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MONITORING STELLAR ORBITS AROUND THE MASSIVE BLACK HOLE IN THE GALACTIC CENTER

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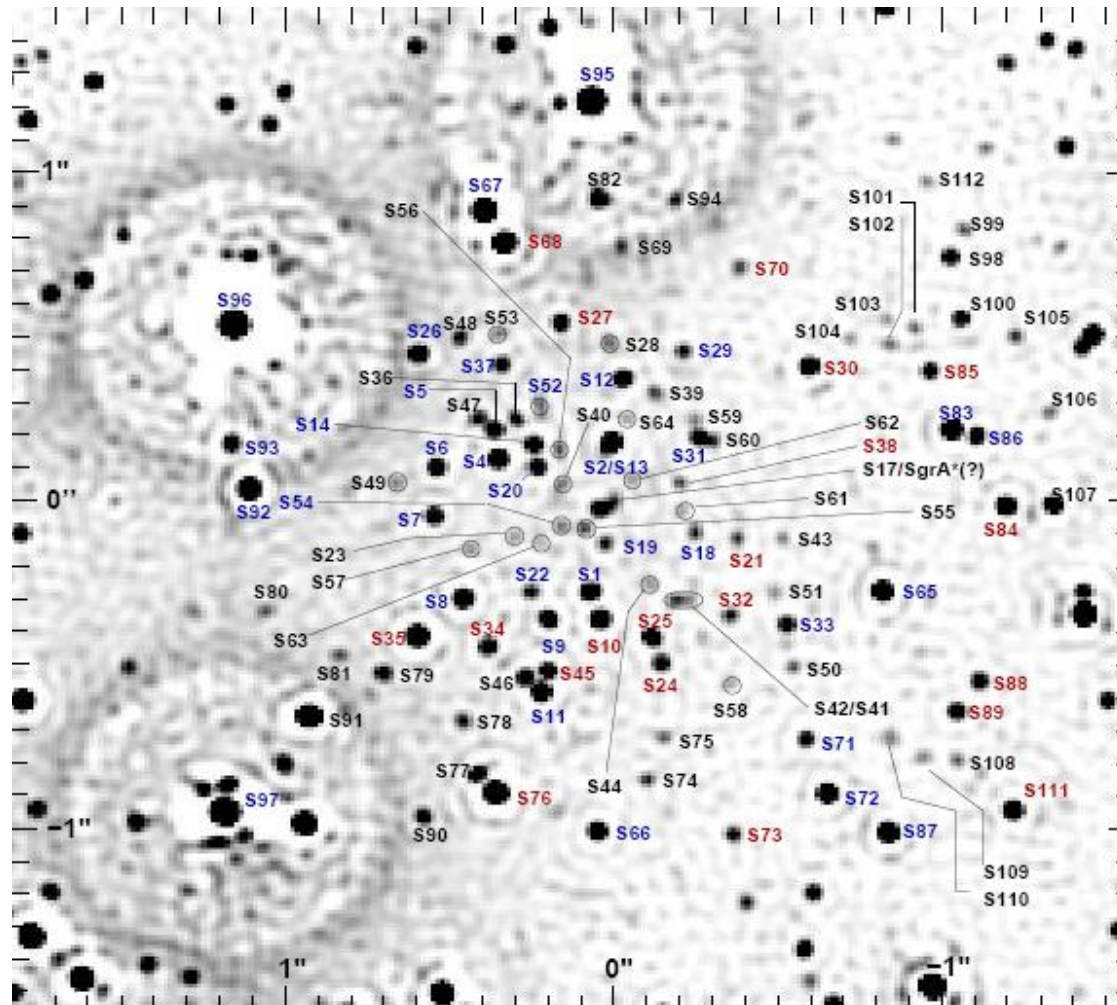[1] Max-Planck-Institut für Extraterrestrische Physik, 85748 Garching, Germany

