

Počítačové algebraické systémy a jejich aplikace (nejen) ve fyzice

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Co jsou to počítačové algebraické systémy?

- Systémy počítačové algebry se začaly objevovat v 60. letech 20. století



zdroj: <https://www.atlaso.cz/data/uploads/2020/09/historicke-pocitace.jpg>



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Co jsou to počítačové algebraické systémy?

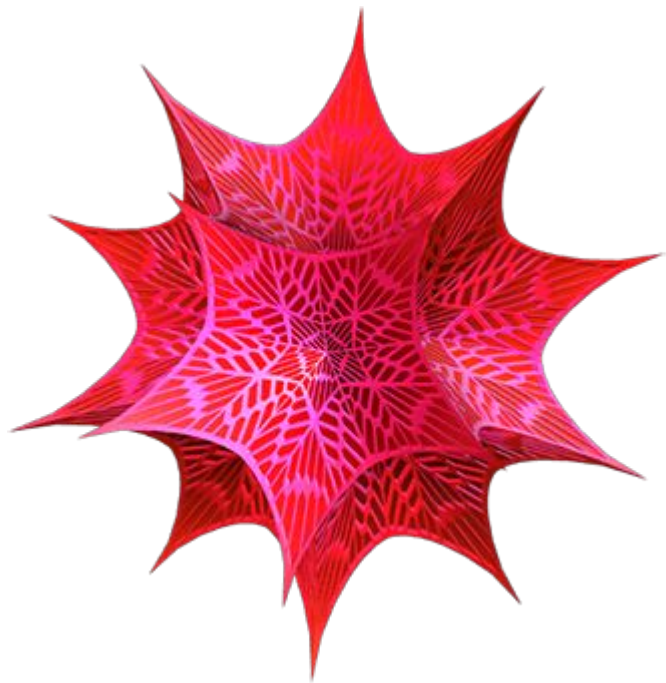


zdroj: <https://spacecenter.org/news-center/digital-assets/apollo-mission-control-center/>



zdroj: <https://www.nasa.gov/feature/building-on-a-mission-the-houston-mission-control-center/>

Mathematica & Wolfram



zdroj: <https://www.wolfram.com/mathematica/>



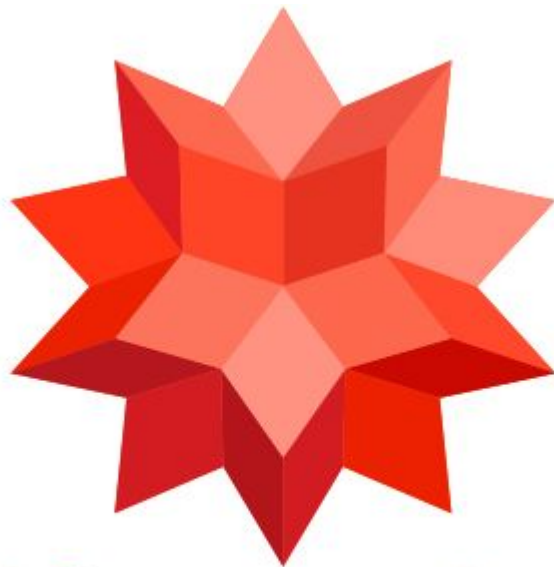
zdroj: <https://cs.wikipedia.org/wiki/Wolfram>



zdroj: <https://www.wolfram.com/>

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EXAMPLES

UPLOAD

RANDOM

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Mathematics >

Step-by-Step Solutions

Elementary Math

x^2-1 Algebra

Plotting & Graphics

$\int f(x)dx$ Calculus & Analysis

$\frac{x^2}{12}$ Geometry

$y''(x)$ Differential Equations

Statistics

More Topics >

Science & Technology >

Units & Measures

Physics

Chemistry

Engineering

Computational Sciences

Earth Sciences

Materials

Transportation

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Political Geography

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Personal Health

Personal Finance

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integrate $x^2 \sin^3 x \, dx$



NATURAL LANGUAGE

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EXAMPLES

UPLOAD

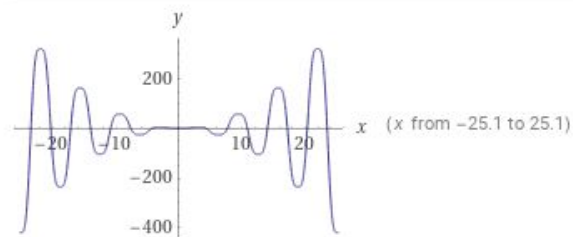
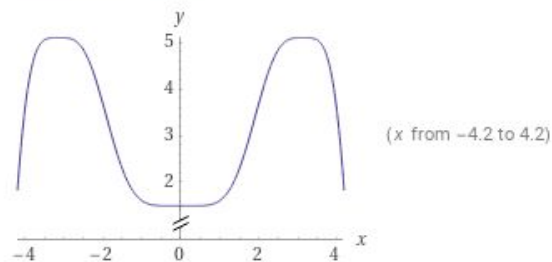
RANDOM

Indefinite integral

Step-by-step solution

$$\int x^2 \sin^3(x) \, dx =$$
$$\frac{1}{108} (-81(x^2 - 2) \cos(x) + (9x^2 - 2) \cos(3x) - 6x(\sin(3x) - 27 \sin(x))) + \text{constant}$$

