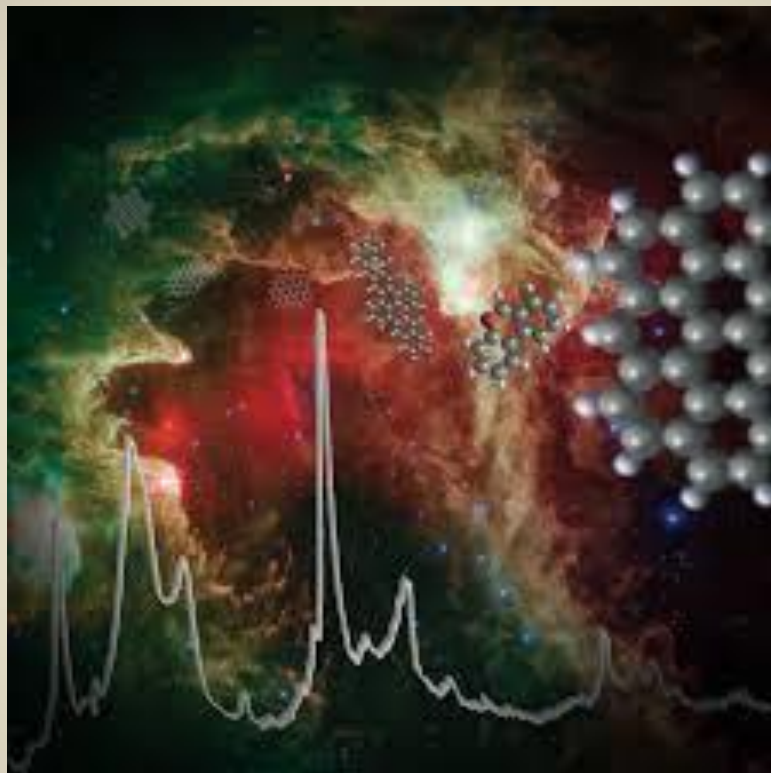


Węglowodory w kosmosie

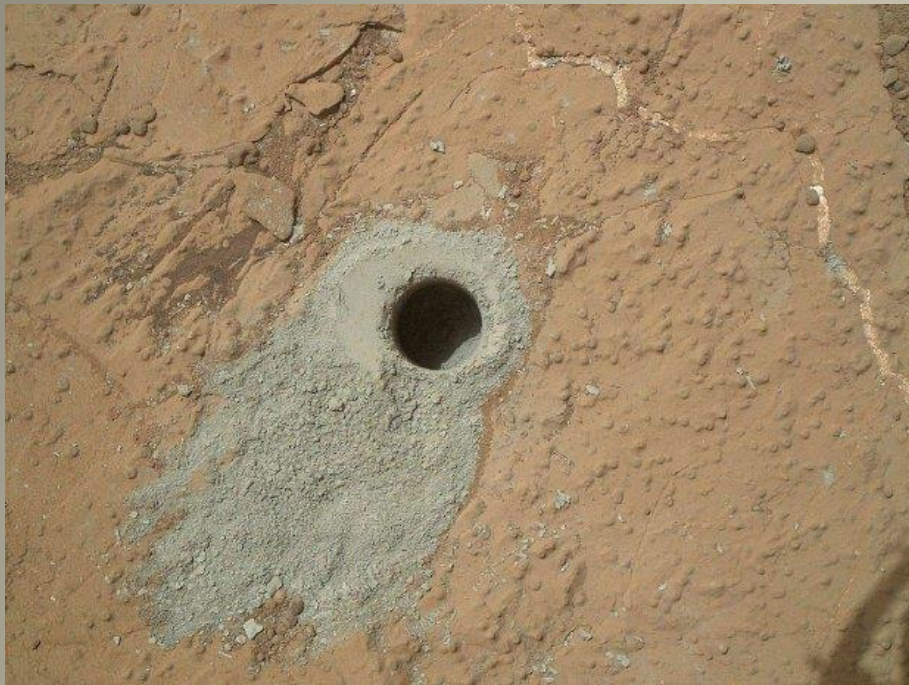


Rys. NASA

Krzysztof Rochowicz, ZDF UMK Toruń

Meteoryty – chondryty węgliste

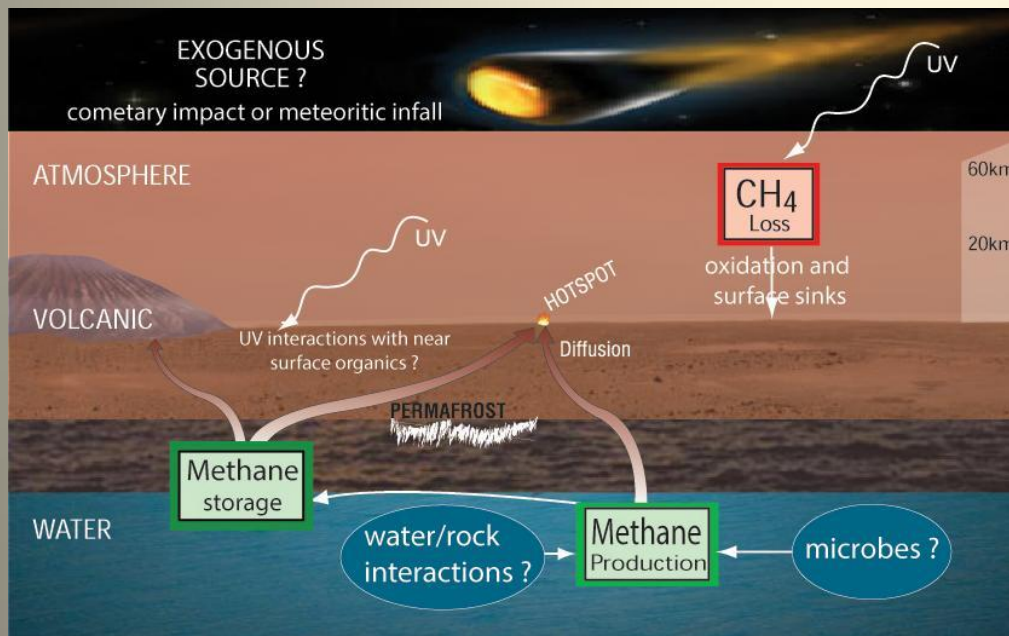




Układ Słoneczny

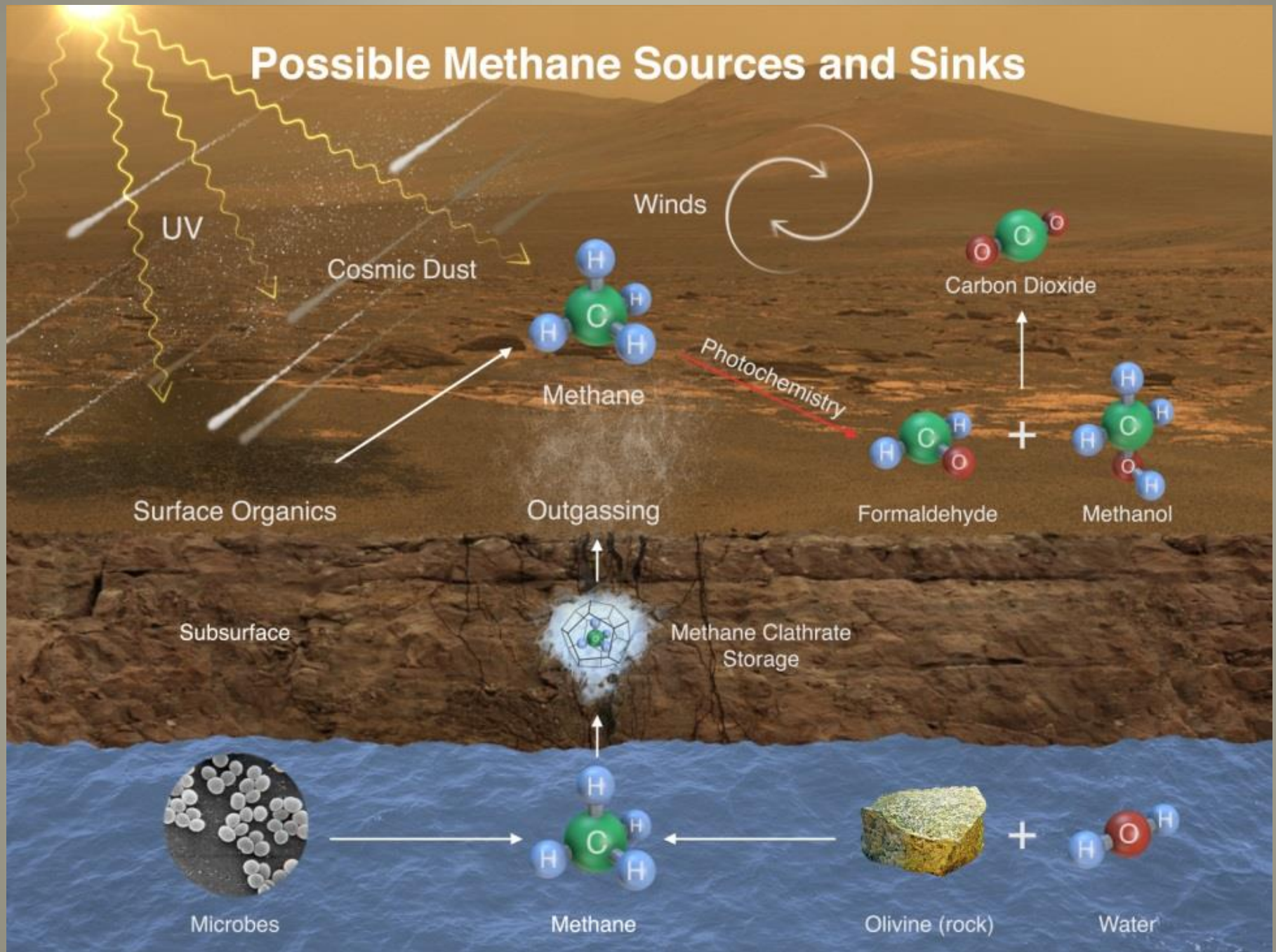
Mars

Grudzień 2014 – *Science*:
cząsteczki metanu - średnio
0,7 cząsteczki na miliard; kilka
razy z rzędu poziom metanu
w okolicach łazika *Curiosity*
niespodziewanie wzrastał aż
dziesięciokrotnie (do ok. 7
cząsteczek na miliard), po
czym po kilku tygodniach
spadał do średniej. Tak jakby
skądś uwalniała się chmura
gazu i stopniowo rozwiewała.