Groundbased observations: ESO Very Large Telescope, Chile

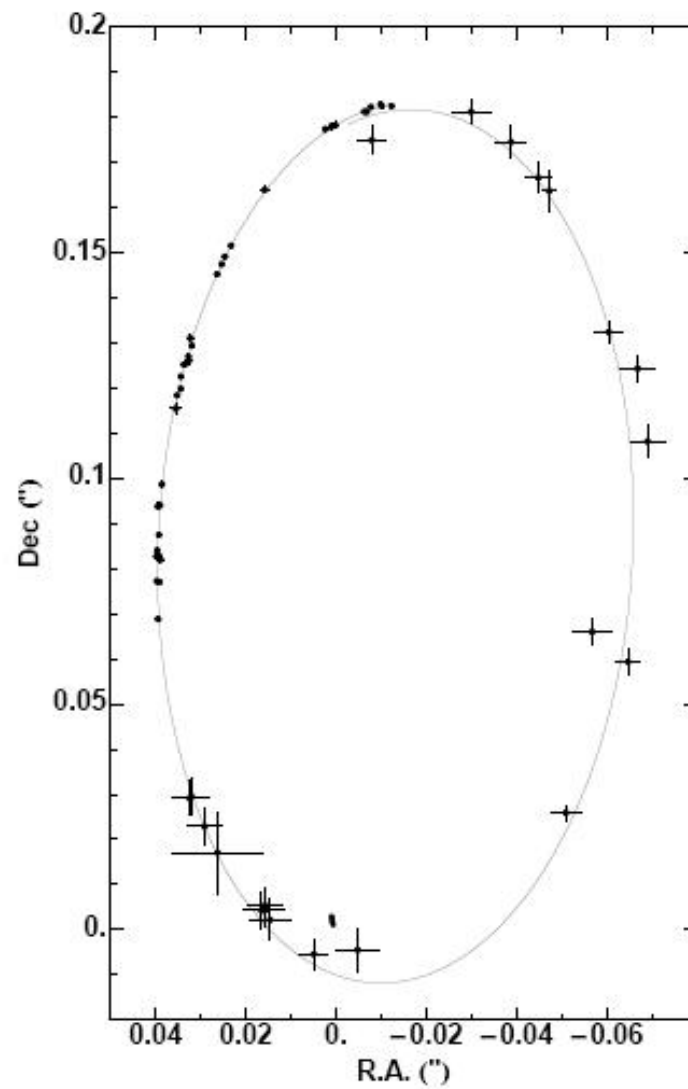Europhysics News, Sept/Oct 2004; nice