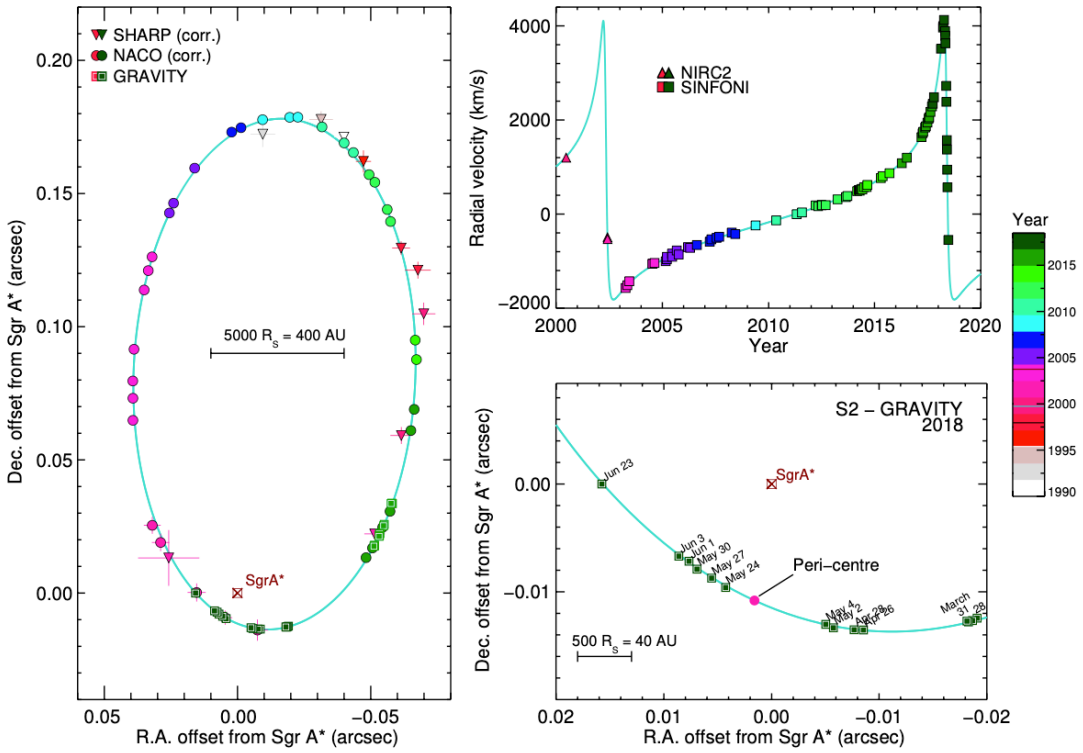

Figure 9. *Summary of the observational results of monitoring the S2–Sgr A* orbit from 1992 to 2018. Left: Projected orbit of the star S2 on the sky (J2000) relative to the position of the compact radio source Sgr A* (brown crossed square at the origin). Triangles and circles (and 1 σ uncertainties) denote the position measurements with SHARP at the NTT and NACO at the VLT, color-coded for time (colour bar on the right side). The cyan curve shows the best-fitting S2 orbit to all these data, including the effects of general and special relativity. The bottom right panel shows a zoom-in around pericentre in 2018. Upper right: Radial velocity of S2 as a function of time (squares: SINFONI/NACO at the VLT; triangles: NIRC2 at Keck). S2 reached pericentre of its orbit at the end of April 2002, and then again on 19 May 2018. The cyan curve shows the best-fitting S2 orbit to all these data, including the effects of General and Special Relativity. From Abuter et al. (2018).*

Detection of motion of heated matter near the innermost stable orbit

The data do not yet allow scrutiny of the compact object closer than several hundred Schwarzschild radii, as shown by the orbit of the S2 star in figure 9. That could change in the future, as deeper observations may reveal stars closer to Sgr A*. However, short infrared flares, about one hour in duration, have been serendipitously discovered over several years (Genzel et al. 2003, Ghez et al. 2003).

These flares originate from the immediate vicinity of the compact object, and the improved angular resolution of GRAVITY potentially allows the use of the flares to trace the innermost region surrounding Sgr A* (Abuter et al. 2018). The sources of the flares appear to orbit around the central object with 30% of the speed of light at a physical distance of only 3–5 R_s, corresponding to the region just outside the innermost stable circular orbit (ISCO) of a Schwarzschild-Kerr black hole of 4 million solar masses. These observations provide additional strong support for the hypothesis that the compact object at the Galactic centre is a supermassive black hole, as predicted by the theory of general relativity.