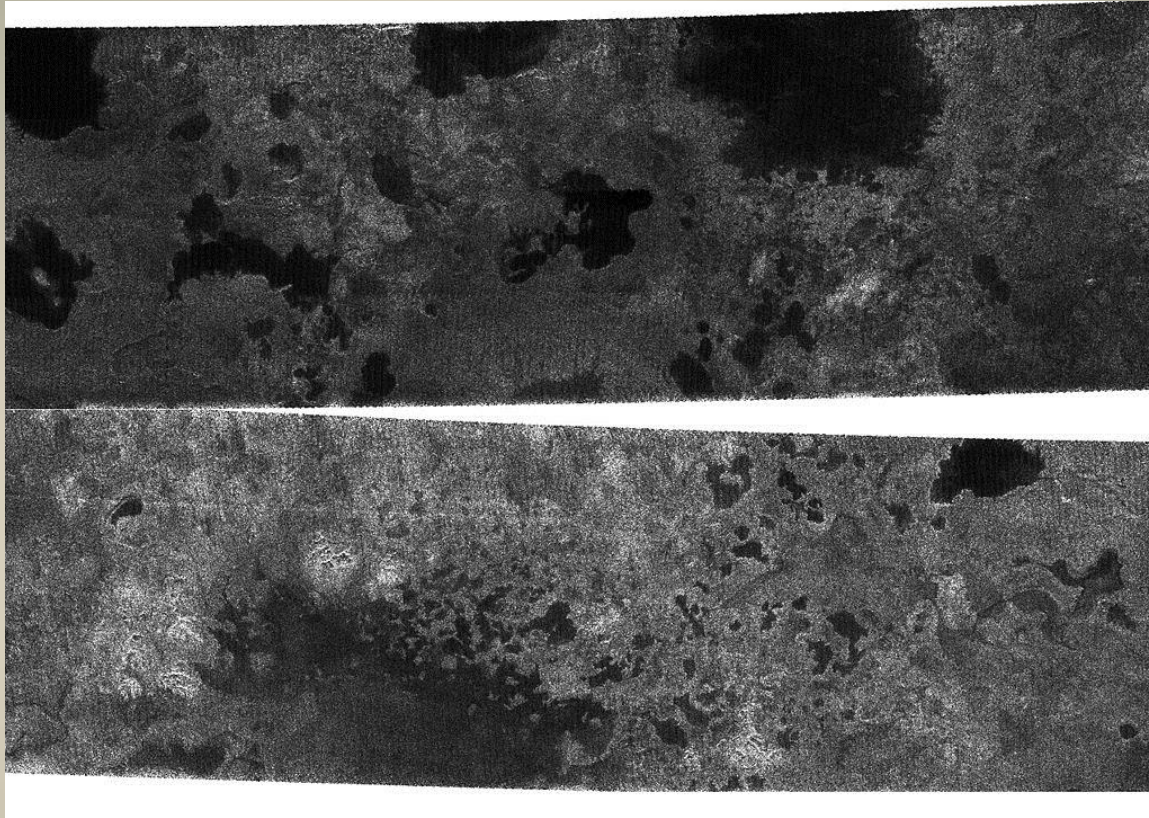


Fot. i rys.: NASA

Possible Methane Sources and Sinks

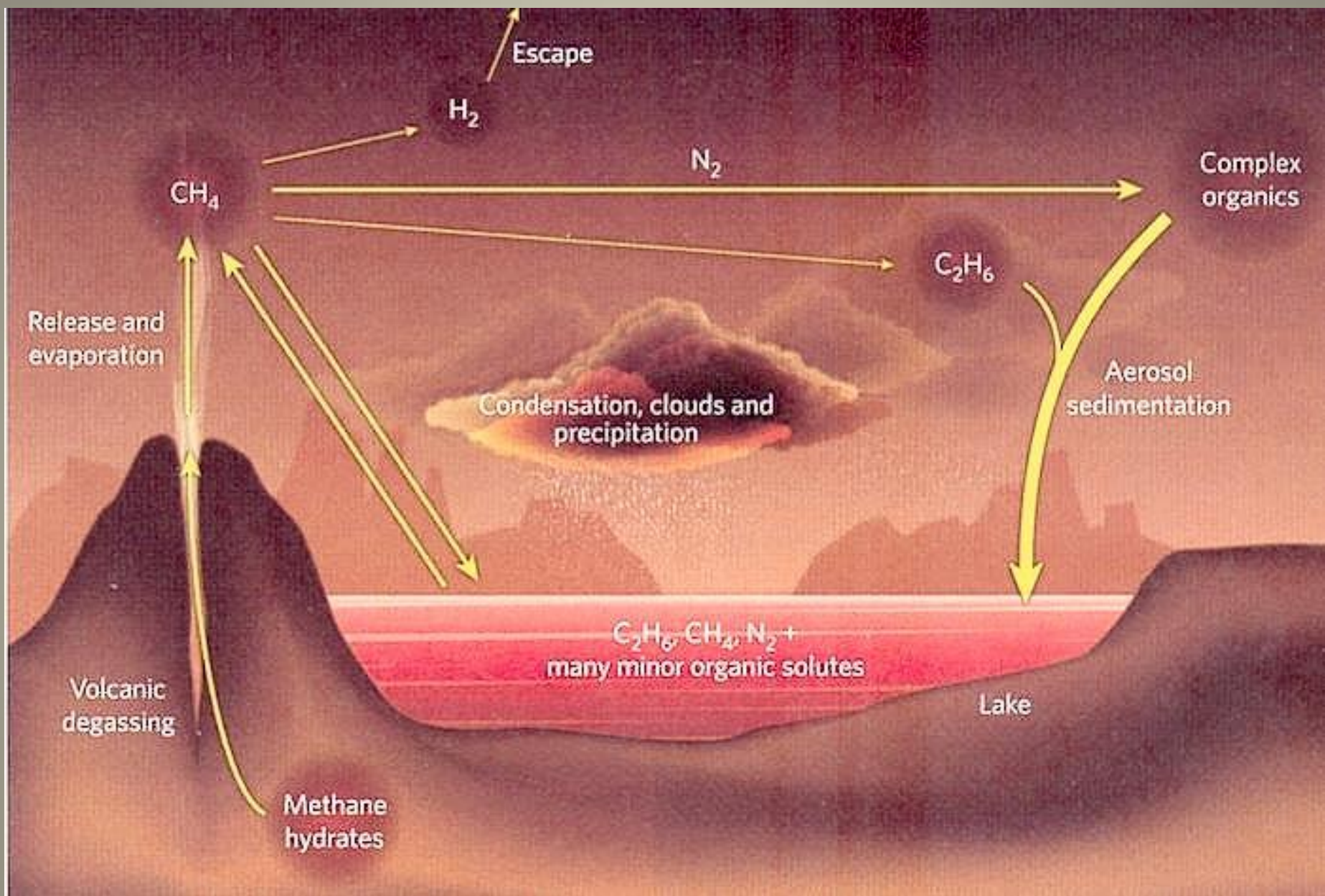


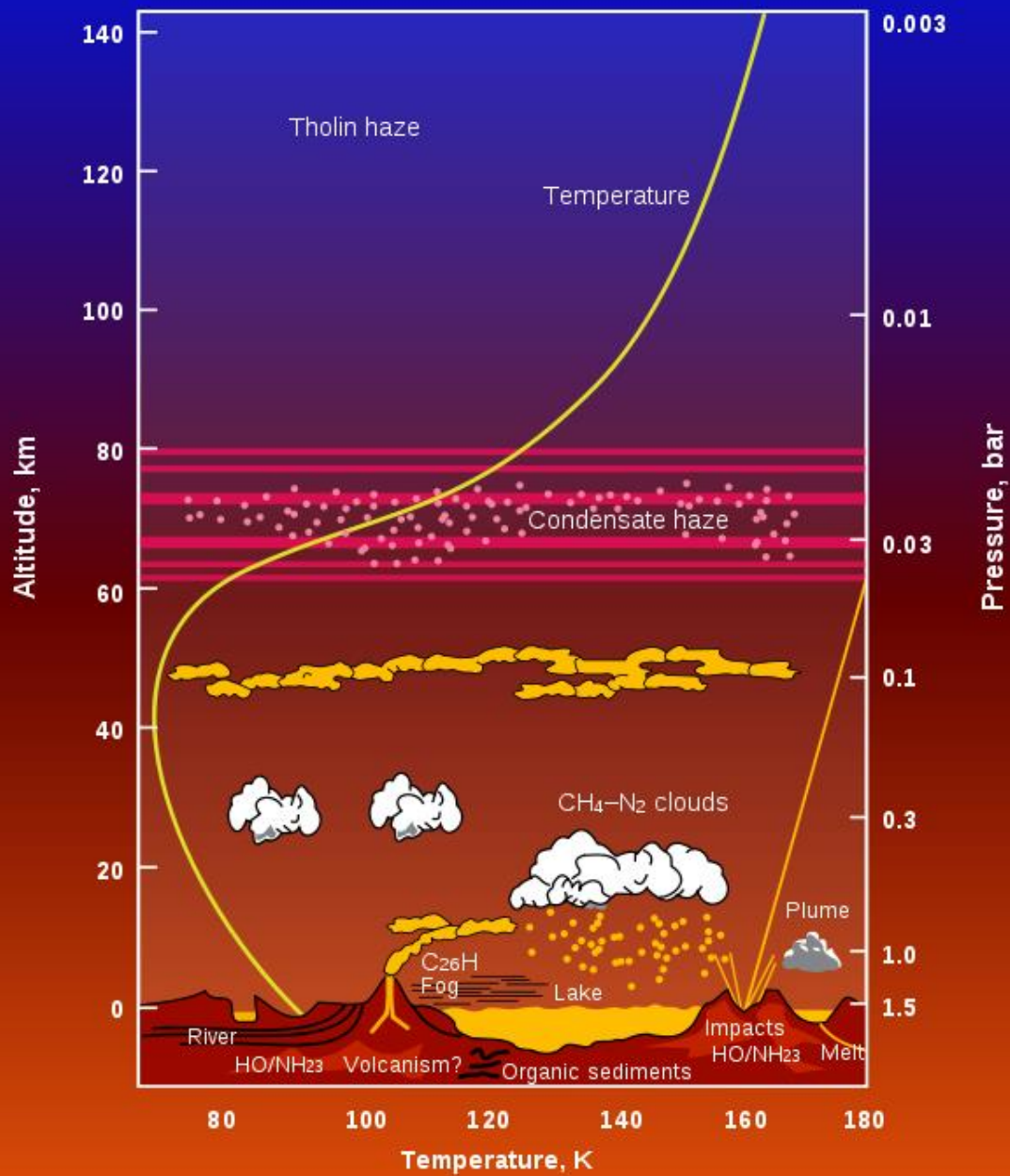
Układ Słoneczny - Tytan

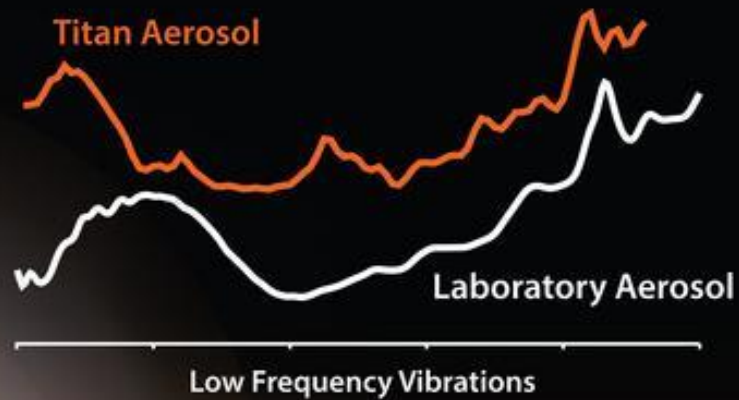


Fot. NASA

Rozmiary złóż płynnych węglowodorów na Tytanie przekraczają setki tysięcy razy wielkość wszystkich znanych złóż ropy naftowej i gazu ziemnego na Ziemi (2008, Cassini-Huyghens)



