

ICOS 2009 in Physics

Po-Jen Hsu

September 25, 2009

1 On-line Resource for Education

- Physics for Journal and Elementary Student
- Physics for Senior High School Student
- Physics in College
- Unit and Constant

2 Open Source for Education

- KDE STEP
- Gvb

3 Physics and Its Applications

- gEDA for Electronics
- KiCAD

4 Physics in Computation and Research

- V-sim
- VMD
- Octave, SciLab, RLab, and NSP

5 Publishing

Flash 理化練功房

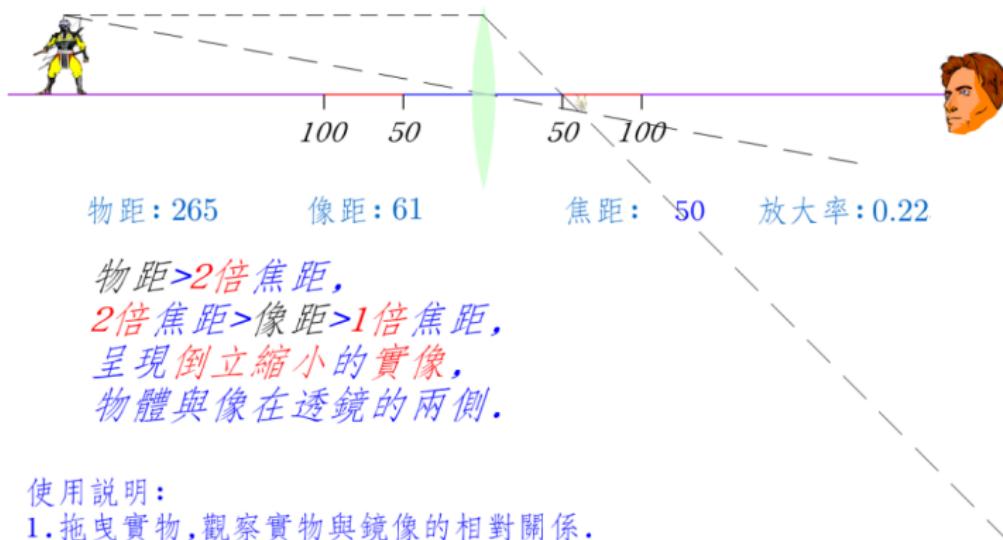
<http://www.tnajh.ylc.edu.tw/~ldc/main.php>

密度: 熱量: 週期表: 原子結構: 分子模型: (以滑鼠拖拉分子模型， 分子模型即可自動旋轉)	1. 液體密度的測量 2. 固體密度的測量 1. 烟量實驗(一)----測量水溫的變化 2. 烟量實驗(二)----不同液體的比熱測定 3. 热傳導實驗 4. 热對流實驗 5. 热輻射實驗 1. 濃縮食---折圖一 2. 濃縮食---折圖二 3. 濃縮食---折圖三 1. 原子模型 1. 氢分子模型 (參考VSEPR理論製作) 2. 水分子模型 (參考VSEPR理論製作) 3. 重氮水分子模型 (參考VSEPR理論製作) 4. 氮分子模型 (參考VSEPR理論製作) 5. 二氧化氮分子模型 (參考VSEPR理論製作) 6. 甲烷分子模型 (參考VSEPR理論製作) 7. 乙烯分子模型 (參考VSEPR理論製作) 8. 乙酸分子模型 (參考VSEPR理論製作) 9. 乙醇分子模型 (參考VSEPR理論製作) 10. 西庚分子模型 (參考VSEPR理論製作) 11. 丁烷分子模型 (參考VSEPR理論製作) 12. 乙醚分子模型 (參考VSEPR理論製作) 13. 乙胺分子模型 (參考VSEPR理論製作) 14. 氨化銅分子模型 (參考VSEPR理論製作) 1. 重氮水分解反應 2. 鐵帶燃燒反應 3. 氢氣燃燒反應 4. 酒精燃燒反應	學習單 學習單 學習單 學習單 學習單 學習單 學習單 學習單 學習單 學習單 學習單 學習單 學習單 學習單 學習單 學習單 學習單 學習單 學習單 學習單
化學反應係數平衡:		



凸透鏡成像

移動實像產生虛像

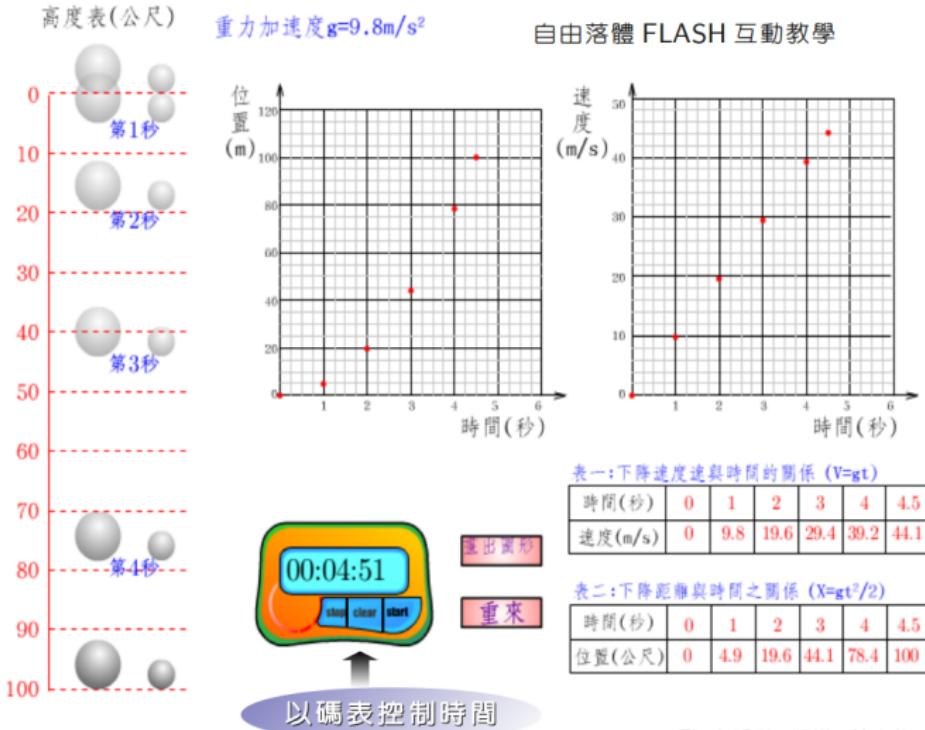


物距 $>$ 2倍焦距,
2倍焦距 $>$ 像距 $>$ 1倍焦距,
呈現倒立縮小的實像,
物體與像在透鏡的兩側.

