PLUTO

Best searched for around opposition in July. Far too dim for the naked eye.

Pluto was accepted as the ninth major planet from its 1930 discovery till 2006, when it and several bodies of similar size were reclassified as "dwarf planets": large enough to assume a spherical shape, but not dominating an orbital region. Pluto turned out to be the first of an abundant class of small bodies near or beyond Neptune's orbit; being one of the nearest-in, and one of the largest, it was discovered 62 years earlier than the next of them. Pluto remains the only trans-Neptunian conceivably accessible for amateurs' telescopes, so we continue to feature it.

A mistaken belief of Percival Lowell and William Pickering that remaining small discrepancies in the orbit of Uranus were evidence of yet another planet inspired a search at Lowell Observatory, Flagstaff, Arizona. Clyde Tombaugh, patiently using a "blink comparator," found the moving body on 1930 Feb. 18, in plates taken Jan. 21-29. The name was chosen to include Lowell's initials.

Yet the discovery was only a coincidental result of the prediction. Pluto was later found to be smaller than any of the major planets and even some of their satellites. It is in an orbit more eccentric and inclined than any of the major planets.

Discovered like Uranus in Gemini (it passed less than 1′ south of δ Gem on 1930 Mar. 8), it was almost at its ascending node (Sep. 9), moving in toward its mean distance, and was the outermost solar-system body then known. It ceased to be such in 1979, by crossing over the orbit of Neptune——very high over, for almost at the same time, in 1980, Pluto was at its highest latitude, 17.2° or nearly 12 a.u. north of the ecliptic plane. It was at perihelion in 1989; then after 20 years as the "eighth planet from the Sun," it re-crossed Neptune's orbit (still well north of it) in 1999, to be outside it for the next 228 years.

In 2017, Pluto slopes from about 1.05° to 0.5° north of the ecliptic. It will descend through the plane on 2018 Oct. 24, half way around the sky from where it was discovered; crawl on out to aphelion in 2114, 49 a.u. from the Sun; return to its region of discovery in 2178.

Pluto has five known satellites. Charon, discovered in 1978 by James Christy as a mere bump on the planet's tiny photographic image, is only 20,000 km from Pluto and more than half its width. They are much nearer in relative size than any planet-satellite pair; unlike any other such system, the center of gravity around which they orbit is not inside Pluto. Charon enabled Pluto's mass and width to be calculated. The other satellites are small and also unusually close to their primary: Nix and Hydra (discovered in 2005), Kerberos and Styx (discovered 2011 and 2012).

From the 1960s to 1990s, Pluto skimmed the northern fringes of the zodiacal constellations and southern corners of Coma, Boötes, and Serpens. Since 1988 it has been south of the celestial equator. In 2006 it entered the northwest corner of Sagittarius, across which it slants till 2023. From about 2000 it was crossing a Milky Way background thronged with stars of confusingly comparable brightness, and in 2010 it crossed the galactic equator. Since about 2012 it has been near enough to the ecliptic for close conjunctions with the Moon and the planets. In 2015-16 it had close encounters with the three stars π, o, and ξ of the "Teaspoon" of Sagittarius.

At the beginning of the year Pluto is behind the Sun. From Apr. 20 to Sep. 27 it appears to swing backward because Earth is passing it on the inside. This retrograde path used to be a fat upward loop, like a backward ***e***, because we were looking "up" to Pluto from our ecliptic plane, but the loop became slender until in 2013 it became a narrow spike. The backward course represents, as for any outward planet, the time when Pluto is nearest to us. In April it begins to rise before midnight, and by the time of opposition it rises around sunset.

mean dist. from sun	39.4 a.u.
sidereal period	248 years
synodic period	367 days
eccentricity	.25
inclination	17.2°
diameter	2,370 km
satellites	5

It is far dimmer than the major planets, even when nearer than Neptune. Even at perihelion its magnitude reached only 13.6——about 700 times dimmer than the extreme naked-eye limit of 6.5. Now more than 33 a.u. from the Sun, and 32.35 from us at opposition, its magnitude has dropped past 14.