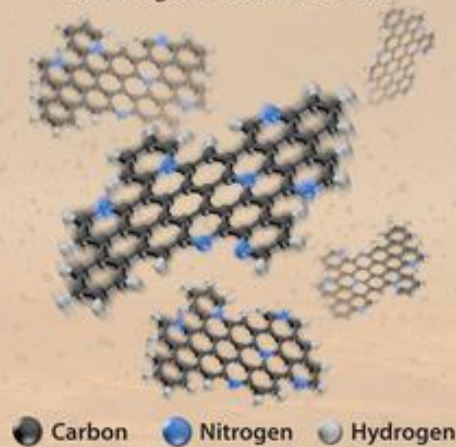


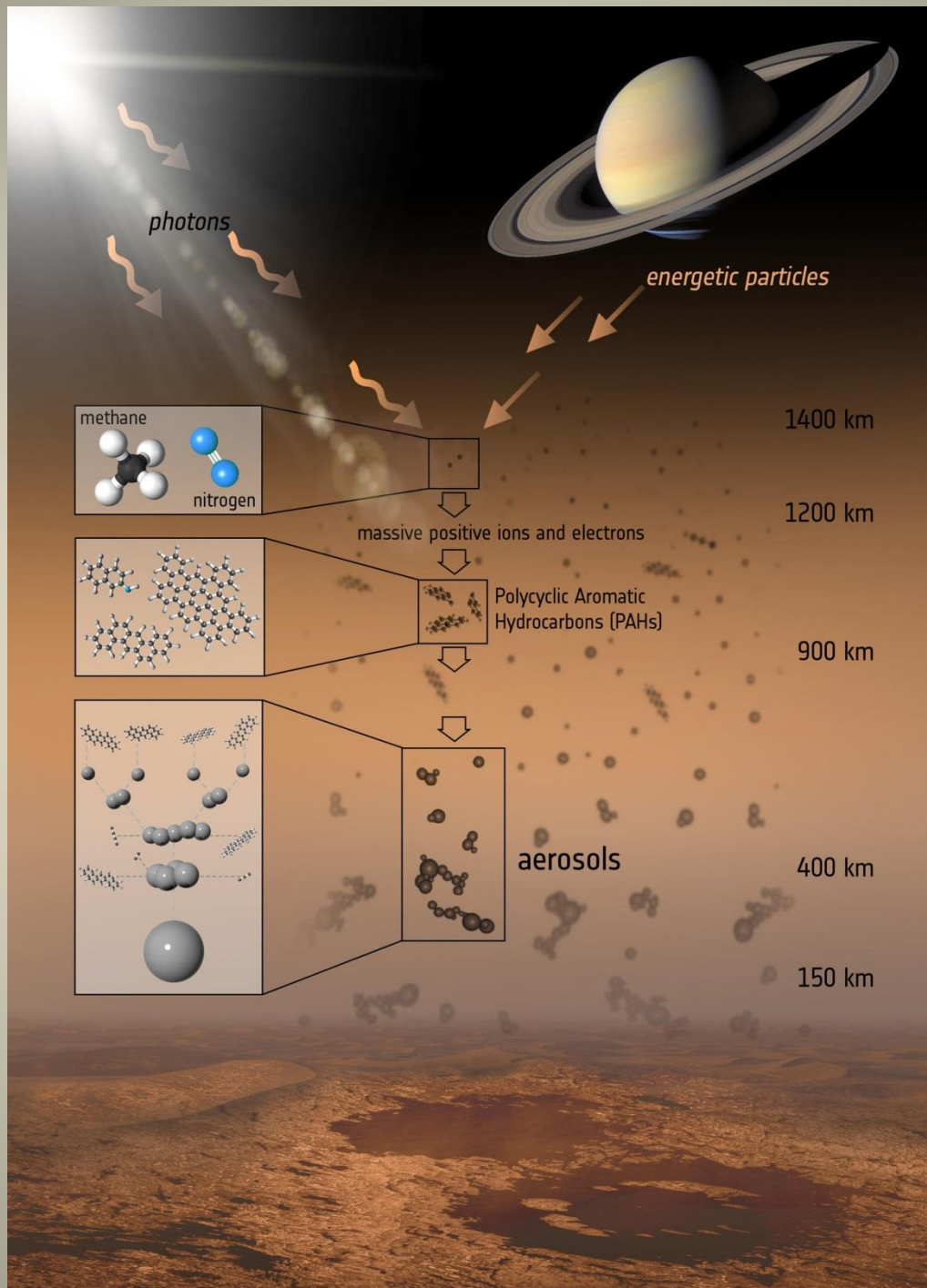


Complex molecules form in Titan's atmosphere: *Polycyclic Aromatic Nitrogen Heterocycles (PANHs)*

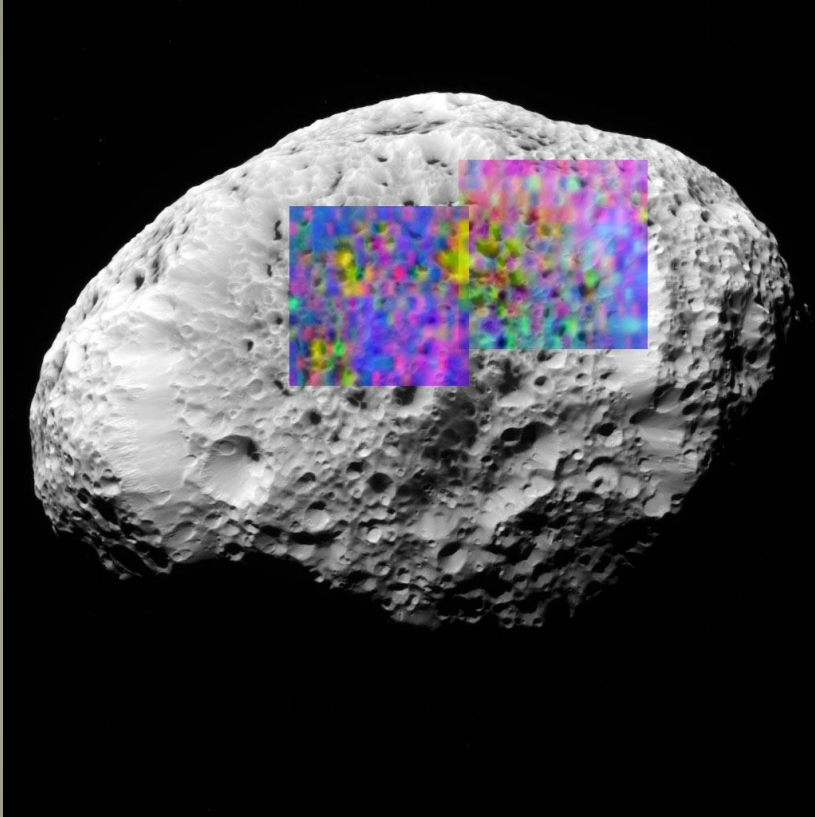
Large aggregates of PANHs sink lower in the atmosphere and become aerosols with a low frequency signature detectable from orbit.