article by D. Rouan, Meudon
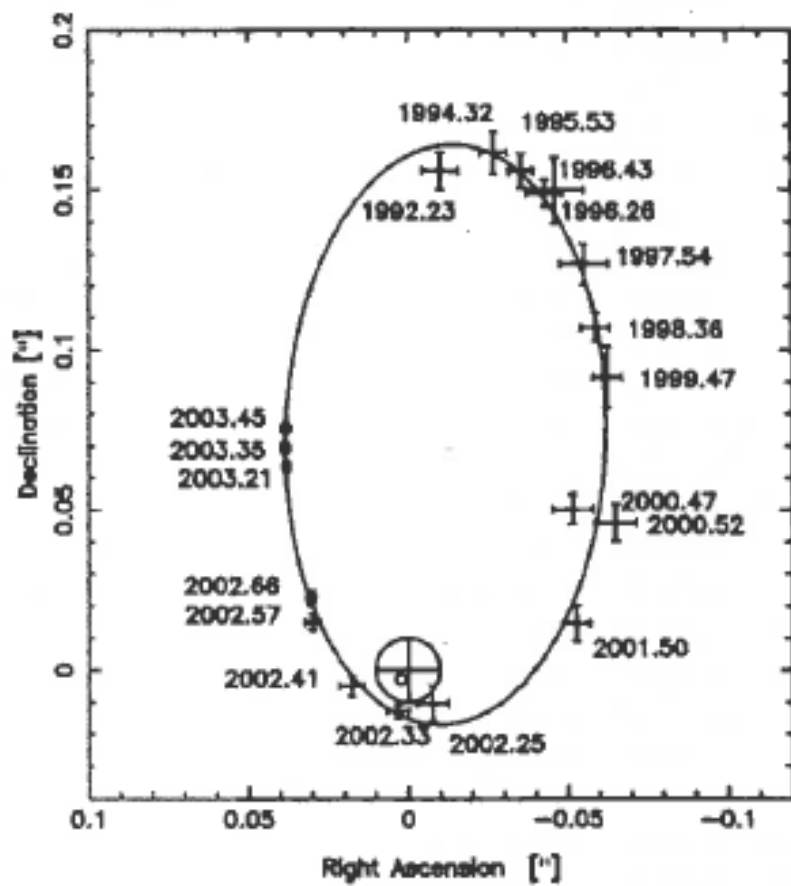
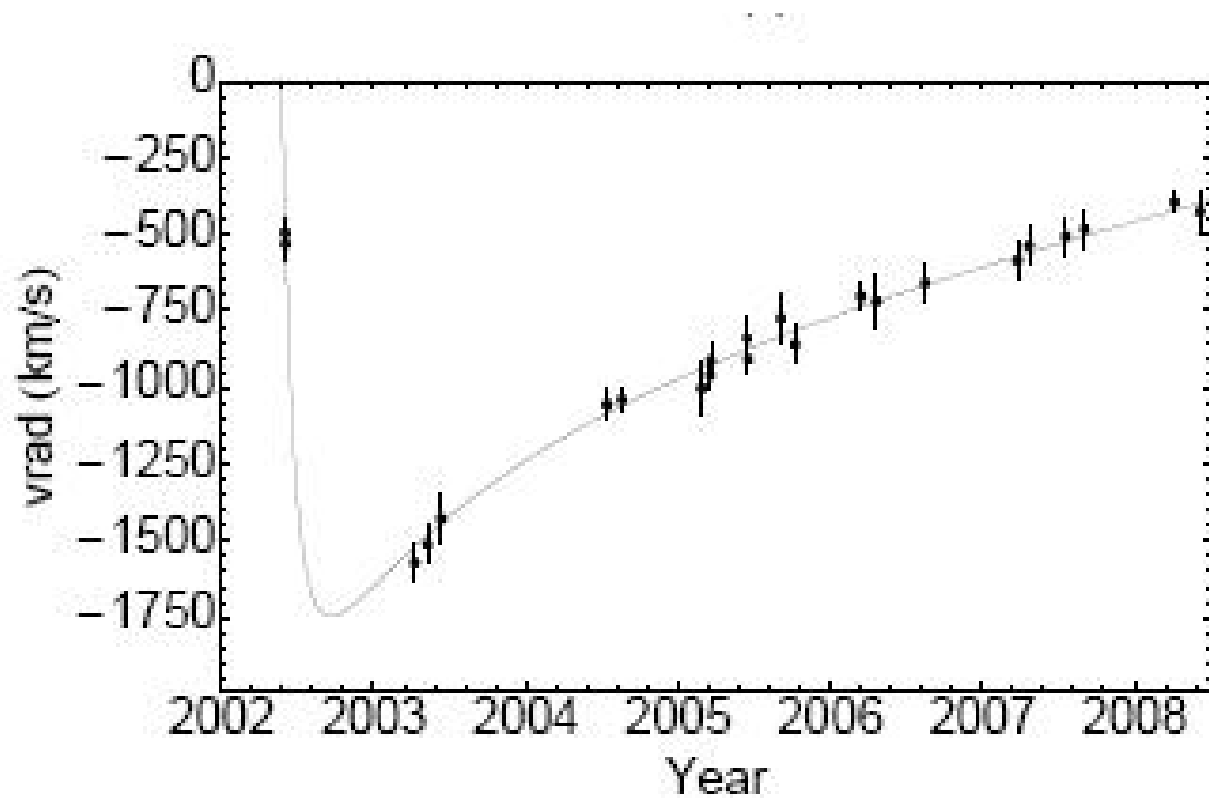# Stars around BigBH   20.7.2007

