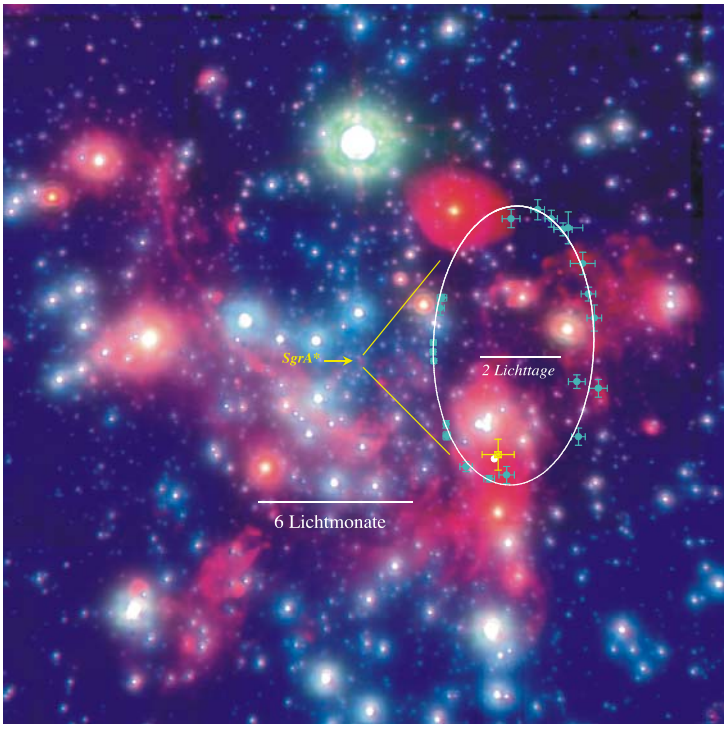
The Galactic Center

The center of our Milky Way is a unique laboratory for studying the properties and evolution of a dense nuclear star cluster and for exploring the physics of accretion and the strong gravity regime around a massive black hole. Becoming available in 2002, we have begun a comprehensive study of the central parsec using diffraction limited imaging, spectroscopy and polarimetry with NACO on the VLT. This research has resulted in a number of results that constitute major breakthroughs in the field:

- determinations of individual three dimensional, stellar orbits within a few light days of the central black hole. In particular, the data give a highly precise determination of the elliptical orbit of the star S2 around SgrA*. The orbital period is 15 years and the peri-bothron distance is 17 light hours. These measurements constrain the density of the central dark mass to exceed 10^{19} Mpc^{-3} and exclude all stable non-black hole configurations, beyond any reasonable doubt (Schödel et al. 2002, 2003a,b)
- a direct geometric determination of the distance to the Galactic center from the orbital parallax method, that is, the simultaneous fitting of the sky and line of sight orbital data (7.94±0.42 kpc, Eisenhauer et al. 2003)
- first detection of quiescent emission and flares from the black hole, including the tantalizing detection of a 17 minute quasi-periodicity in several flares. The IR emission comes from energetic electrons or hot gas just outside the event horizon and the periodicity suggests that the black hole has about half the maximum possible spin (Genzel et al,. 2003b)
- discovery of a stellar cusp centered on the position of the black hole, as well as the finding that the massive young stars reside in two coeval but counter-rotating disks (Genzel et al., 2003a)



Orbit of the star S2 around the black hole Sgr A*, superposed on a 3-color image of the galactic center taken with NACO in the H, Ks, and L'-Bands.

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