Vibrating aerosol molecules





Układ Słoneczny - Hyperion

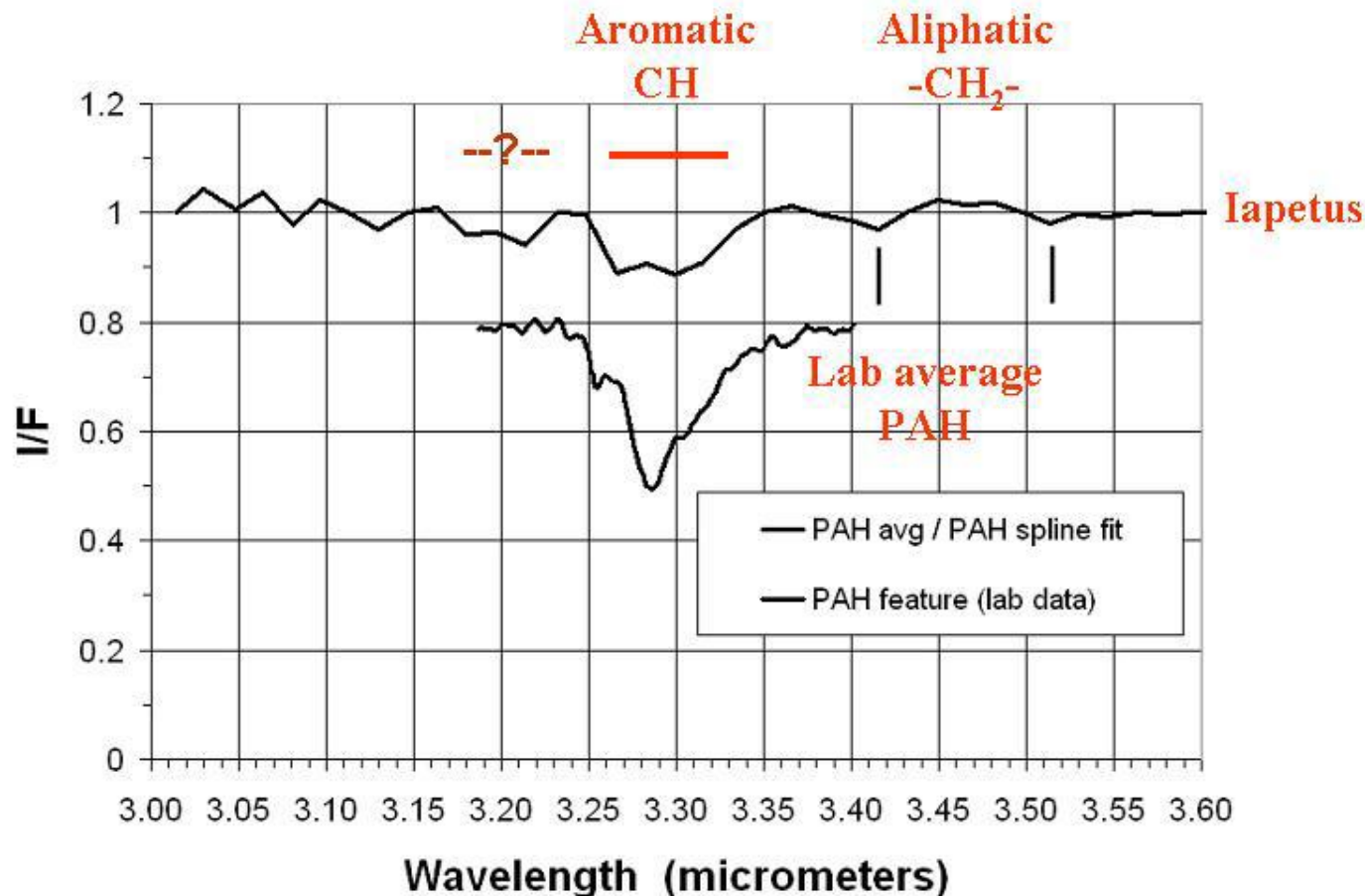


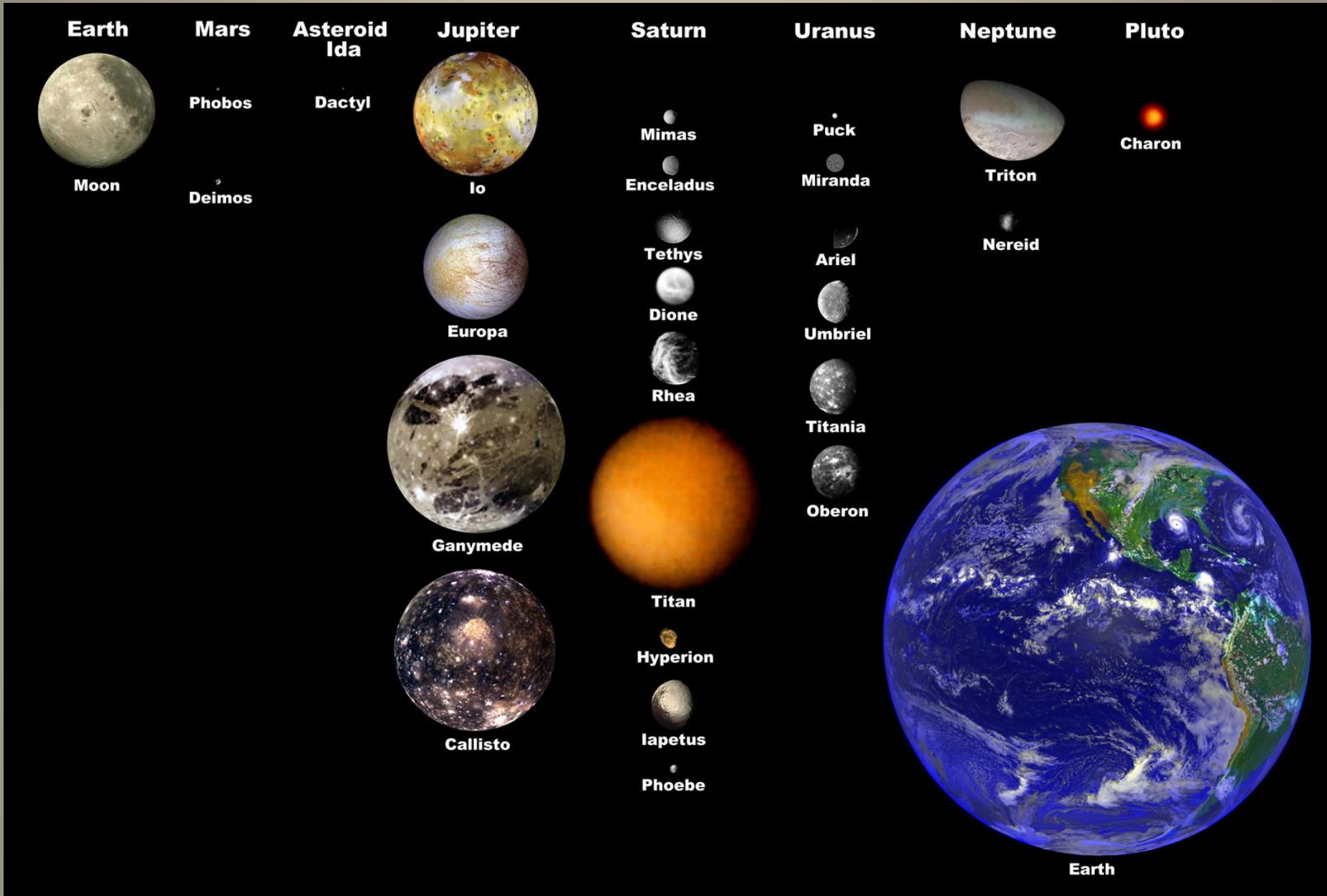
http://www.nasa.gov/mission_pages/cassini/media/

Na powierzchni Hyperiona i w jego głębokich kraterach znajduje się zamrożona woda, zestalony dwutlenek węgla oraz związki, których cechy widmowe przypominają właściwości węglowodorów (lipiec 2007, *Nature*)