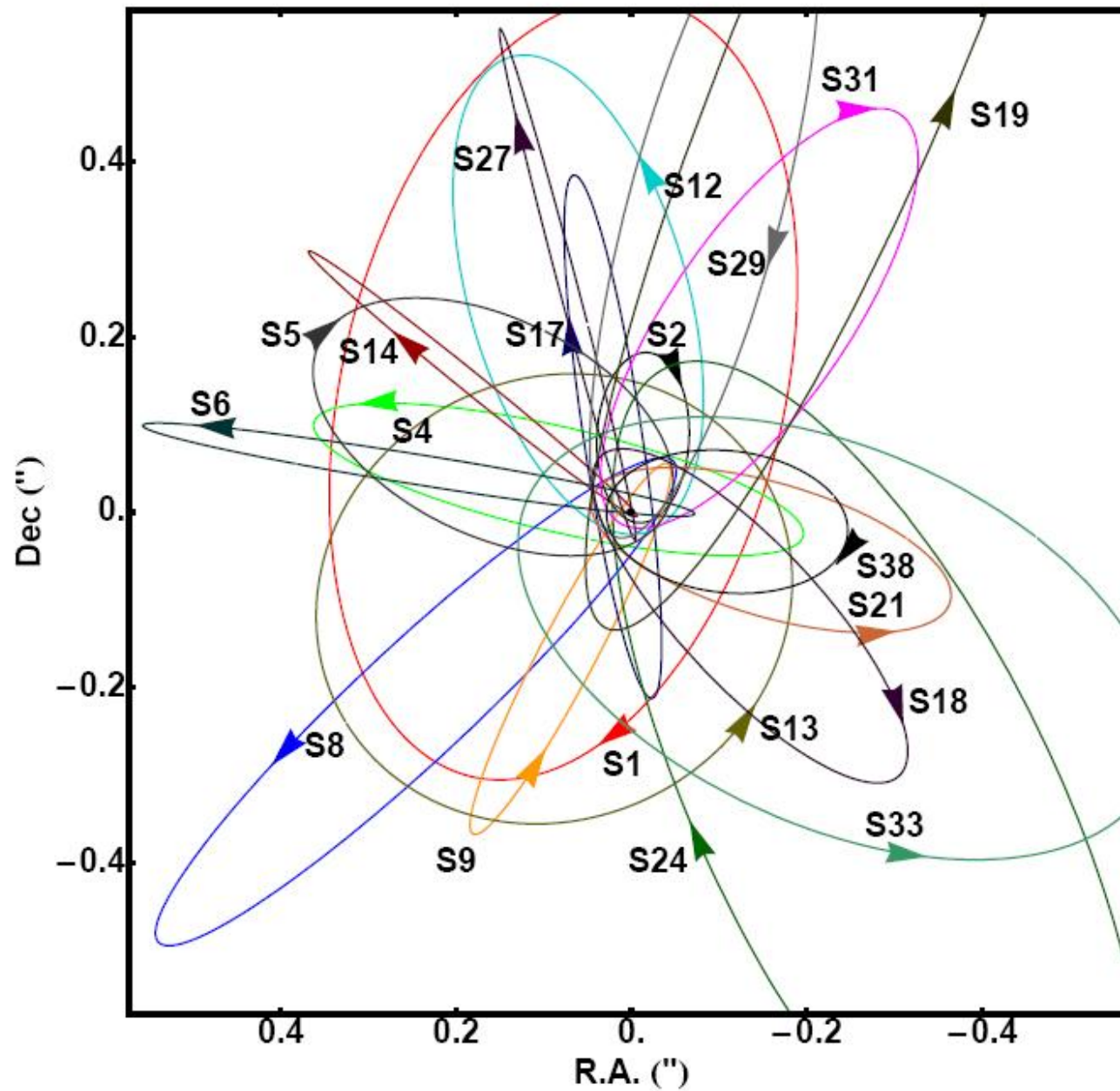Declination
In arc sec

Right ascension in arc sec

A special star, S$_2$

S$_2$ orbit is Keplerian with pointlike central mass

All the orbits determined:

Some orbital parameters:

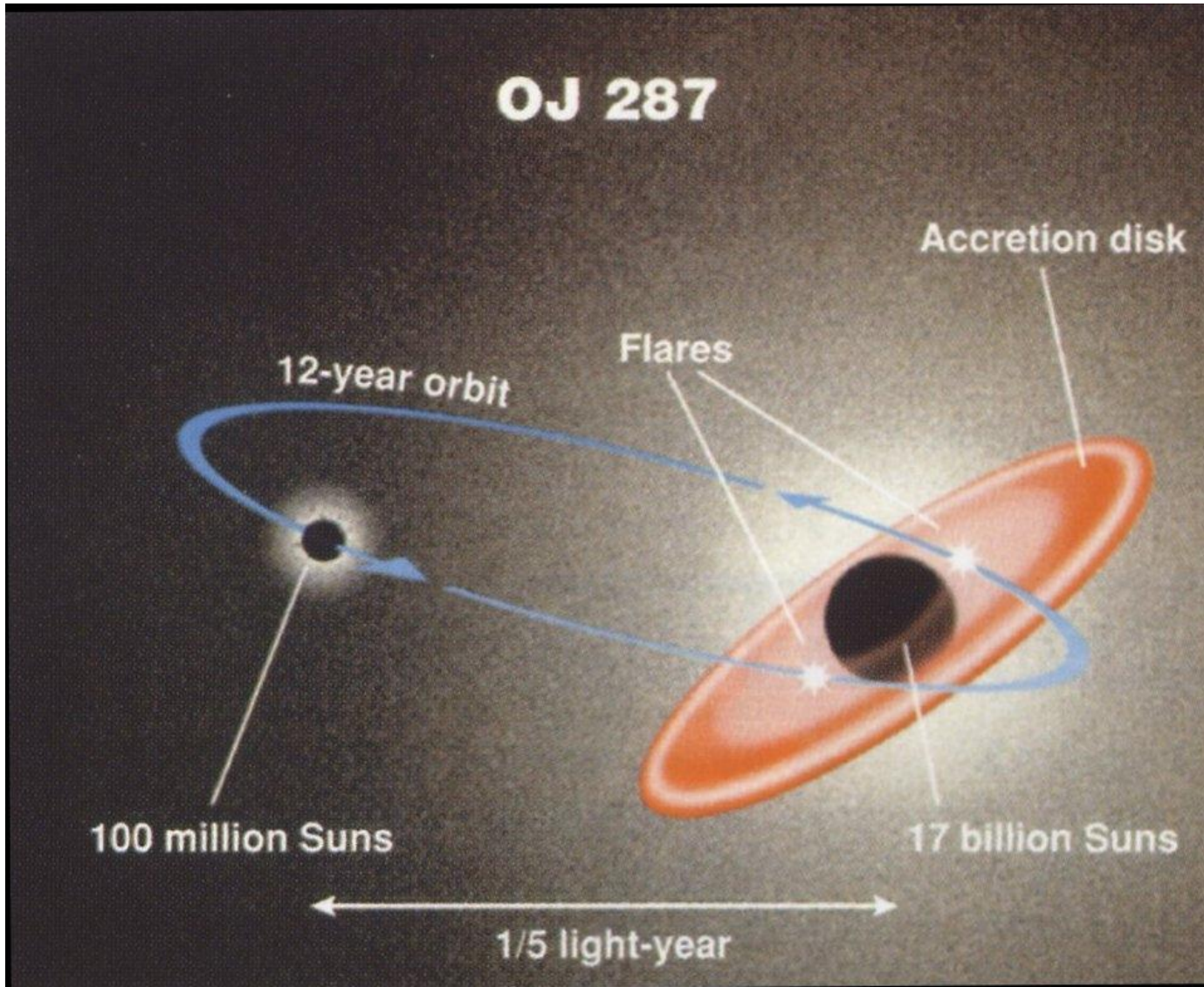| Star	$a["]$	e	$i\,[°]$	$\Omega\,[°]$	$\omega\,[°]$	$t_P\,[\text{yr-2000}]$	$T[\text{yr}]$
S1	0.508 ± 0.028	0.496 ± 0.028	120.82 ± 0.46	341.61 ± 0.51	115.3 ± 2.5	0.95 ± 0.27	132 ± 11
S2	0.123 ± 0.001	0.880 ± 0.003	135.25 ± 0.47	225.39 ± 0.84	63.56 ± 0.84	2.32 ± 0.01	15.8 ± 0.11
S4	0.298 ± 0.019	0.406 ± 0.022	77.83 ± 0.32	258.11 ± 0.30	316.4 ± 2.9	-25.6 ± 1.0	59.5 ± 2.6
S5	0.250 ± 0.042	0.842 ± 0.017	143.7 ± 4.7	109 ± 10	236.3 ± 8.2	-16.4 ± 2.5	45.7 ± 6.9
S6	0.436 ± 0.153	0.886 ± 0.026	86.44 ± 0.59	83.46 ± 0.69	129.5 ± 3.1	63 ± 21	105 ± 34