使用說明：

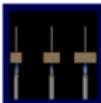
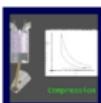
1. 拖曳實物，觀察實物與鏡像的相對關係。

Designed by 林大欽 at 2002.3.18

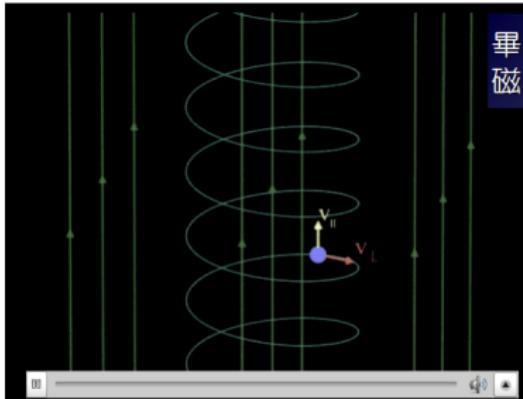


Animations for Physics and Astronomy(物理與天文的動畫)

http://phys23p.sl.psu.edu/phys_anim/thermo/indexer_thermo.html

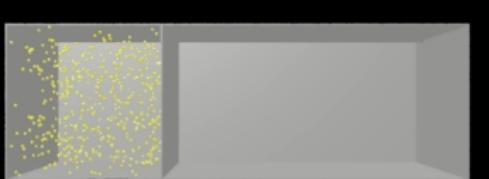
氣體自由膨脹		Kinetic Theory
	Free Expansion of A Gas [QT Embedded Media Old Embedded]	
比熱與壓力體積		Heat
	Heat Capacity and Sample Size [QT Embedded Media Old Embedded]	
	Joules Experiment to Determine the Mechanical Equivalence of Heat [QT Embedded Media Old Embedded] 焦耳的熱能測量實驗	
等定容循環		Thermodynamic Cycles
	The Otto cycle in a Four Stroke Engine [QT Embedded Media Old Embedded]	





畢歐沙伐定理：
磁場與電場，磁力與帶電粒子軌跡

Charge in a Uniform B Field



理想氣體：
 $PV=NRT$

Free Expansion of A Gas

Falstad's Math and Physics Applets(Falstad 的數學與物理程序)

<http://www.falstad.com/mathphysics.html>

Oscillations and Waves 波動與振盪

-  [Ripple Tank \(2-D Waves\) Applet](#)
Ripple tank simulation that demonstrates wave motion, interference.
-  [2-D Waves Applet](#)
Demonstration of wave motion in 2-D.
-  [3-D Waves Applet](#)
Demonstration of wave motion in 3-D.
-  [Coupled Oscillations Applet](#)
Demonstration of longitudinal wave motion in oscillators connected.
-  [Dispersion Applet](#)
Dispersion and group velocity.

Acoustics 聲學

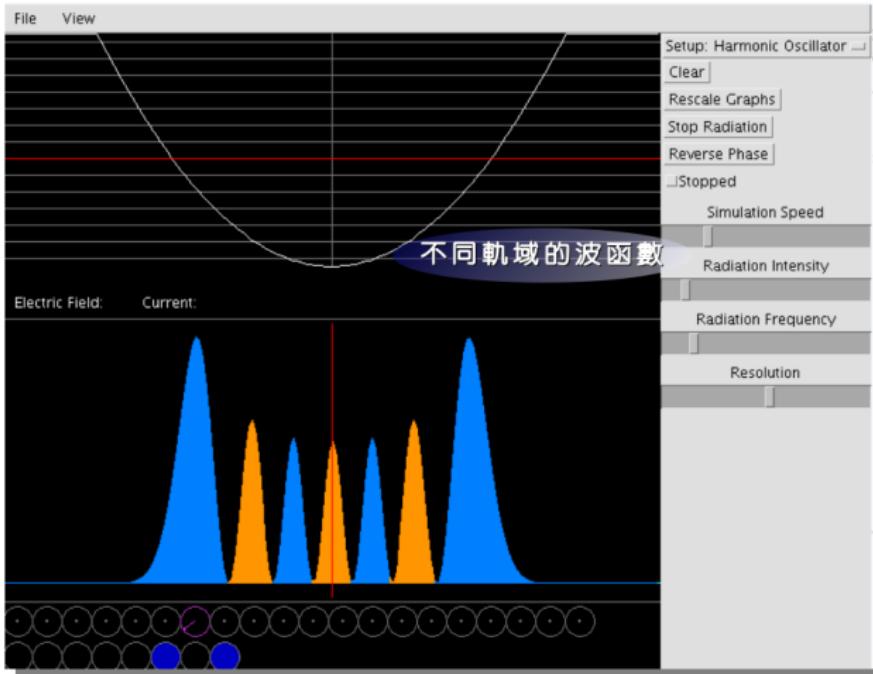
-  [Loaded String Applet](#)
Simulation of wave motion of a string.
-  [Rectangular Membrane Waves Applet](#)
Vibrational modes in a 2-d membrane.
-  [Circular Membrane Waves Applet](#)
Vibrational modes in a 2-d circular membrane (drum head).
-  [Bar Waves Applet](#)
Bending waves in a bar.
-  [Box Modes Applet](#)
Acoustic standing waves in a 3-d box.
-  [Acoustic Interference Applet](#)
Generates audio interference between your speakers.

Quantum Mechanics 量子力學

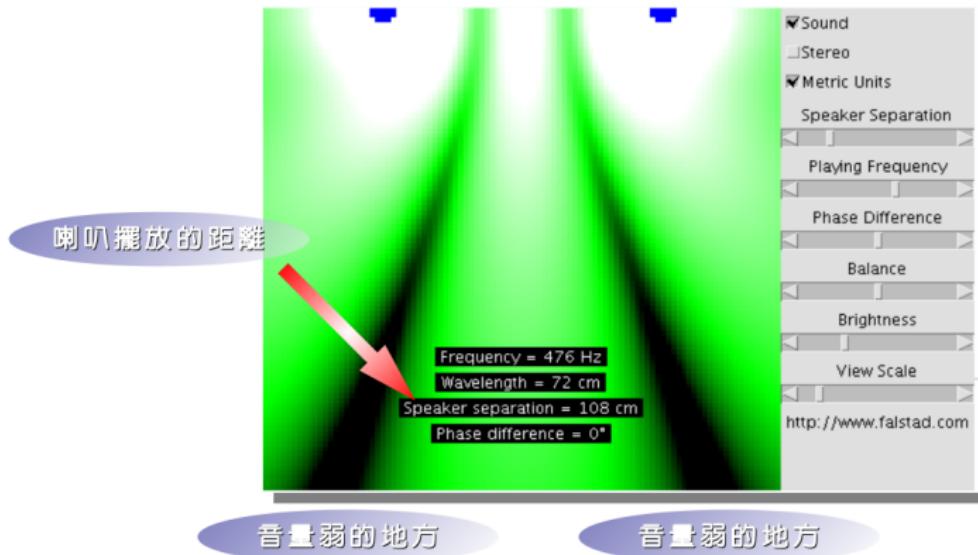
-  [Hydrogen Atom Applet](#)
Shows the orbitals (wave functions) of the hydrogen atom.
-  [Molecular Orbitals Applet](#)
Shows the orbitals (wave functions) of the hydrogen molecular ion.
-  [1-D Quantum Mechanics Applet](#)
Single-particle quantum mechanics states in one dimension.
-  [1-D Quantum Crystal Applet](#)
Periodic potentials in one dimension.
-  [2-D Quantum Crystal Applet](#)
Periodic potentials in two dimensions.
-  [1-D Quantum Transitions Applet](#)
Radiative transitions (absorption and stimulated emission) in one dimension.
-  [Atomic Dipole Transitions Applet](#)
Radiative transitions (absorption and stimulated emission) in atoms.
-  [2-D Rectangular Square Well Applet](#)
Rectangular square well (particle in a box) in two dimensions.
-  [2-D Circular Square Well Applet](#)
Circular square well in two dimensions.
-  [2-D Quantum Harmonic Oscillator Applet](#)
Harmonic oscillator in two dimensions.
-  [Quantum Rigid Rotator Applet](#)
Particle confined to the surface of a sphere.
-  [3-D Quantum Harmonic Oscillator Applet](#)
Harmonic oscillator in three dimensions.



Harmonic Oscillator /H-atoms model (簡諧振盪或氫原子模型)

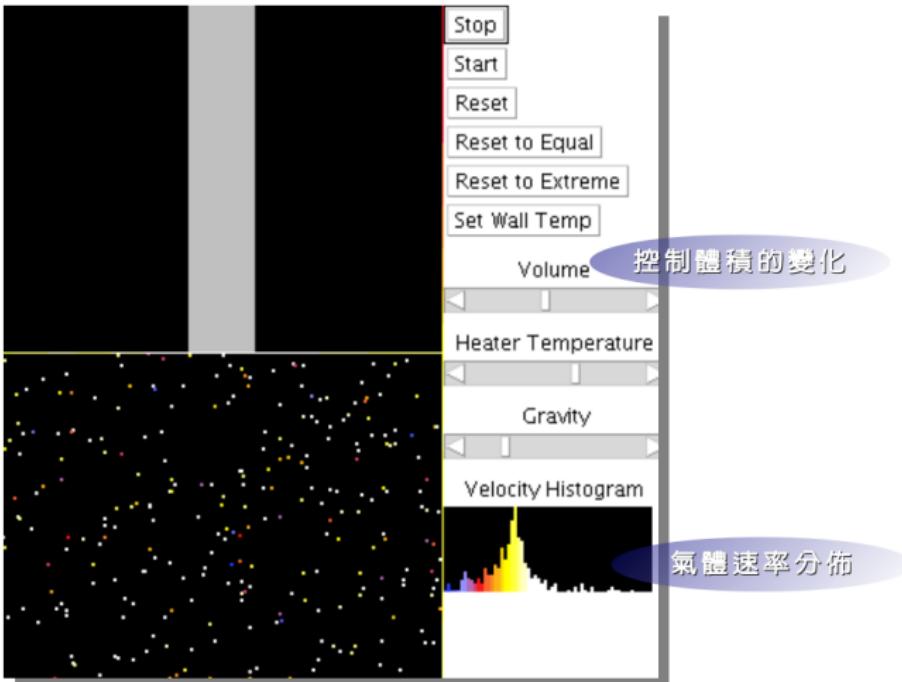


用身體去感覺兩個聲源的聲波干涉



利用兩個喇叭 (左右聲道)，調整出互相干涉的聲波，聆聽者可以移動身體，在不同的位置感受音量的消長。

理想氣體 $PV=nRT$



研究物理的第一步 :CODATA(國際科學技術數據委員會)

<http://www.codata.org/>

The NIST Reference on Constants, Units, and Uncertainty

Fundamental Physical Constants

Click symbol for equation

Boltzmann constant in eV/K
 k

Value $8.617\ 343 \times 10^{-5}$ eV K⁻¹

Standard uncertainty $0.000\ 015 \times 10^{-5}$ eV K⁻¹

Relative standard uncertainty 1.7×10^{-6}

Concise form $8.617\ 343(15) \times 10^{-5}$ eV K⁻¹

Click here for correlation coefficient of this constant with other constants

Source: 2006 CODATA recommended values

Definition of uncertainty

Correlation coefficient with any other constant

Constants Topics:
Values
Energy
Equivalents
Searchable
Bibliography
Background
—
Constants Bibliography
—
Constants Units & Uncertainty home page

關於物理常數的參考文獻與最新測量方法

There are 53 citations matching "Boltzmann constant".

A cryogenic radiometer for absolute radiometric measurements

J. E. Martin, N. P. Fox, and P. J. Key
Metrologia **21**(3), 147-155 (1985)

A radiometric determination of the Stefan-Boltzmann constant and thermodynamic tempe

T. J. Quinn and J. E. Martin
Philos. Trans. R. Soc. London, Ser. A **316**(1536), 85-189 (1985)

Precision measurements of the Boltzmann constant

L. Storm
Metrologia **22**(3), 229-234 (1986)

The Boitzman constant, in *Units and Fundamental Constants in Physics and Chemistry*:

B. Kramer
J. Bortfeldt and B. Kramer, eds., vol. Subvolume b,
New York: Springer-Verlag, ch. 3.2.15, pp. 259-273 (1992)

The Stefan-Boltzmann constant, in *Units and Fundamental Constants in Physics and Che*

W. Blevin
J. Bortfeldt and B. Kramer, eds., vol. Subvolume b,
New York: Springer-Verlag, ch. 3.2.16, pp. 274-283 (1992)

Measurements on a dielectric constant gas thermometer between 3 K and 84 K, in *Tempe*

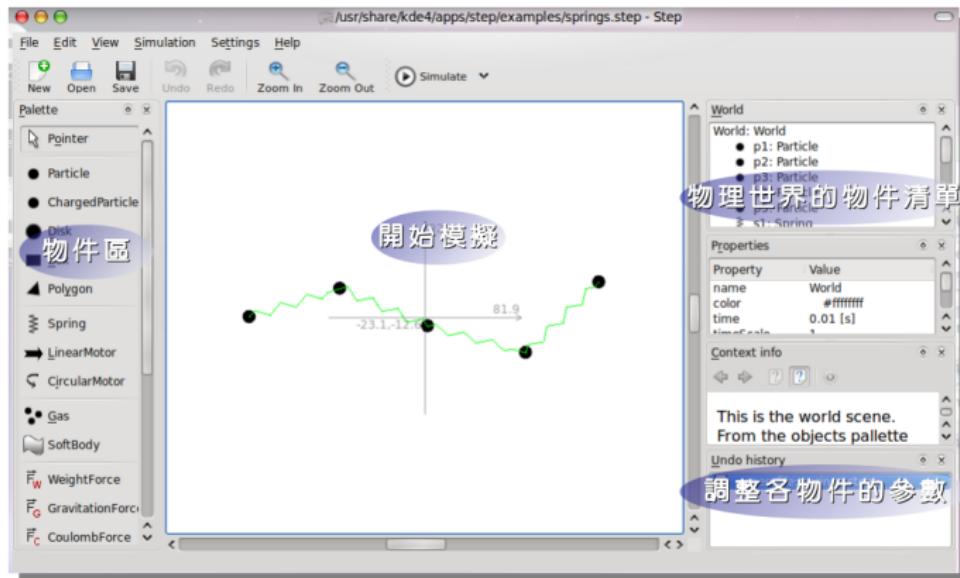
K. Grohmann and H. Luther
J. F. Schooley, ed., vol. 6, part 1,
New York: American Institute of Physics, pp. 21-26 (1992)

An Acoustic Method of Measuring the Universal Gas Constant and Boltzmann's Constant

E. Shapoval
Izmer. Tekh. **37**(1), 5-7 (1994)
[*Meas. Tech.* **37**(1), 6-9 (1994)]

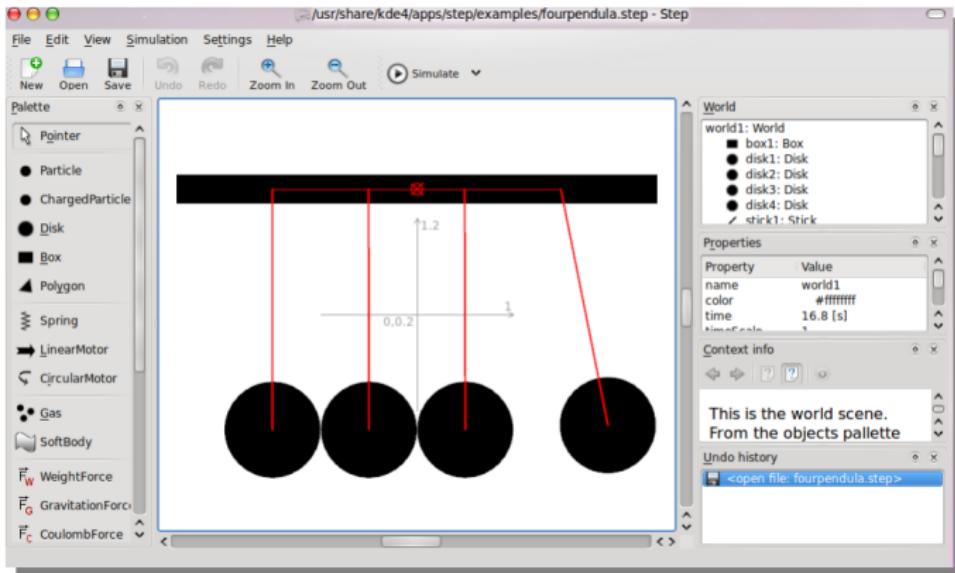


無限自由的物理世界 KDE Step0.1.0



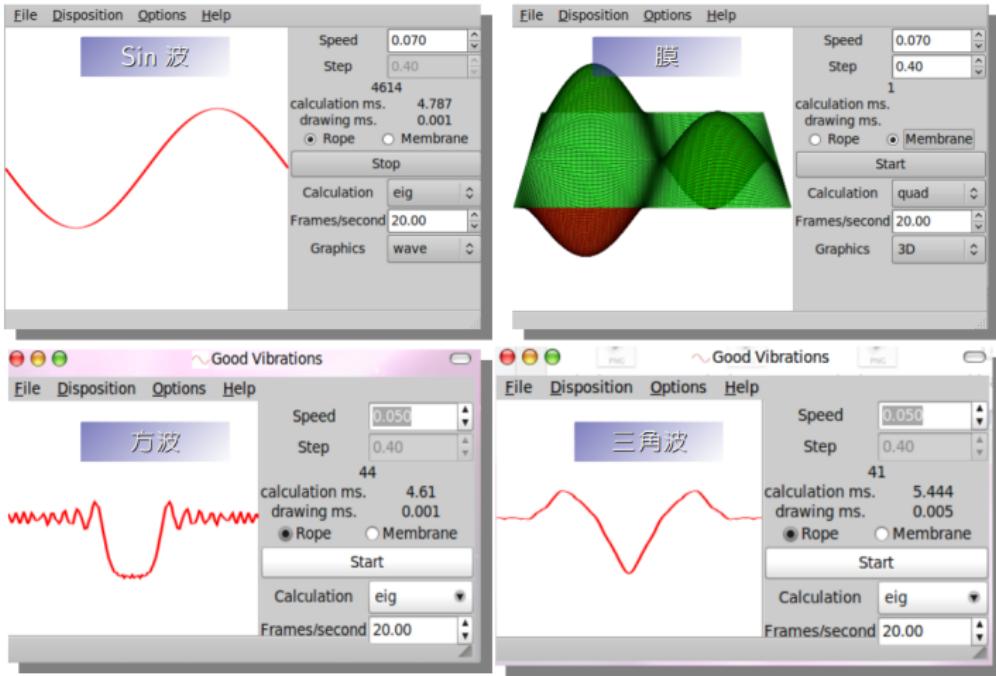
1. 真正可自訂物理系統與物件。
2. 可以模擬氣體分子，動力學，甚至是行星系統，除了彈力，也可以設定重力及庫倫力。
3. 目前為 0.1.0 版，仍在開發初期，但完成度高，已可以應用在教學上。
4. 可用桌面錄製動畫軟體將示範錄製，也可以動手操作，只要有創意。

單擺運動

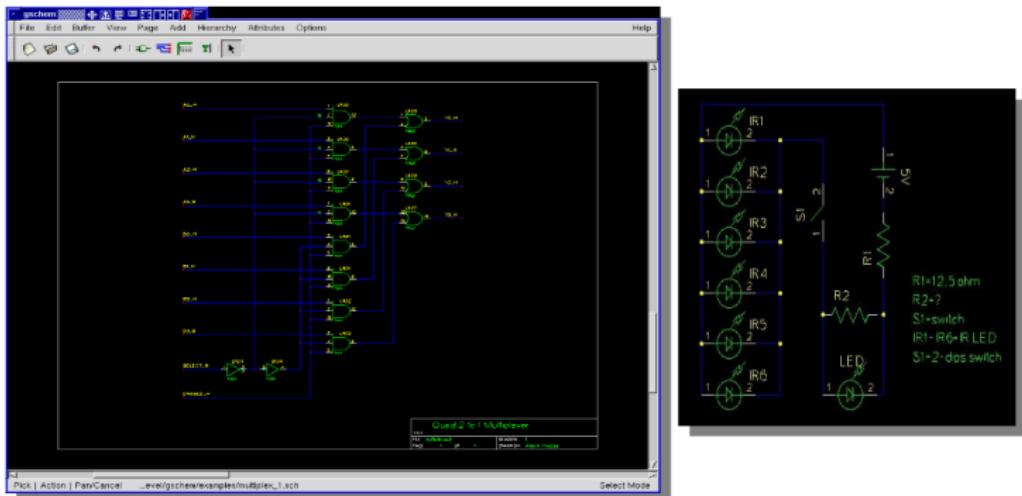


1. 只要運用創意，幾乎可以設計出經典物理的任何問題。
2. 真正動手設計實驗的理念。
3. 穩定度仍須加強，有些參數設計還未完成，有時程序會當機，建議在 KDE 下使用。

另類的示波器 Good Vibration(Gvb)

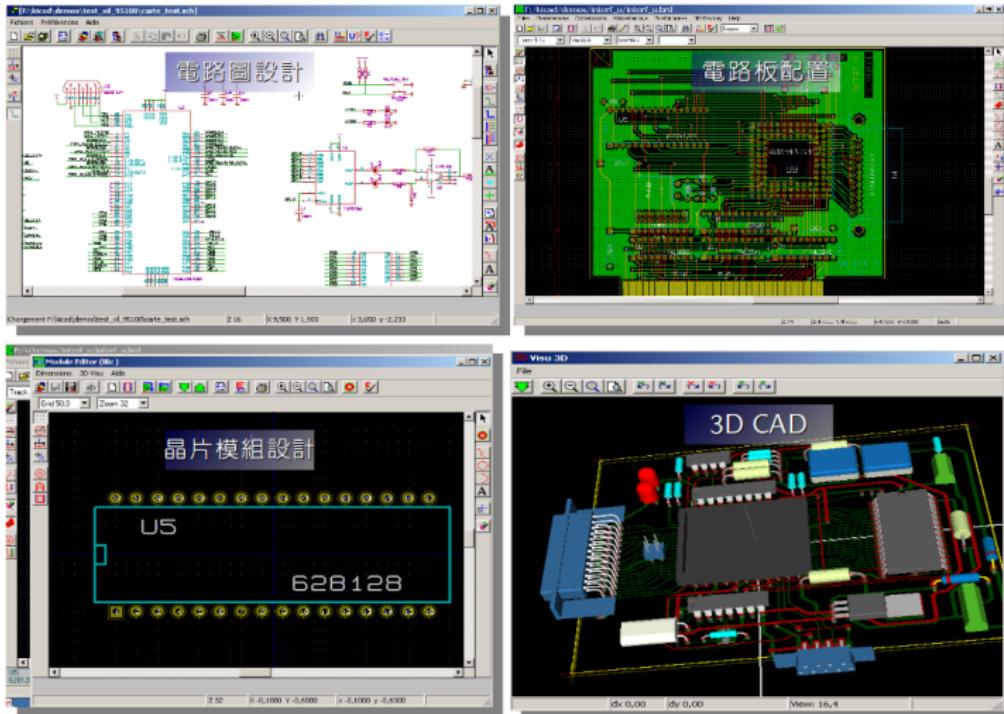


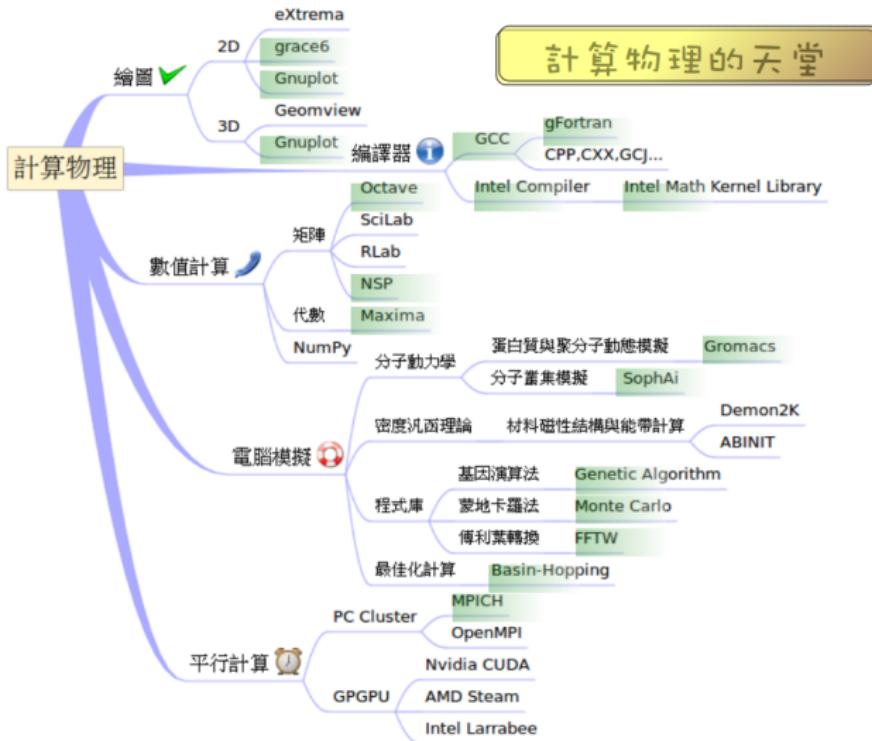
設計電路好幫手 gEDA



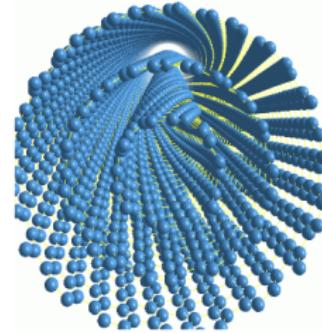
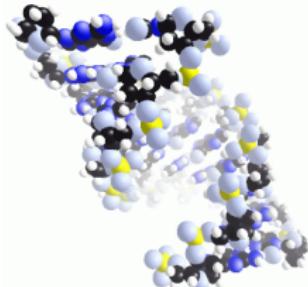
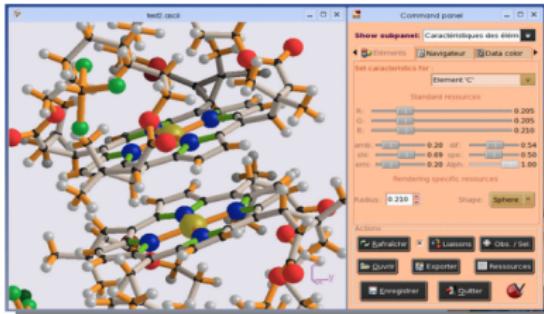
操作簡單，分類清楚，適合作業與輸出。

重量級的電路設計軟體 KiCAD

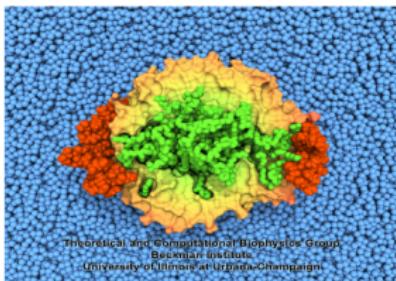
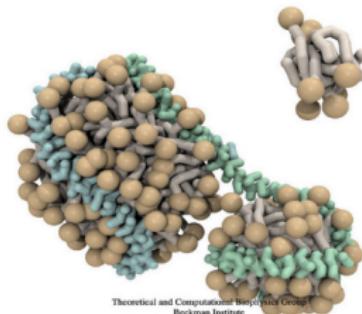
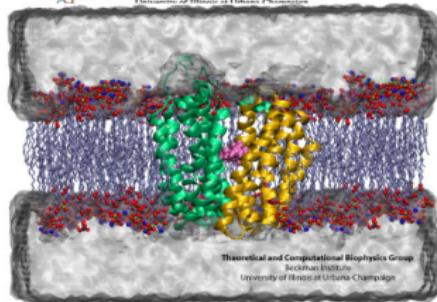
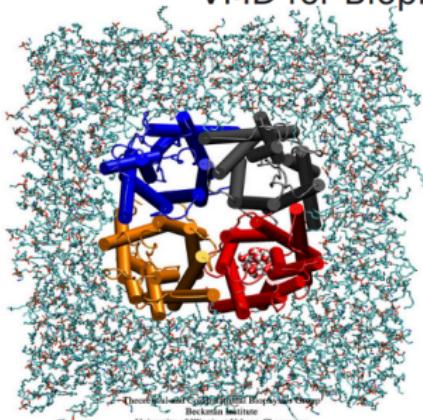




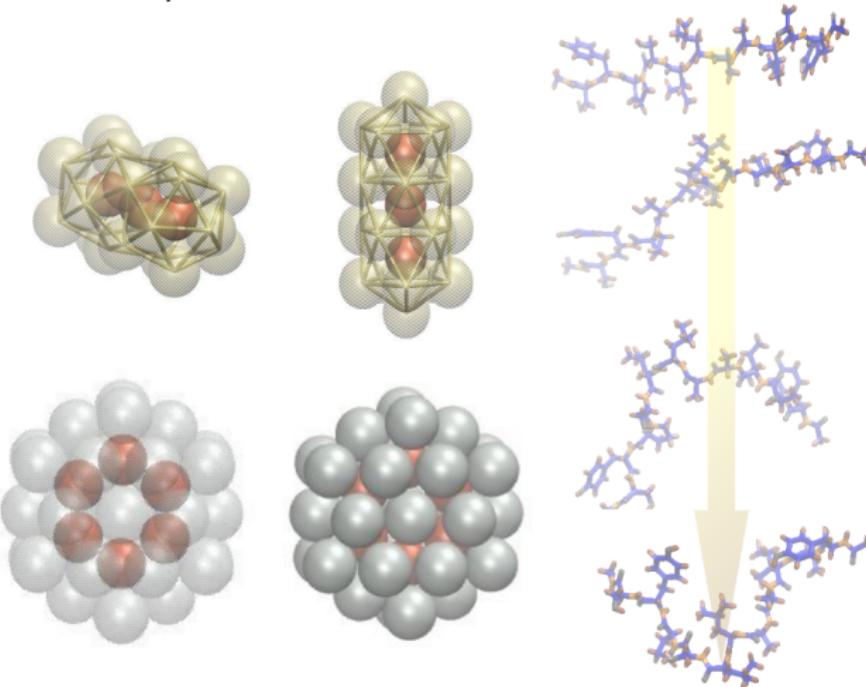
V-sim for Solid State Visualization



VMD for Biophysics and Polymer Dynamics



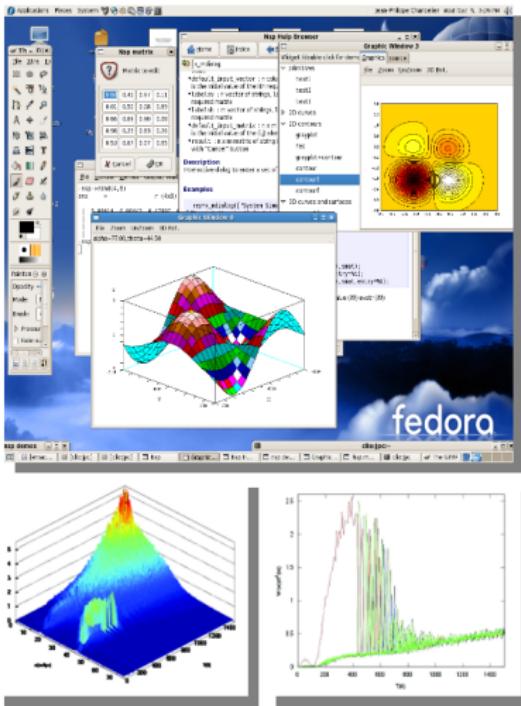
Nanoparticle and micromolecule



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VMD
Octave, SciLab, RLab, and NSP

數值計算、矩陣與工程計算

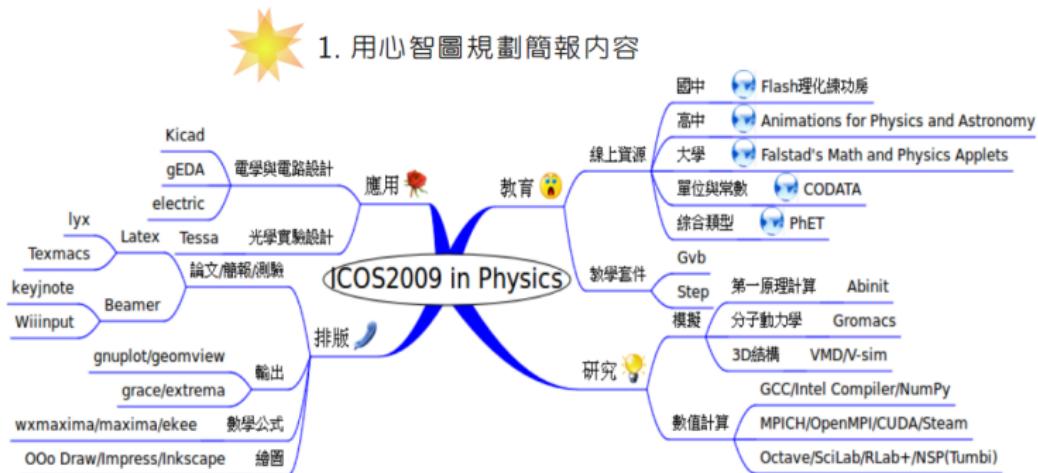


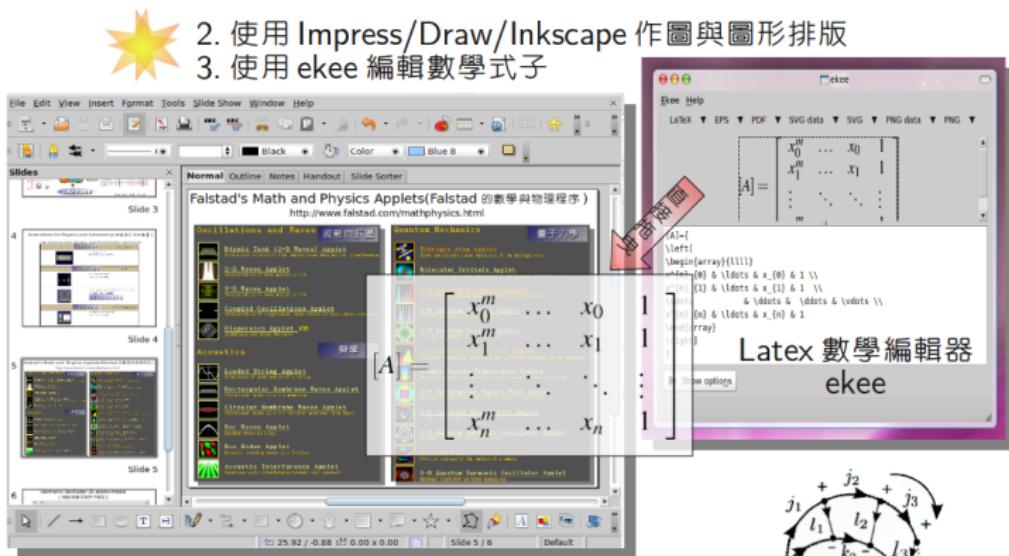
test	octave 2.9.10	matlab 7.1	nspl	scilab-unx	scilab-win
fibonnaci	5.768	2.153	1.230	1.460	1.362
subsets	6.444	1.883	1.484	2.760	2.854
im55_rand	7.465	1.372	1.750	1.560	1.692
tri_fusion	7.881	0.571	1.407	1.430	1.282
tri_rapide	8.144	1.973	1.494	1.900	1.612
harvest	1.745	1.702	1.169	1.230	1.152
harminloop	5.486	0.030	1.876	1.790	1.692
fannkuch	7.433	0.831	1.343	0.900	0.831
mon_lu	3.135	2.023	1.544	1.850	1.953
crible	1.092	0.981	0.985	1.210	1.432
make_perm	5.431	1.021	1.146	1.740	1.472
inv_perm	6.206	0.010	1.128	0.910	0.831
fft	18.020	3.104	1.737	7.290	7.140
pascal	3.413	0.481	1.084	1.310	2.964
hmeans	4.351	1.833	1.605	3.090	4.987
simplexe	1.883	1.072	1.248	1.630	1.773
loop_call_f	6.611	0.100	1.306	1.710	1.292
loop_call_p	3.706	0.300	1.039	0.470	0.461
form_vect1	1.963	2.664	0.029	2.110	4.266
form_vect2	4.230	2.864	0.815	1.390	3.024
loop1	4.576	0.010	1.407	1.330	1.242
loop2	14.155	0.040	2.115	1.960	1.853
loop3	5.378	0.010	1.644	1.550	1.452
test_bool	1.416	3.986	1.238	2.840	3.175
test_find	4.801	2.363	1.417	4.490	4.857
prime_factors	17.843	0.060	0.851	5.000	4.236
extraction	3.557	1.562	1.189	3.080	3.124
insertion	2.209	1.242	1.177	2.270	2.293
Total time (sec)	164.36	36.24	36.45	60.26	66.31



科學簡報排版的一些常見問題：

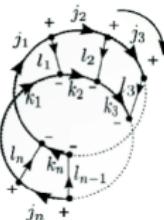
- 格式太自由，花太多時間排版，或者根本不排版？
- 前後不連貫，章節混亂，主題不明顯。
- 數學輸入方法百百種，每次都要重新學起。
- 花很多時間在頁面間跳躍。