Discovery of aromatic hydrocarbons on Iapetus' low-albedo hemisphere.

December, 2004 flyby (published in Icarus, 2008)





Poza US: Mgławica Koński Łeb

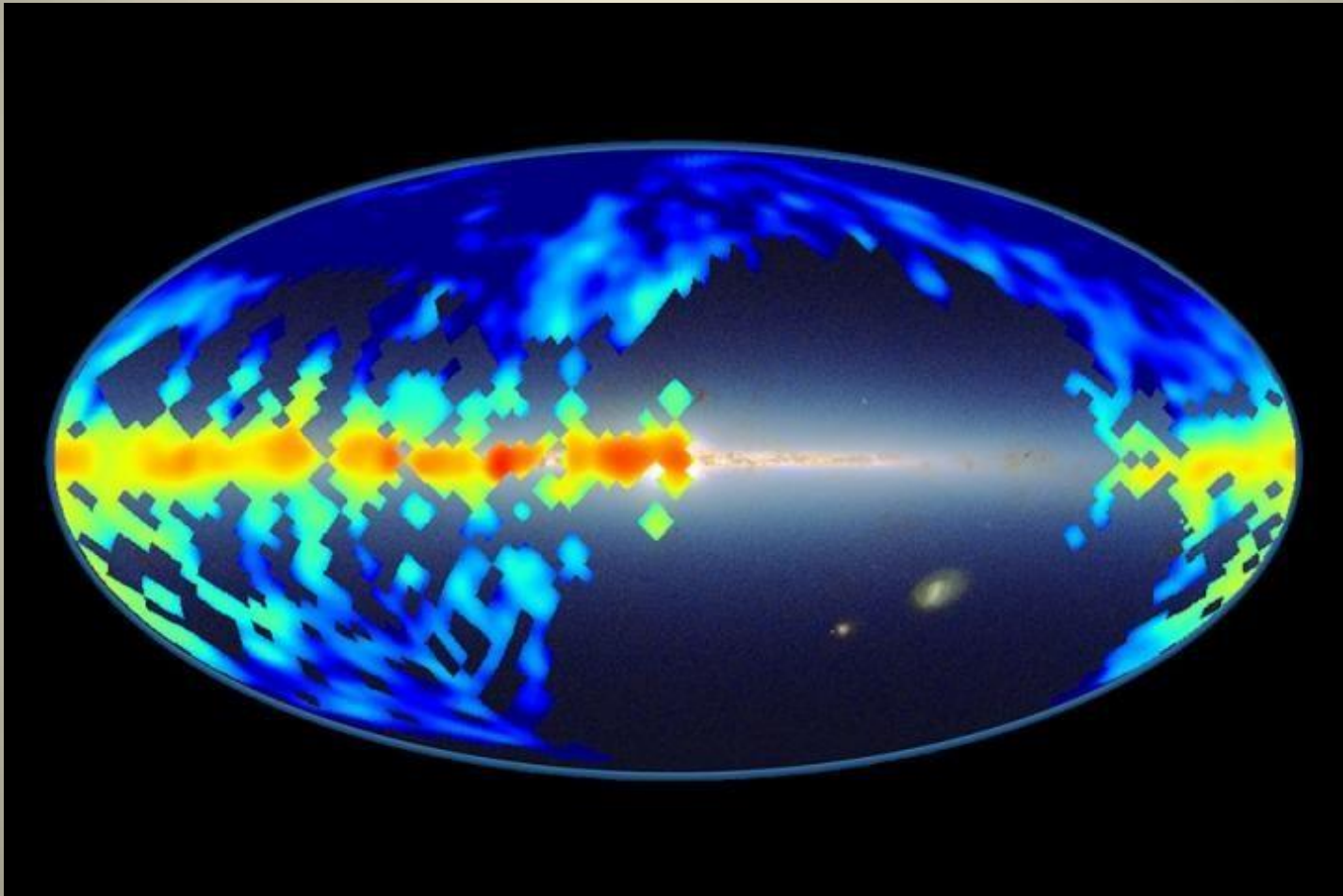


Fot. NASA

http://www.dailygalaxy.com/my_weblog/2012/11/horsehead-nebula-found-to-cloak-a-vast-interstellar-chemistry-lab.html