$N(e) \sim e^{2.6}$ Eccentricity distribution chaotic!

Compare Valtonen:

ra = 9h, declination = 20 degrees

z = 0.306, distance 3.5 Gly, magn = 14

OJ 287

Accretion disk

Flares

12-year orbit

100 million Suns

17 billion Suns

1/5 light-year

Parameters: Masses = $1.80 \cdot 10^{10}$ and $1.3 \cdot 10^8$ m_{sun} ,, Rs = 355 and 2.6 au,

Peri/aphelion = 2980 and 18140 au, e=0.72, J = $0.46 J_{max}$, period= 12.2a

Note: perihelion/Rs = 8.3, big gen rel effects!

Orbital velocity 0.06c….0.28c !!
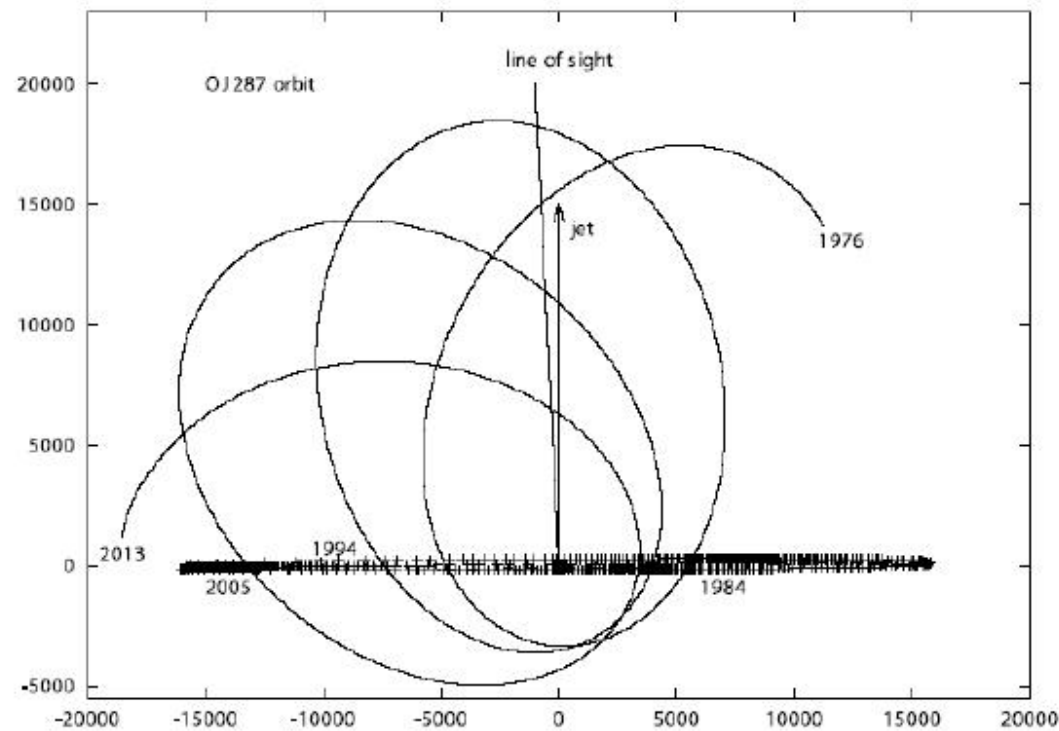
Future: approaching strong gravity, Rs: