# TPT *WebSights* column draft for December 2024:

*WebSights* features announcements an reviews of select sites of interest to learners and teachers of introductory physics. This column is available as a web page at [PhysicsEd.BuffaloState.Edu/pubs/WebSights/](http://PhysicsEd.BuffaloState.Edu/pubs/WebSights/).

If you have successfully used a physics website that you feel is appropriate for *WebSights*, please email me the URL and describe how you use it to teach or learn physics. [macisadl@buffalostate.edu](mailto:macisadl@buffalostate.edu).

**Nobel goes to Hinton and Hopfield for machine learning and neural networks**

[**https://www.nobelprize.org/prizes/physics/2024/summary/**](https://www.nobelprize.org/prizes/physics/2024/summary/)

[**https://www.nobelprize.org/prizes/physics/2024/advanced-information/**](https://www.nobelprize.org/prizes/physics/2024/advanced-information/)

[**https://en.wikipedia.org/wiki/Lateral\_inhibition**](https://en.wikipedia.org/wiki/Lateral_inhibition)

[**https://tinyurl.com/WS-CarlsonAPS-Ncrit**](https://tinyurl.com/WS-CarlsonAPS-Ncrit)

[**https://tinyurl.com/WS-CSnotPhysics**](https://tinyurl.com/WS-CSnotPhysics)

Professor John Hopfield of Princeton University physics and Professor Geoffrey Hinton of University of Toronto computer science received the 2025 Nobel Prize in physics "for foundational discoveries and inventions that enable machine learning with artificial neural networks." Their (biophysics-inspired) investigations and models tremendously extended simple analog and digital electronic then purely computational approaches replicating how sensory cells and neurons are interconnected both backwards and forwards in biological systems and organs. For instance, much visual processing like edge detection (via lateral inhibition) takes place on the retina and interconnections of insect eyes so little or no “brain power” is needed to quickly detect and evade (or capture) moving objects in insect vision. Biological vision and memory models were used to inspire and guide first electronic and later computer models of interconnection, inspiring machine learning and A.I. The (now software engineering) fields of computer/ robot vision and speech recognition also rely heavily on this background. A lot of physics experimentation consists of getting measurements into software and culling the data as quickly as possible looking for particular patterns, and unsurprisingly places like CERN have tremendous expertise in data management and machine learning – part of the reason the world wide web was invented.

Hopfield’s biophysical work was inspired by networks of neurons in the brain, modeling these as multiple weighted signal inputs through a recurrent neural network to explain associative memory. Dynamical modeling of similar collective phenomena with feedback in other physical systems like domains in magnetic systems and vortices in fluid flow has also proven very fruitful, and is cited in the Nobel prize synopsis. Hinton’s work involved trainable deep and dense neural networks, and he is currently an A.I. skeptic. The currently booming field of A.I. relies heavily on the work of these leaureates.

APS writer Erika Carlson wrote a nice critical piece summarizing how Nobel prizes in physics (at least) no longer appropriately portray how physics (and science in general) are done, skewing the recognition process and distorting the reward structure and portrayal of people in physics (including under-represented physicists). Finally physics curmudgeon Dr. Sabine Hossenfelder argues that this computer science stuff isn’t physics at all (anymore). Congrats to the new laureates.

**2024 Physik im Advent: Holiday physics experiments from Germany**

<https://www.physics-in-advent.org/>

<https://www.pia.eu>

<https://www.youtube.com/@PhysikimAdvent_TV> (English and German both, with captioning)

With twenty-four experiments until Christmas, the online PiA event runs December 1-24 and participants may choose to register (for free) and contribute solutions for prizes in a light-hearted competition, though with some significant prizes. PiA is principally intended for 11-18 year old students and presents daily experimental challenge problems provided via YouTube videos (and then later their solutions). Videos are available in German and English, with captions for several other European languages. Participants can watch the video problem daily, try the experiment yourself and respond to questions on the website (if registered). Individual, class, group and school registrations are supported, and teachers may register within and across class accounts. Registration runs 1 November through 24 December, and last year over 70,000 registrants from over 72 countries participated. Some few experiments do require drugstore or dollar-store materials and materials lists are provided in advance on the website.

A very nice way to incorporate physics activities into the holidays, and to involve younger children while developing their STEM interests well before traditional formal HS physics instruction.

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**Describing e (Euler’s number; Napier’s constant) to different student audiences**

<https://tinyurl.com/WS-e5levels>

<https://www.youtube.com/@DrSeanGroathouse>

<https://en.wikipedia.org/wiki/E_(mathematical_constant)>

Dr. Sean Groathouse has a YouTube channel dedicated to mathematics, and I have been called upon a number of times to explain why e is an important constant to a number of audiences. Hence I found very useful this series of “Five levels of complexity” – basically explanations of applications arranged in order of difficulty from those accessible to students beginning their use of algebra to math majors. Dr. Sean includes some thoughtful history (e is credited to Jacob Bernouilli examining compound interest, despite common appellations) and he has 20-odd videos, including e, imaginary numbers, Bayes rule, Pascal’s Triangle, Infinity, properties of zero, and more.

**Maxwell’s Laws videos**

<https://tinyurl.com/WS-uaa-Maxwell>

<https://www.youtube.com/@upandatom/videos>

<https://tinyurl.com/WS-klp-Maxwell>

<https://kathylovesphysics.com/>

Jade Tan-Holm has released another “Up and Atom” channel YouTube video, reviewing Maxwell’s Laws in ntegral form and reviewing fields, field lines and circulations, surface and path integrals, vector dot products, flux and so forth accompanied with a richly illustrated set of animations and static images. I wish that I had access to these kinds of presentations as an undergraduate learner, and I will be recommending this video to my own undergraduate E&M students, who are highly motivated to learn these initially complex ideas. There are a number of others who explain Maxwell’s equations, notably Kathy Joseph’s “Kathy Loves Physics” channel has a nice (differential form) video. These are half hour videos reviewing (or introducing) much