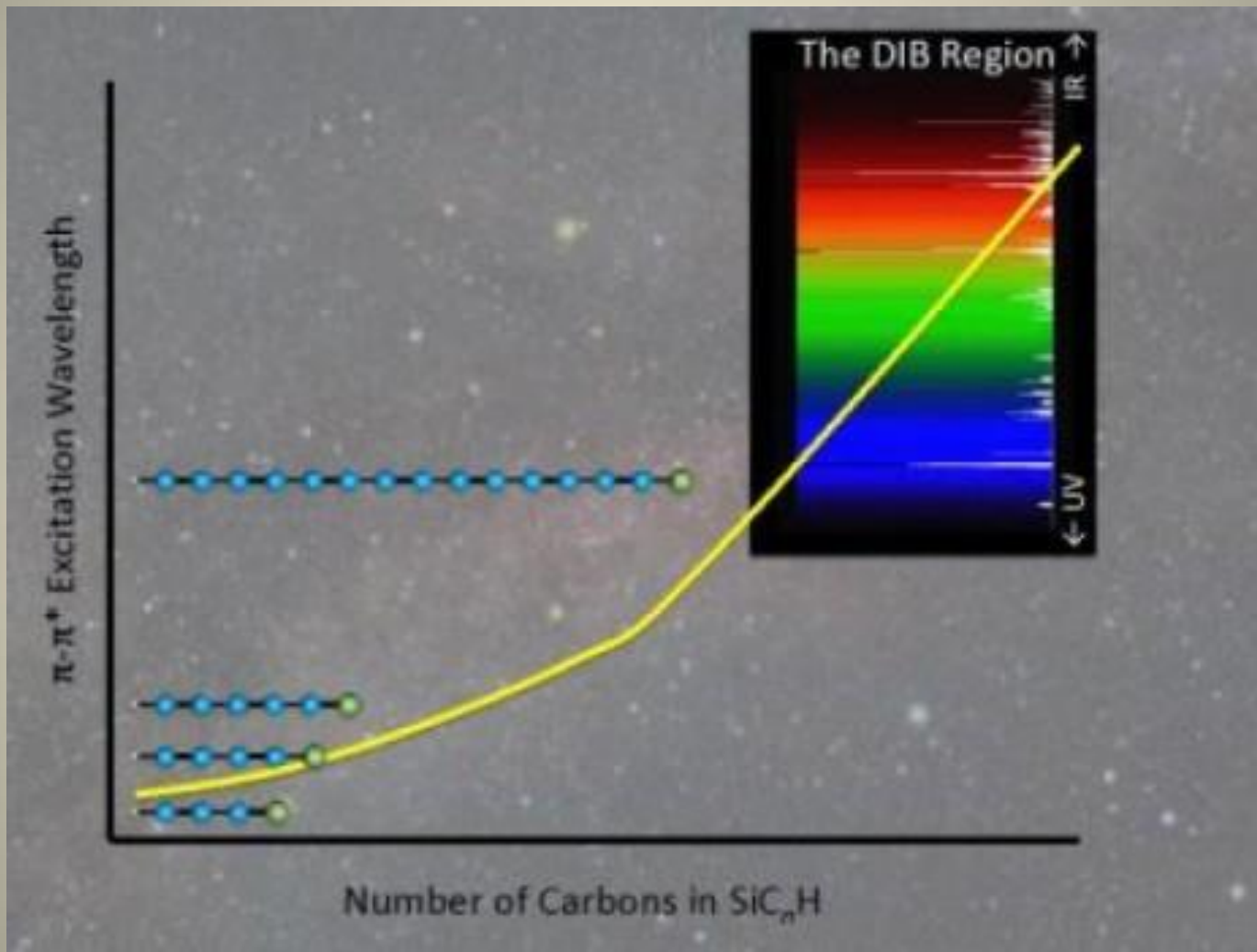
According to scientists, more than 20% of the carbon in the universe may be associated with PAHs, possible starting materials for the formation of life. PAHs seem to have been formed shortly after the Big Bang, are widespread throughout the universe, and are associated with new stars and exoplanets.

Linie rozmyte (DIBs) w ośrodku międzygwiazdowym



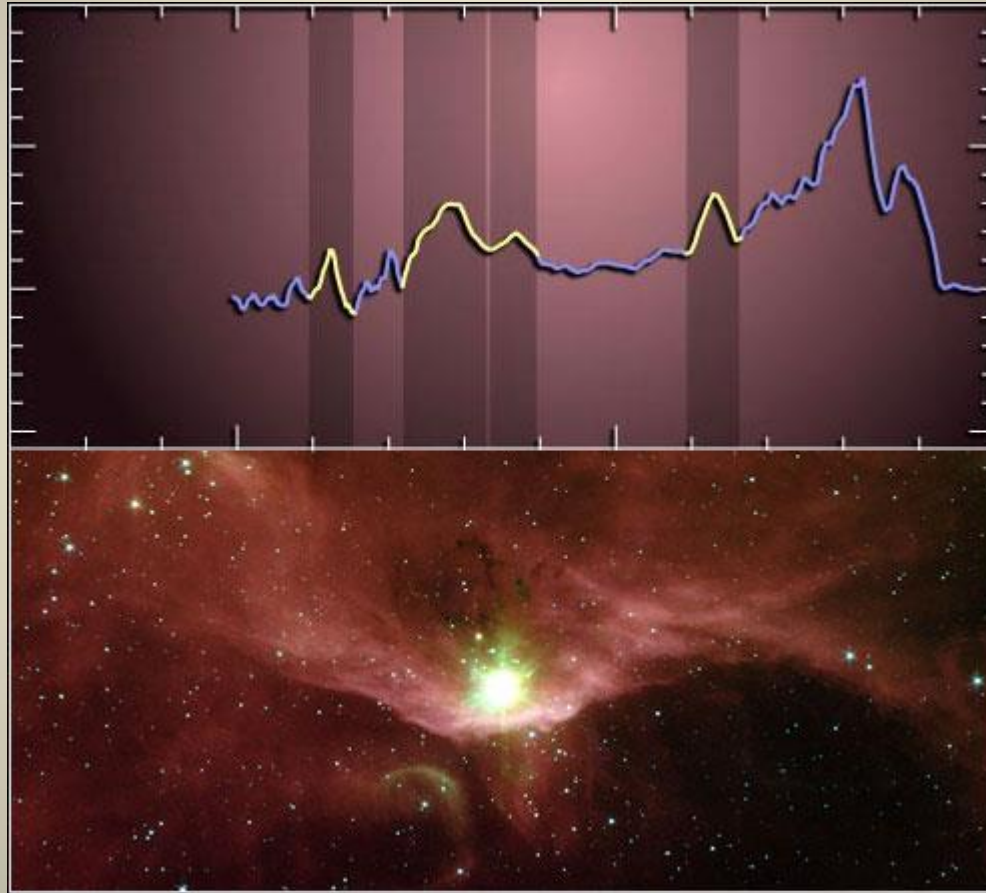
<http://www.sciencedaily.com/releases/2015/01/150109093528.htm>

