right panel). Data from NTT/VLT and Keck are shown. Blue, filled circles, denote the NTT/VLT points and open and filled red circles are the Keck data. The positions are relative to the radio position of Sgr A* (black circle). The grey crosses are the positions of various Sgr A* infrared flares. From Genzel, Eisenhauer & Gillessen (2010).*

Recent updates on Galactic centre results

The ESO/VLT observations using interferometric imaging and astrometry connecting the four VLT telescopes, have now been carried out by the GRAVITY collaboration (Abuter et al., 2018) with Genzel among the leading investigators. GRAVITY has achieved an angular resolution of only 20 micro-arcseconds, about 100 times sharper than the first SHARP speckle imaging results.

Figure 9 summarizes 26 years of imaging the motion of the S2 star around Sgr A* based on observations with ESO telescopes. The upper-right panel shows the spectroscopic observations from both Keck and ESO that were used to measure the radial velocity. The observations are now precise enough that the position of the star can be seen to change between consecutive nights, as indicated in the bottom-right panel. The best fit of the orbit including special and general relativistic effects is shown as a solid line in the plots. Not only have the measurements provided exquisite kinematic evidence for a compact object in the Galactic centre, but also a sub-percent error estimate of the distance to the Galactic centre and a 20σ detection of the relativistic corrections needed to model the orbit of the star to the supermassive black hole. Furthermore, the team was able to detect the relativistic precession of the orbit—a truly remarkable experimental achievement addressing fundamental physics.