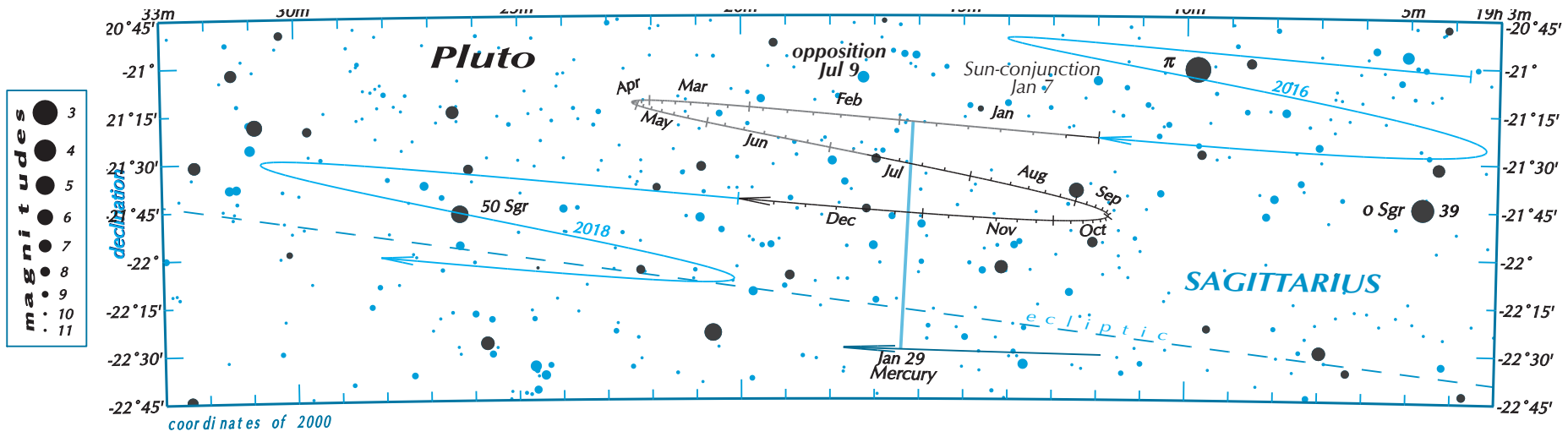
The **New Horizons** spacecraft, designed to study Pluto and built at the Applied Physics Laboratory (APL) of Johns Hopkins University, was launched 2006 Jan. 19. It happened to fly by an asteroid (discovered in 2002) which therefore was named 132524 APL. O 2007 Feb. 28 the spacecraft looped by Jupiter to increase its speed, and on 2015 July 14 it flew by Pluto at a distance of 12,500 km and Charon at 28,800. It is on course to pass a more remote trans-Neptunian, called 2014 MU69, on 2019 Jan. 1.

New Horizons sent back a wealth of information about Pluto, much of it surprising——a surface mainly\ of frozen nitrogen, mountains of water ice, cliffs,canyons, and more contrast of brightness and color than almost any other solar-system body, with large dark and light regions called Tombaugh Regio or the "Heart," Sputnik Planitia, and Cihulhu Regio or the "Whale."

TABLE OF PHENOMENA. Columns are: right ascension (in hours, minutes, seconds) and declination (in degrees and minutes), for epoch 2000; distance from Sun and Earth, in astronomical units; elongation from Sun (in degrees; negative means "westward"); magnitude; diameter in arc seconds. "Stat.in r.a.>dir." and "stat.in long>dir." mean "stationary in right ascension]or longitude], starts to move direct (eastward)"; "retr" means retrograde (westward). "Inf." and "sup. conj." mean inferior and superior conjunction with the Sun; these divide the planet's morning and evening apparitions. Dates of conjunctions with other planets are in right ascension.

Pluto 2017	RA (2000) decl	hedist	geodist	elo	magn	dia"
Jan 1 0	19 11 58 -21 22	33.243	34.221	6	14.3	0.1
Jan 7 1 conjunc.with sun	19 12 52 -21 21	33.247	34.230	-1	14.3	0.1
Jan 29 18 1.2°N of Mercury	19 16 8 -21 17	33.262	34.171	-22	14.3	0.1
Apr 20 1 stat.in long>retr	19 22 26 -21 11	33.312	33.106	-101	14.2	0.1
Apr 20 11 stat.in r.a.>retr	19 22 26 -21 11	33.313	33.100	-101	14.2	0.1
Jul 9 22 opposition	19 17 5 -21 28	33.364	32.347	179	14.2	0.1
Sep 27 21 stat.in r.a.>dir.	19 11 45 -21 46	33.415	33.199	102	14.2	0.1
Sep 28 11 stat.in long>dir.	19 11 45 -21 46	33.415	33.208	101	14.2	0.1
Jan 1 0	19 20 4 -21 41	33.476	34.450	8	14.3	0.1

FINDER CHART for Pluto. The scale is 3 cm to 1°. Ticks mark Pluto's positions at days 1, 6, 11, 16, 21, and 26 of each month. The planet's track is shown gray when it is in the morning sky (from Sun-conjunction to opposition). Shown in blue is Pluto's course in the adjacent years. Opposition falls in the middle of each retrograde loop, only about 1 or 2 days later each year. Plotted in blue are stars from the Tycho catalogue of the Hipparcos mission, which can be as faint as magnitude 11.5; those also plotted in black are in the 9-times-smaller Hipparcos catalogue itself. Pluto's magnitude is no higher than 14, so it is dimmer than the faintest stars on the chart. To find it, use a telescope of aperture 10 inches or preferably much more (though it has been seen in 6-inch reflectors); locate the right part of the star field; make a careful sketch of all stars; look on a later night; and find the "star" that has moved.



LONG-TERM CHART for Pluto from 1930 (discovery) to 2018 (descending node).