Poszukiwanie pochodzenia DIBs

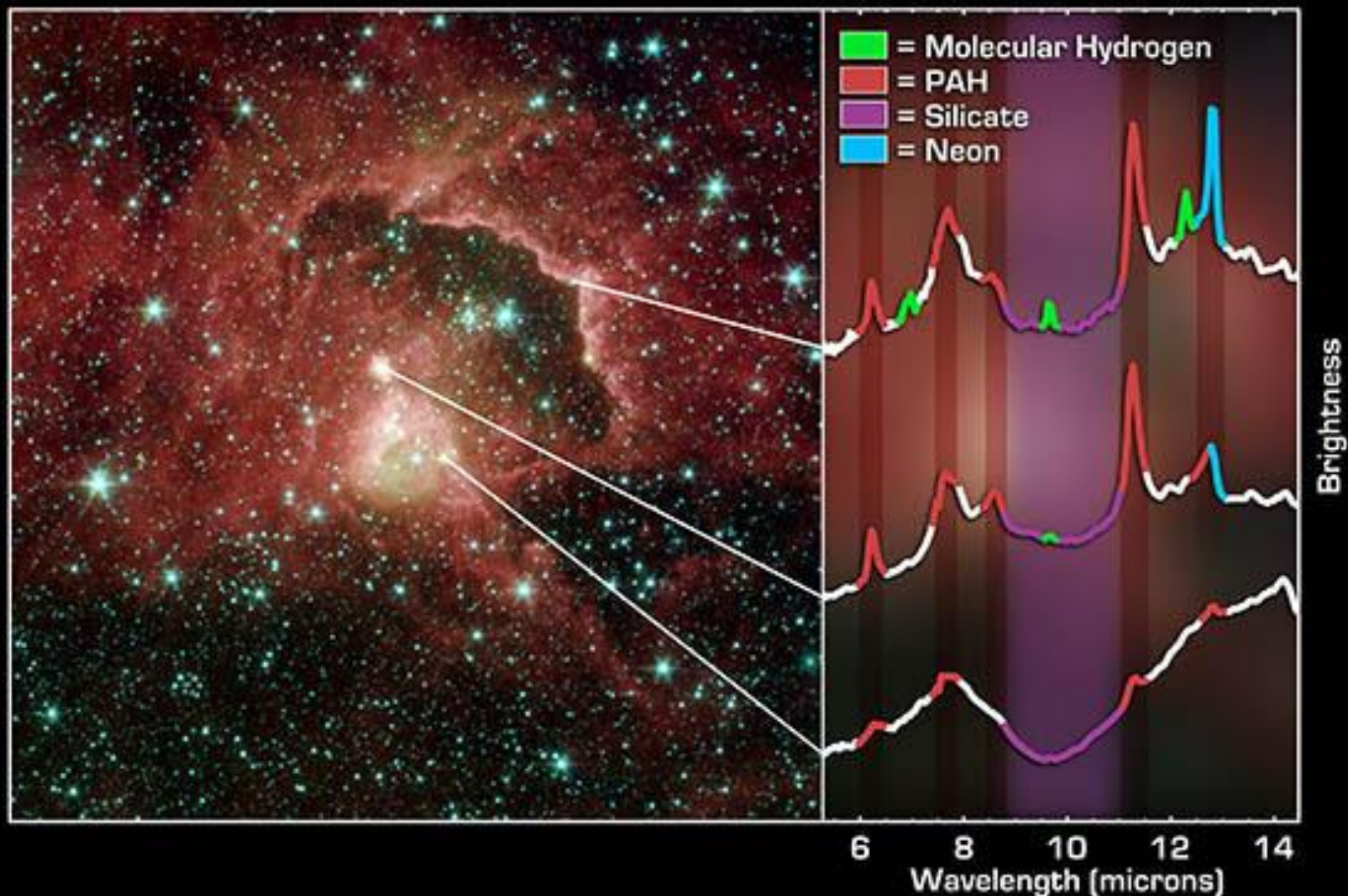


<http://www.sciencedaily.com/releases/2014/07/140729152735.htm>

Spitzer IRAC images



<http://legacy.spitzer.caltech.edu/features/articles/20050627.shtml>



Star-Forming Cloud in Cepheus

Spitzer Space Telescope • IRS

NASA / JPL-Caltech / J. Ingalls & S. Carey (Spitzer Science Center/Caltech)

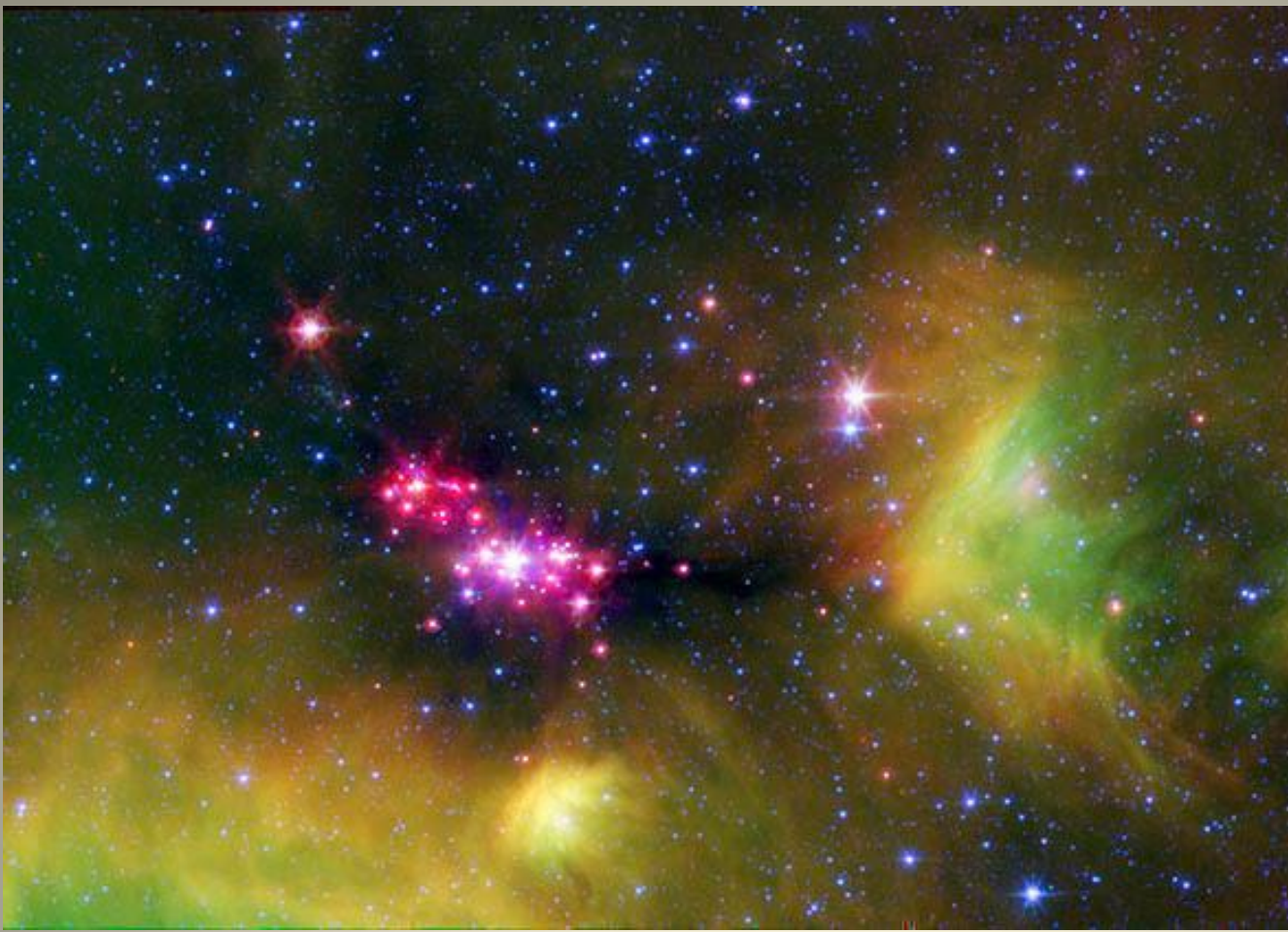
(Image: Spitzer Space Telescope • IRAC)

