

**PLUTO'S ATMOSPHERE IS EXPANDING, RESEARCHERS SAY**

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<http://web.mit.edu/newsoffice/nr/2003/pluto.html>

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CAMBRIDGE, Mass. – Pluto's atmosphere is expanding even as it continues on its long orbit away from the sun, a team of astronomers from MIT, Boston University, Williams College, Pomona College, Lowell Observatory and Cornell University report in the July 10 issue of Nature.

The team, led by James Elliot, professor of planetary astronomy at MIT and director of MIT's Wallace Observatory, made this finding by watching the dimming of a star when Pluto passed in front of it on Aug. 20, 2002. The team carried out observations using eight telescopes at Mauna Kea Observatory, Haleakala, Lick Observatory, Lowell Observatory and Palomar Observatory.

Elliot said the new results seem counterintuitive, because observers assumed Pluto's atmosphere would begin to collapse as it cooled. In fact, the temperature of Pluto's mostly nitrogen atmosphere has increased around 1 degree Celsius since it was closest to the sun in 1989.

Elliot attributes the increase to the same lag effect that we experience on Earth—even though the sun is most intense at its highest point at noon, the hottest part of the day is around 3 p.m. Because Pluto's year is equal to 248 Earth years, 14 years after Pluto's closest approach to the Sun is like 1:15 p.m. on Earth. At the rate of Pluto's orbit, it may take another 10 years to cool down and would just be beginning to cool when the NASA New Horizons mission to Pluto, scheduled to be launched in 2006, reaches it in 2015.

Pluto's predominantly nitrogen atmosphere is in vapor pressure equilibrium with its surface ice, and can therefore undergo large changes in pressure in response to small changes in surface ice temperature. As its icy surface gets colder, it condenses into fresh white frost that reflects more of the sun's heat and gets colder still. As space dirt and objects collect on its surface, it darkens and absorbs more heat, accelerating the warming effect. Pluto has been darkening since 1954.

"The August 2002 data have allowed us to probe much more deeply into Pluto's atmosphere and have given us a more accurate picture of the changes that have occurred," Elliot said.

Pluto's orbit is much more elliptical than that of the other planets, and its rotational axis is tipped by a large angle relative to its orbit. Both factors could contribute to drastic seasonal changes.

Since 1989, for example, the sun's position in Pluto's sky has changed by more than the corresponding change on the Earth that causes the difference between winter and spring. Pluto's atmospheric temperature varies between around -235 and -170 degrees Celsius, depending on the altitude above the surface.

Pluto has nitrogen ice on its surface that can evaporate into the atmosphere when it gets warmer, causing an increase in surface pressure. If the observed increase in the atmosphere also applies to the surface pressure—which is likely the case—this means that the average surface temperature of the nitrogen ice on Pluto has increased slightly more than 1 degree Celsius over the past 14 years.

expand	rozpínat se
researcher	vědec, výzkumník
say	říci
even	i (dokonce)
as	jak, zatímco
continue	pokračovat
long orbit	dlouhá cesta, oběh
the sun	Slunce
team	tým
report	hlásit, oznamovat
issue	vydání
led by	“v čele s”
made finding	učinit objev
watch	sledovat
dimming	zeslabení
star	hvězda
pass in front	přejít před
carry out	uskutečnit, provést
observation	pozorování
using telescope	pomocí dalekohledu
eight	osm
said	minulý čas od say
new results	nové výsledky
seem	zdát se
counterintuitive	“proti mysli”
because	protože
observer	pozorovatel
assume	předpokládat
would begin	měla začít
collapse	poklesnout, stlačit se
cool	ochladit (se)
in fact	ve skutečnosti
temperature	teplota
mostly	převážně
nitrogen	dušik, dusíkatý
increase	zvýšit se, zvýšení
around	okolo, asi
degree Celsius	stupeň Celsia
since	od té doby, co...
closest	nejblíže
attribute	přičítat, zdůvodnit
same	tentýž, stejný
lag effect	efekt zpoždění
we experience	
on Earth	známe ze Země
even though	i když, přestože
most intense	nejsilnější
highest point	nejvyšší bod
at noon	v poledne
hottest part	nejteplejší část
day	den
3 p.m.	3 hod. odpoledne
year	rok
equal to	roven
after approach	po přiblížení
is like	je jako
at rate	pří tempu
may take	muže trvat
another 10 years	dalších 10 let
cool down	zchladnout
just be beginning	být právě na začátku
schedule	plánovat
launch	odstartovat
reach	dosáhnout
predominantly	převážně
vapor pressure	tlak páry
equilibrium	rovnováha
surface ice	povrchový led

## Studying atmospheres with shadows

Researchers study faraway objects through occultations-eclipse-like events in which a body (Pluto in this case) passes in front of a star, blocking the star's light from view. By recording the dimming of the starlight over time, astronomers can calculate the density, pressure and temperature of Pluto's atmosphere.

Observing two or more occultations at different times provides researchers with information about changes in the planet's atmosphere. The structure and temperature of Pluto's atmosphere was first determined during an occultation in 1988. Pluto's brief pass in front of a different star on July 19 led researchers to believe that a drastic atmospheric change was under way, but it was unclear whether the atmosphere was warming or cooling.

The data resulting from this occultation, when Pluto passed in front of a star known as P131.1, led to the current results. "This is the first time that an occultation has allowed us to probe so deeply into Pluto's atmosphere with a large telescope, which gives a high spatial resolution of a few kilometers," Elliot said. He hopes to use this method to study Pluto and the Kuiper Belt objects more frequently in the future.

Redakčně zkráceno.

led to believe	vést k doměnce
be under way	probíhat
unclear	nejasný
whether	zda, zdali
result from	vyplývat z
known as	známý jako
current result	nynější výsledek
first time	poprvé
spatial resolution	prostorové rozlišení
few	několik, málo
hope	doufat
use method	použít postup
more frequently	častěji
in the future	v budoucnosti

can therefore	proto může
undergo	podléhat
large change	velká změna
in response to	v reakci na
small	malý
get colder	chladnout
condense into	kondenzovat na
fresh white frost	čerstvá bílá jinozatka
reflect heat	odrážet teplo
get colder still	ještě více se ochladit
space dirt	nečistoty z vesmíru
collect	usazovat
darken	tmavout
absorb more heat	absorbovat více tepla
accelerate	urychlit
warming	oteplení
allow	umožnit
probe	sondovat
deeply	hlouběji
give more	dát přesnější obrázek
accurate picture	
occur	udát se
rotational axis is	rotační osa je skloněná
tipped by angle	o úhel
relative	vůči
both factors	oba factory
contribute	přispívat
drastic	drastický
seasonal	sezónní
for example	například
position in sky	poloha na obloze
corresponding	odpovídající
cause difference	způsobit rozdíl
between winter	
and spring	mezi zimou a jarem
vary	kolísat, měnit se
depending on	v závislosti na výšce
altitude above	nad
evaporate	vypařovat se
get warmer	oteplít se
apply to	platí pro
which is likely	“což je zřejmě tento
the case	případ”
this means	to znamená
average	průměrný
slightly	mírně
over the past	během posledních
14 years	14 let
study	studium, výzkum
with shadows	“pomocí stínů”
faraway	vzdálený
through	zkrze, pomocí
occultation-eclipse-like event	událost podobná zákrytu či zatmění
block light	zastínit světlo
view	pohled
by recording	zaznamenáváním
over time	v průběhu času
calculate density	spočítat hustotu
different	rozdílný, odlišný, jiný
provide with	opatřit (čím)
first determined	poprvé stanoven
during	během
brief	krátký

Připravil Petr Scheirich

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