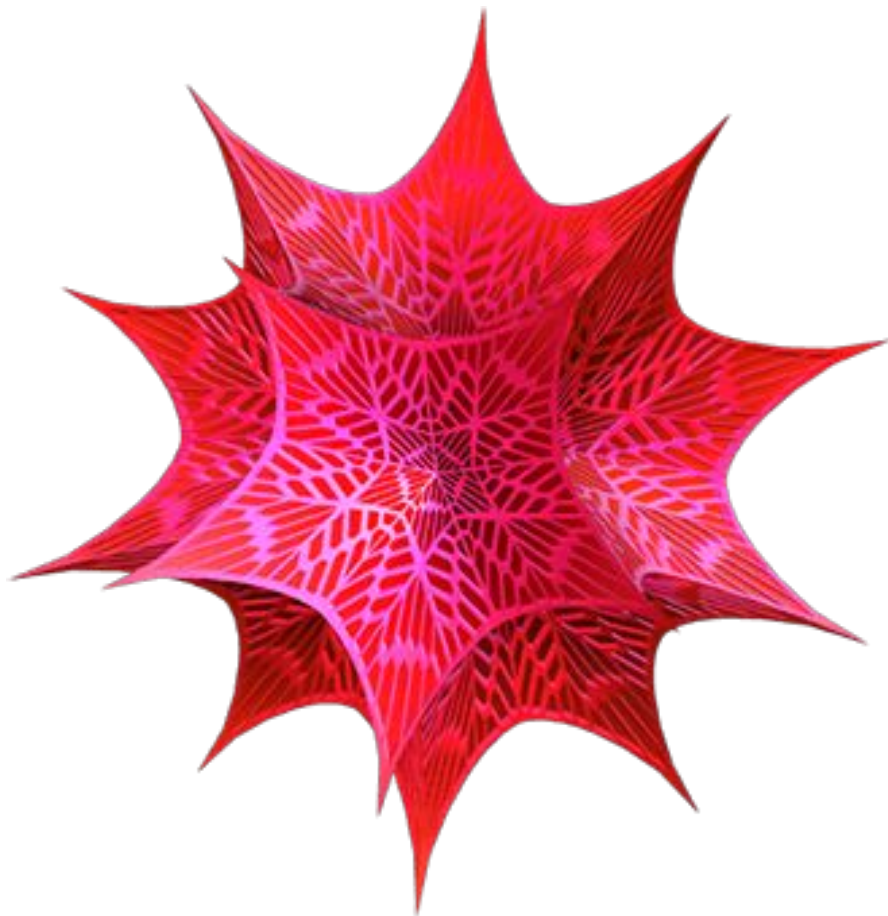
Plots of the integral



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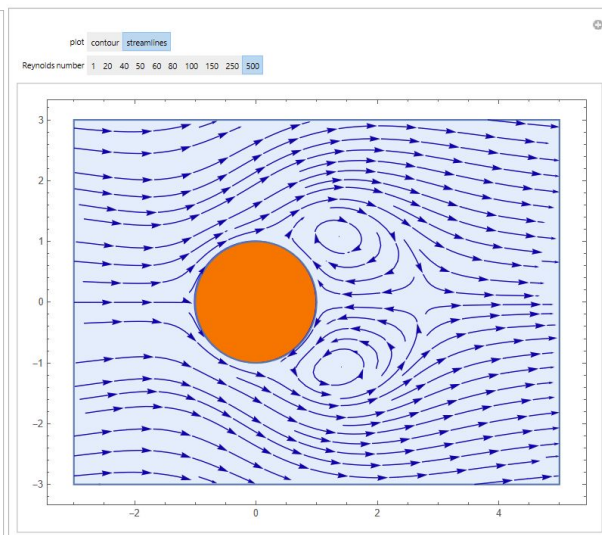
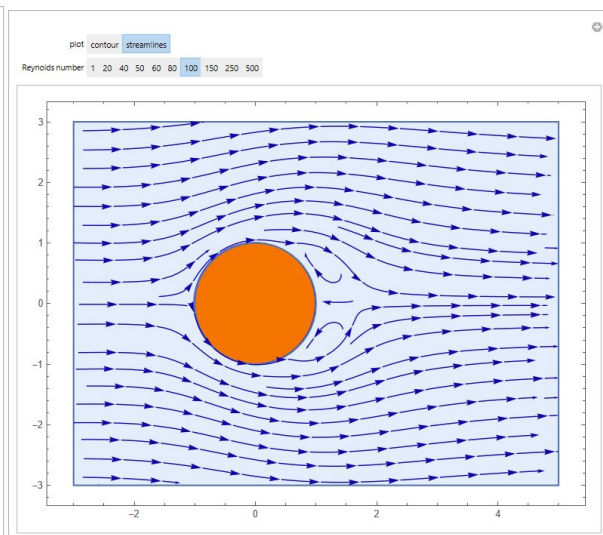
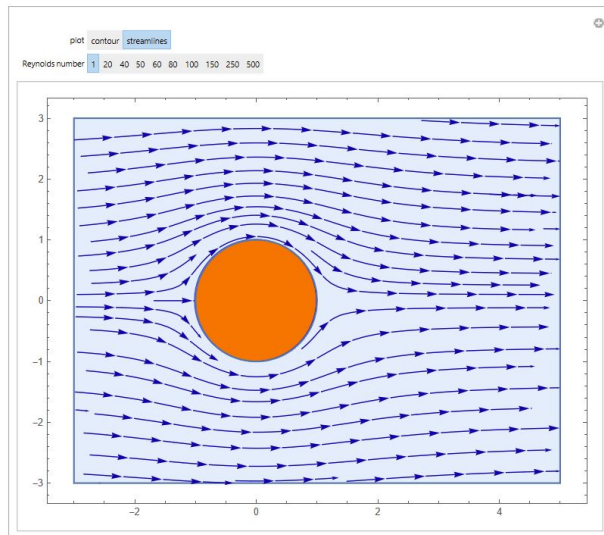
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Mathematica

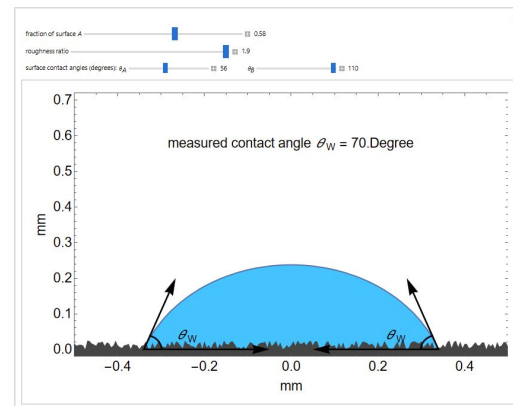
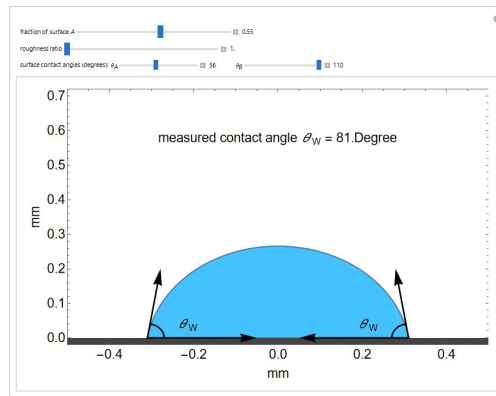
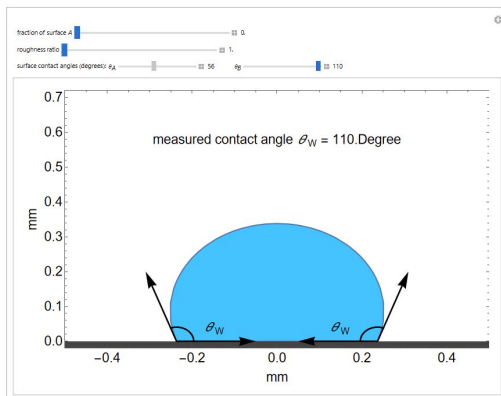
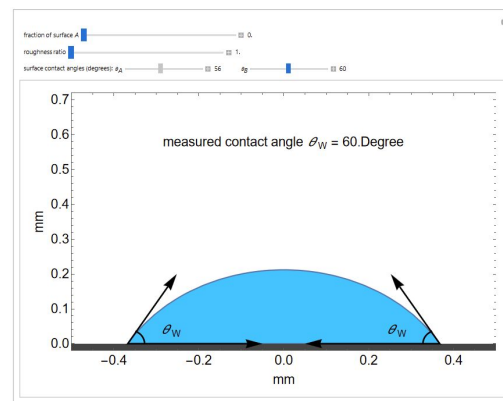
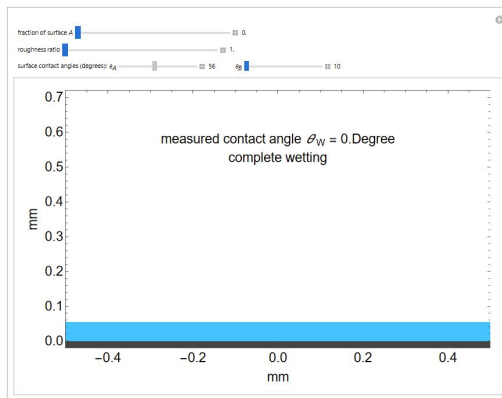


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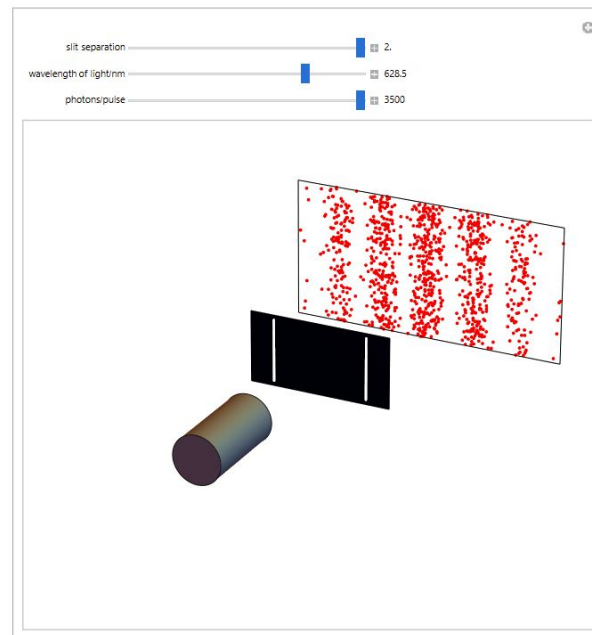
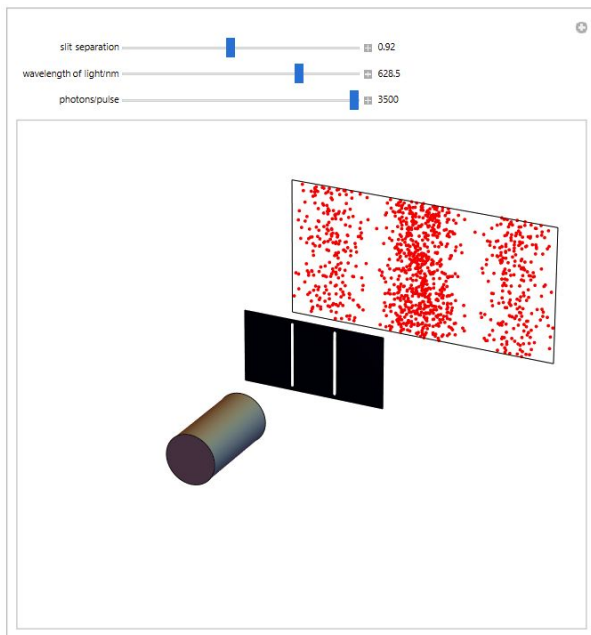
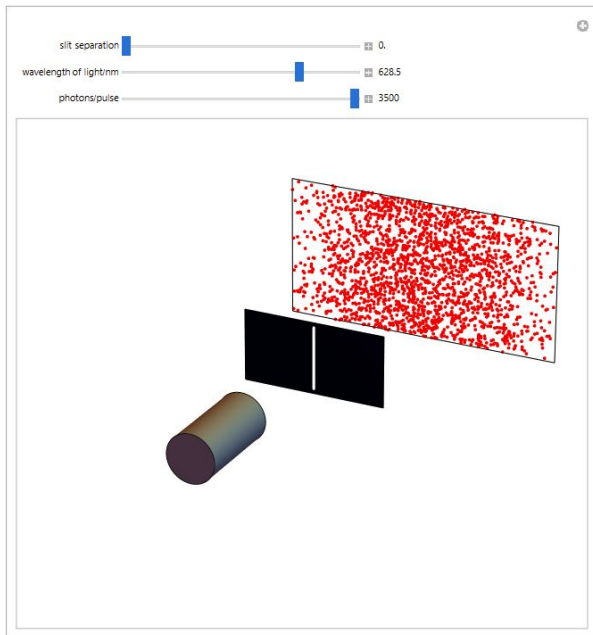
Ukázky - matematika



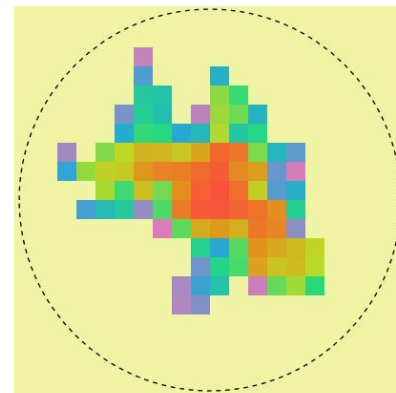
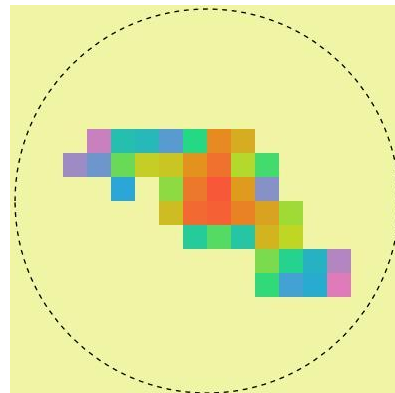
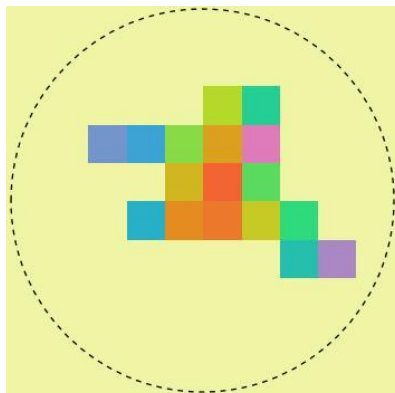
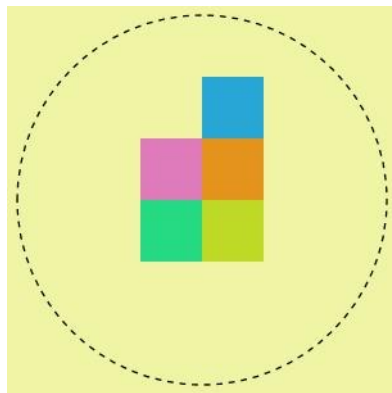
Ukázky - chemie



Ukázky - fyzika

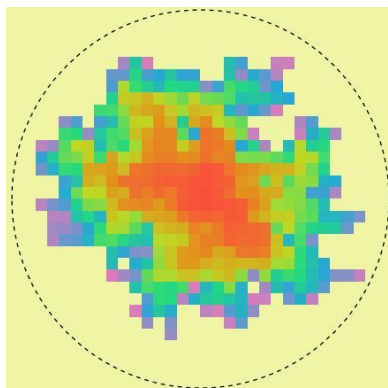


Ukázky - biologie



Vývoj buňky s rakovinou

čas - od leva do prava



Ukázky - "astronomie"

```
Untitled-1* - Wolfram Mathematica 13.2
File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
+ Insert Cell...
In[1]:= sun = Entity["Star", "Sun"];
        jupiter = Entity["Planet", "Jupiter"];

In[3]:= Entity["MinorPlanet", "Hilda"][{"SemimajorAxis", "OrbitPeriod", "Inclination", "Eccentricity"}]
Out[3]= { 3.99 au, 7.96 a, 7.83°, 0.140 }

In[4]:= duration = jupiter[EntityProperty["Planet", "OrbitPeriod"]];

In[5]:= hildas = EntityClass["MinorPlanet", {"OrbitPeriod" -> Between[2/3 { .9, 1.1 } duration], "Inclination" -> LessThan[Quantity[20, "AngularDegrees"]], "Eccentricity" -> LessThan[.3]};

In[6]:= trojansgreeks = EntityClass["MinorPlanet", {"OrbitPeriod" -> Between[{ .9, 1.1 } duration]};

In[27]:= date = DateObject[{2018, 5, 9, 0, 0, 0.}, "Instant", "Gregorian", -6.];

In[8]:= xyz[entity_, date_] := N@EntityValue[entity, Dated["HelioCoordinates", date]];
        speed[entity_, date_] := (xyz[entity, date + Quantity[1, "Days"]] - xyz[entity, date]) / Quantity[1, "Days"]

In[10]:= hildasName = EntityList[hildas];
         hildasLoc = xyz[hildas, date];
         hildasSpeed = speed[hildas, date];

In[13]:= trojansgreeksName = EntityList[trojansgreeks];
         trojansgreeksLoc = xyz[trojansgreeks, date];
         trojansgreeksSpeed = speed[trojansgreeks, date];

In[16]:= sunjupiterData = {sun -> {"Mass" -> sun["Mass"], "Position" -> xyz[sun, date], "Velocity" -> speed[sun, date]}, jupiter -> {"Mass" -> jupiter["Mass"], "Position" -> xyz[jupiter, date], "Velocity" -> speed[jupiter, date]};

In[17]:= hildasData = Table[hildasName[[i]] -> {"Mass" -> Quantity[3.*^10, "Kilograms"], "Position" -> hildasLoc[[i]], "Velocity" -> hildasSpeed[[i]]}, {i, Length[hildasName]};

In[18]:= trojansgreeksData = Table[trojansgreeksName[[i]] -> {"Mass" -> Quantity[3.*^10, "Kilograms"], "Position" -> trojansgreeksLoc[[i]], "Velocity" -> trojansgreeksSpeed[[i]]}, {i, Length[trojansgreeksName]};

In[19]:= potentials = { {sun, _} -> "Gravity", {jupiter, _} -> "Gravity"};

In[20]:= simulate[data_, duration_] := NBodySimulation[{"PairwisePotential" -> potentials}, N@data, N@duration]

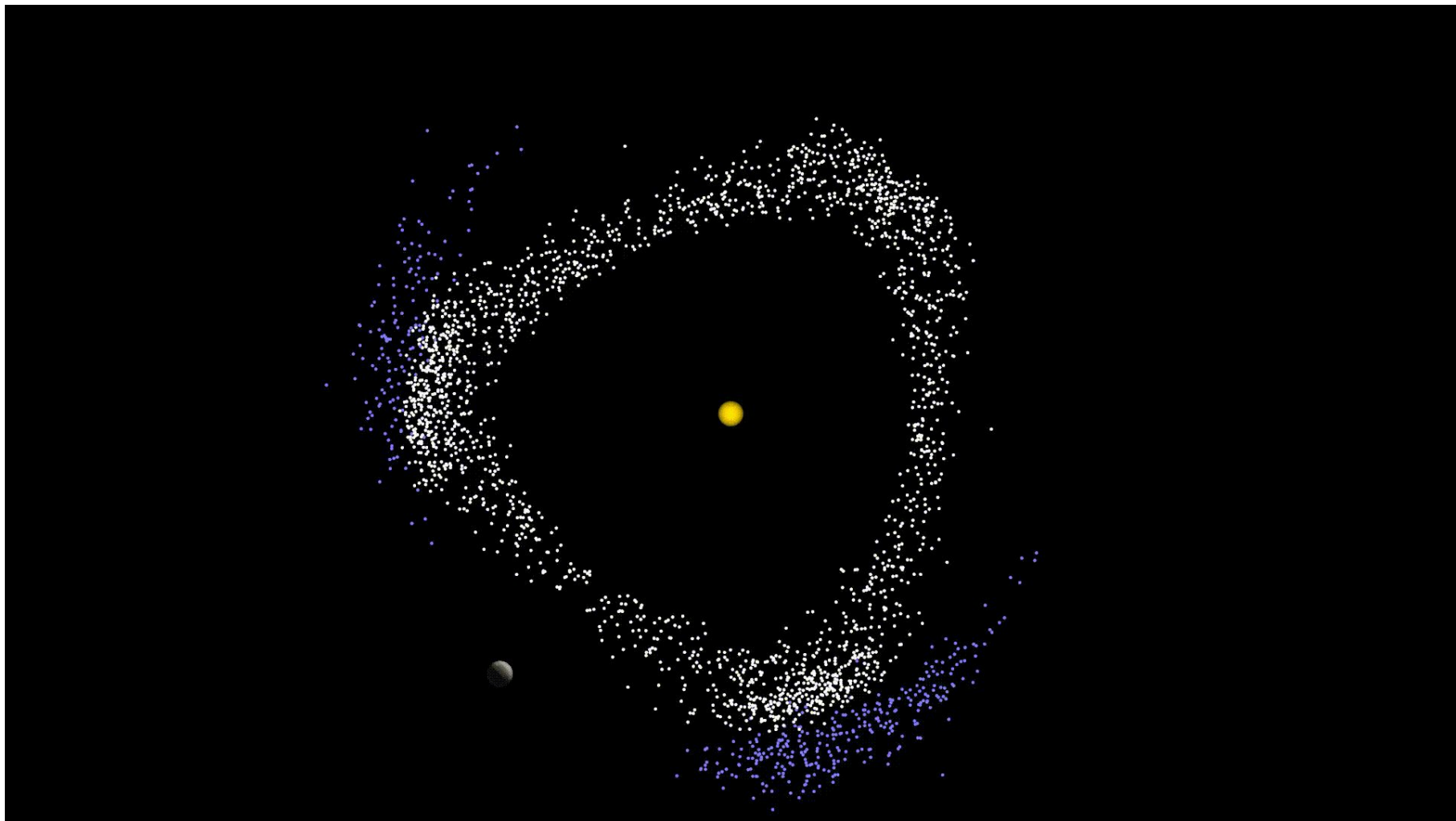
In[21]:= hildanbs = simulate[Join[sunjupiterData, hildasData], duration];

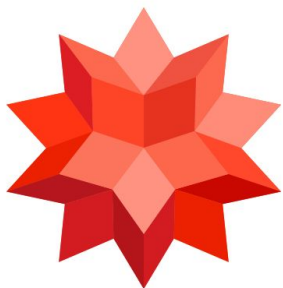
In[22]:= trojansgreeksnbs = simulate[Join[sunjupiterData, trojansgreeksData], duration];

In[23]:= simtime = trojansgreeksnbs["SimulationTime"]
Out[23]= 3.74356 x 10^8

In[24]:= metersToAU[data_] := QuantityMagnitude[Quantity[data, "Meters"], Quantity[1, "AstronomicalUnit"]]

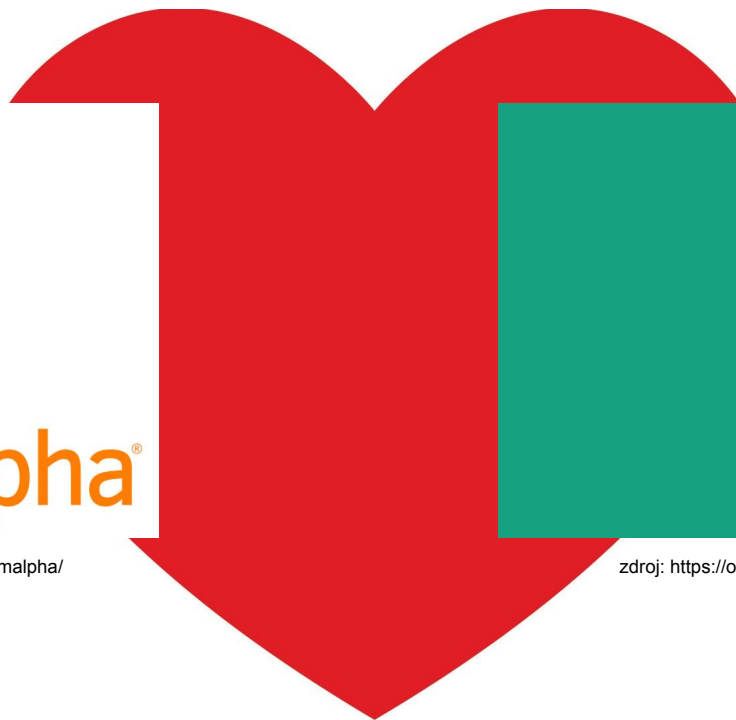
In[30]:= With[{t = simtime / 4}, Graphics3D[{PointSize[0.01], Sphere[metersToAU[hildanbs[jupiter, "Position", t]], .2], GrayLevel[1], PointSize[0.006], Point[metersToAU[hildanbs[All, "Position", t]]], RGBColor[0.5, 0.5, 1.],
        Point[metersToAU[trojansgreeksnbs[All, "Position", t]]], Lighting -> {{"Ambient", GrayLevel[0.1]}, {"Directional", GrayLevel[1], ImageScaled[{0, 0, 1}]}}, Hue[0.14, 1], Sphere[{0, 0, 0}, 0.2]},
        {PlotRange -> {{-8, 8}, {-8, 8}, {-1, 1}}, ViewPoint -> {0, 0, 2}, Boxed -> False, SphericalRegion -> True, ViewAngle -> Rational[1, 8] Pi, Background -> GrayLevel[0], Lighting -> {{"Ambient", GrayLevel[0.1]}, {"Point", GrayLevel[1], {0, 0, 0}}}}]]
```





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ChatGPT

zdroj: <https://openai.com/blog/chatgpt>

zdroj: <https://www.history.com/news/what-is-the-origin-of-the-heart-symbol>

S

What is the integral of $x^2 \cos(2x)$?



Used **Wolfram**





The integral of $x^2 \cos(2x)$ with respect to x is:

$$\frac{x \cos(2x)}{2} + \frac{(-1 + 2x^2) \sin(2x)}{4} + C$$


where C is the constant of integration.

Využití databáze Wolfram

 Make a map of these

 Used **Wolfram**

Here is a map showing the top 10 beef-producing countries:



The map displays the top 10 beef-producing countries in orange. These countries are: Canada, the United States, Brazil, Mexico, India, China, Australia, Argentina, South Africa, and the United Kingdom. The rest of the world is shown in light blue.

5

A boy on being asked the age of himself and of his sister replied:

"Three years ago I was seven times as old as my sister; two years ago I was four times as old; last year I was three times as old; and this year I am two and one-half times as old."
What are their ages?

S

A boy on being asked the age of himself and of his sister replied:

"Three years ago I was seven times as old as my sister; two years ago I was four times as old; last year I was three times as old; and this year I am two and one-half times as old."

What are their ages?



Let's denote the boy's age as B and the sister's age as S . We are given four pieces of information:

1. Three years ago: $B - 3 = 7 * (S - 3)$
2. Two years ago: $B - 2 = 4 * (S - 2)$
3. Last year: $B - 1 = 3 * (S - 1)$
4. This year: $B = 2.5 * S$

We can set up a system of equations and solve for B and S .

Used **Wolfram**

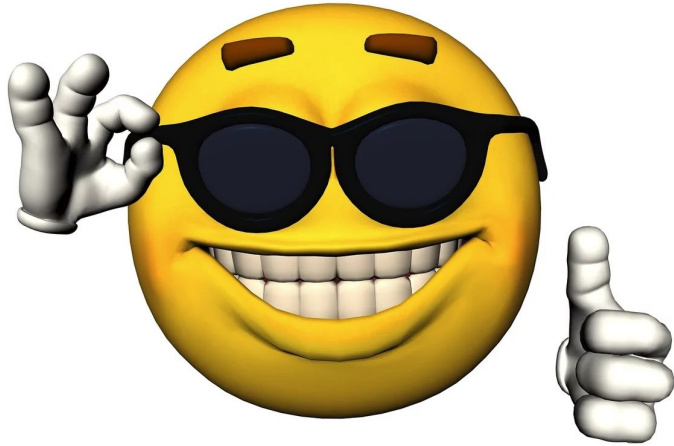


The boy is 10 years old, and his sister is 4 years old.

Poděkování

Rádi bychom poděkovali našemu mentorovi doc. Dr. Ing. Milanu Šiňorovi
a organizátorům Týdne vědy.

Děkujeme/Ďakujeme za pozornost/pozornost'



<https://www.ahaonline.cz/clanek/musite-vedet/85194/smajlik-slavi-narozeny-uz-se-na-nas-smeje-pul-stoleti.html>



<https://stock.adobe.com/cz/images/smiley-with-heart-shape-hand-sign-cute-smiley-emoji-being-in-love/202951817>

Diskuse