sig06-021



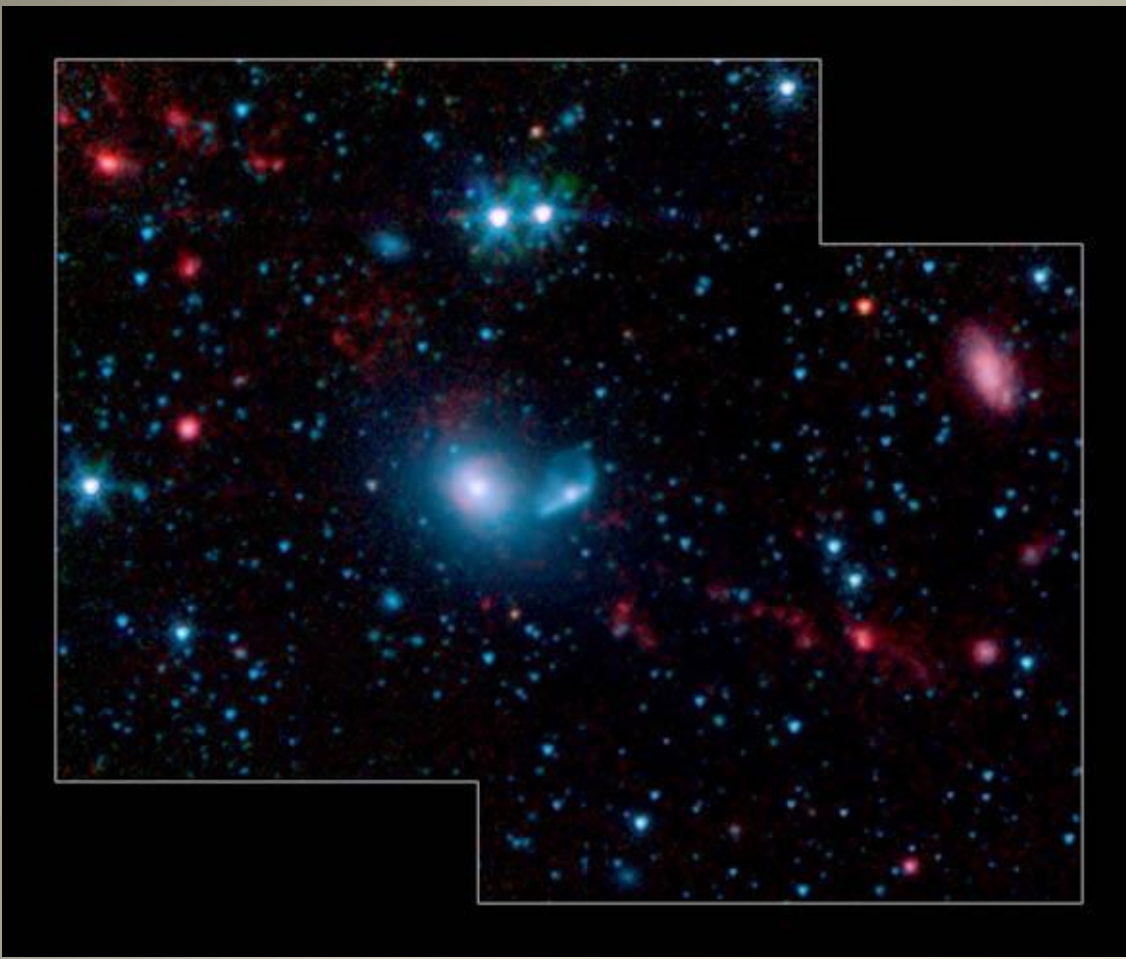
Fot. NASA/JPL/Spitzer

This image of prolific star-forming region RCW 49 exposes breathtaking detail of this dark and dusty region, which is home to more than 2,200 stars. Shown here in two channels, 3.6 microns mapped as cyan and 4.5 microns mapped as red, dusty organic molecules called polycyclic aromatic hydrocarbons (PAHs) glow in the warmth of the starlight.



Fot. NASA/JPL/Spitzer

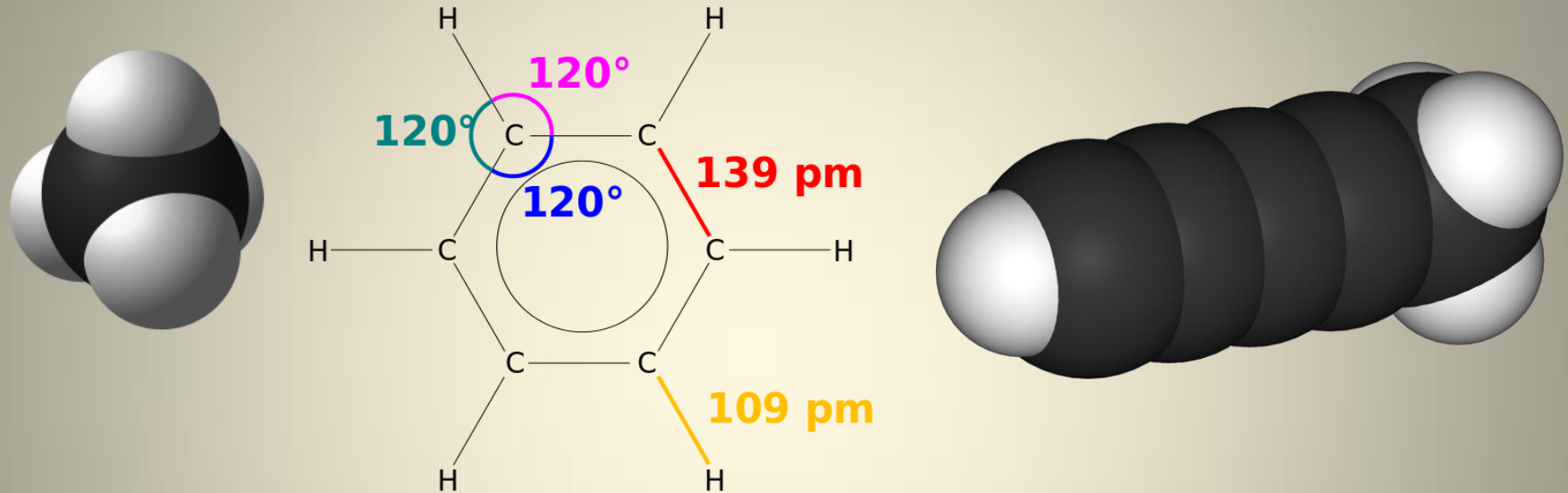
Wisps of green throughout the image indicate the presence of carbon rich molecules called PAHs. Blue specks sprinkled throughout the image are background stars in our Milky Way Galaxy. The Serpens star-forming region is located approximately 848 light-years away in the Serpens constellation. The image is a three-channel false-color composite, where emission at 4.5 microns is blue, emission at 8.0 mic. is green, and 24 micron emission is red.



Fot. NASA/JPL/Spitzer

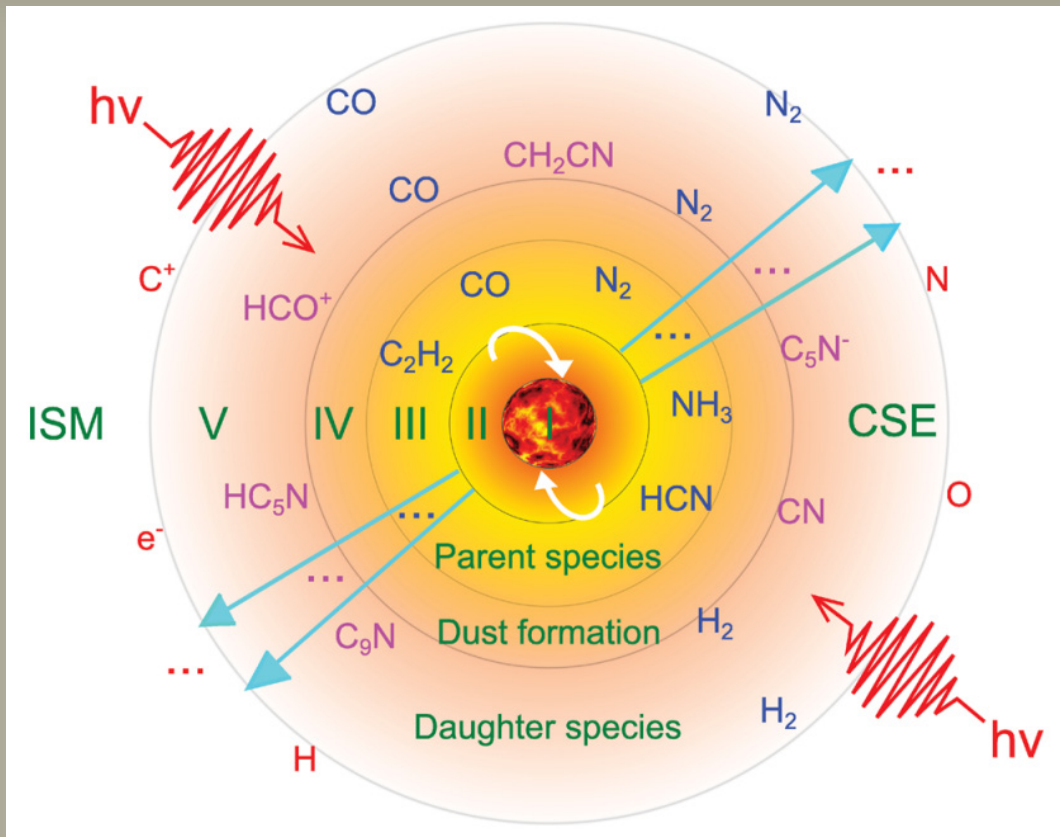
The new Spitzer picture demonstrates dwarf galaxies. The red color indicates the presence of dust produced in star-forming regions, including organic molecules called PAHs. This is a 4-color composite of infrared light, showing emissions from wavelengths of 3.6 microns (blue), 4.5 mic. (green), 5.8 mic. (orange), and 8.0 mic. (red). Starlight has been subtracted from the orange and red channels in order to enhance the dust, or PAH, features.

Lista molekuł w kosmosie



- http://en.wikipedia.org/wiki/List_of_interstellar_and_circumstellar_molecules

Powstawanie węglowodorów



Jeden z modeli, które pokazują jak gwiazdy powodują powstawanie węglowodorów.

Literatura i odnošniki

- [Astrophysics and Astrochemistry Lab](#)
- [The molecular Universe](#)
- [PAHs and the Universe](#)
- Annual Reviews A&A: [2000](#), [2008](#) (PAHs)
- [AMES PAH IR Spectral Database](#)
- [Molecular abundances \(table\)](#)