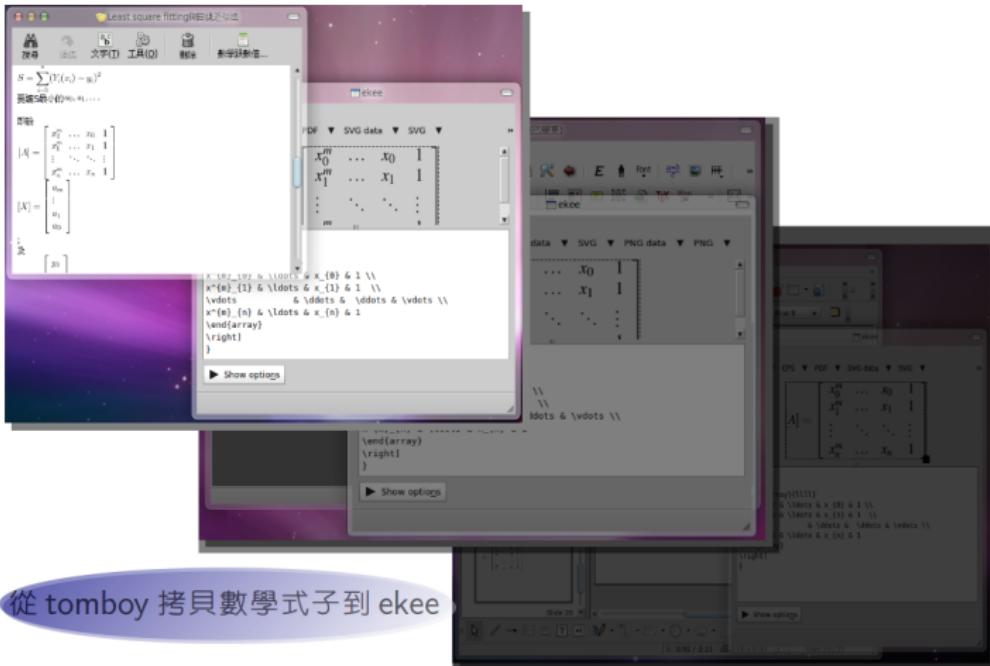
- a. 數學輸入學一種即可。
 - b. 輸入速度快，公式美觀。
 - c. 試著打出下列式子：

$$\underbrace{\begin{pmatrix} j_1 & j_2 & m_3 \\ m_1 & m_2 & j_3 \end{pmatrix}}_{\text{3-jm coeff.}} = (-1)^{j_1-j_2-j_3} \frac{1}{\sqrt{2j_3+1}} \underbrace{< j_1 m_1 j_2 m_2 | j_3 m_3 >}_{\text{CG coeff.}}$$



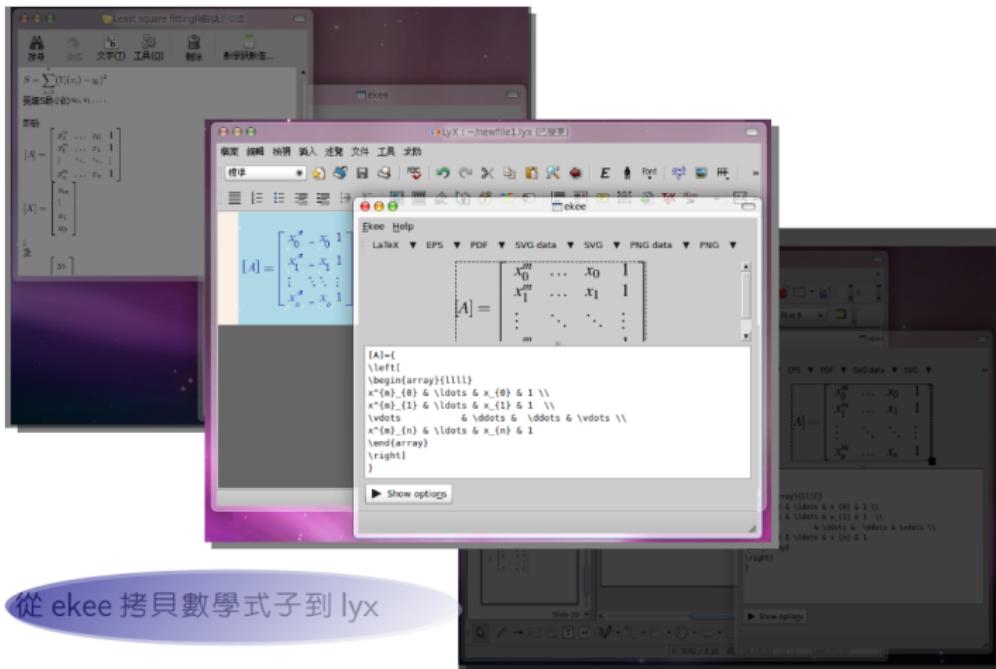
使用 Inkscape+ekee 繪圖

使用 Tomboy 做科學筆記



從 tomboy 拷貝數學式子到 ekee

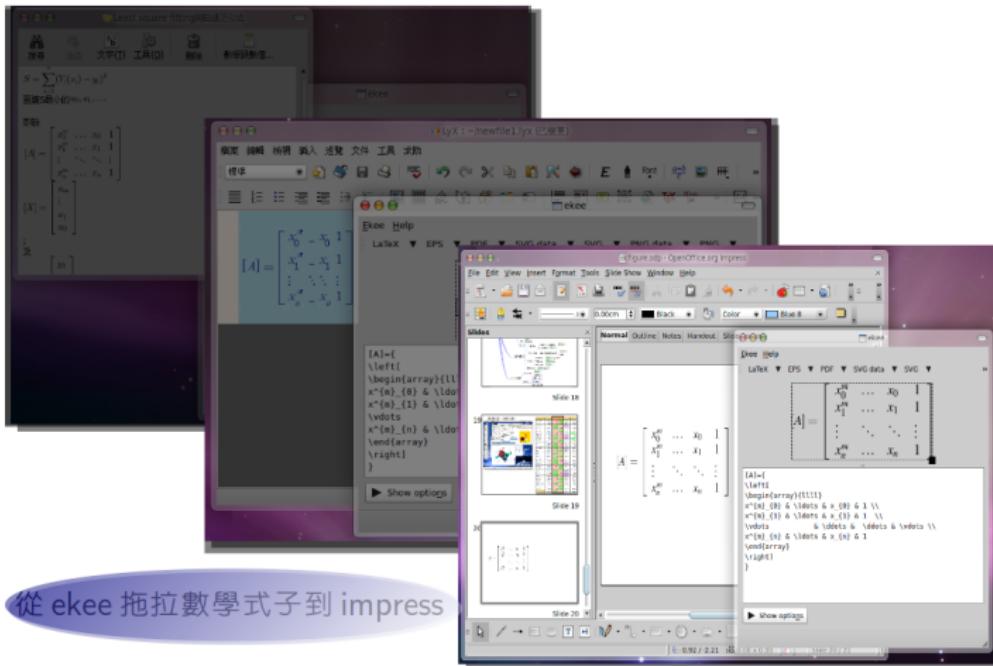
使用 lyx 進行整理與付文



Outline
On-line Resource for Education
Open Source for Education
Physics and Its Applications
Physics in Computation and Research
Publishing

View Your Mind
Latex Equations and Graphic Layout
Tomboy Associated with ekee
Lyx Associated with ekee
Drag the Equation anywhere
Referencer
Presentation, Paper and Website

使用 impress 進行圖片排版



個人圖書館 : Referencer

The screenshot shows the Referencer application interface. At the top is a menu bar with Library, Edit, View, Tags, Documents, Tools, and Help. Below the menu is a toolbar with icons for search, add, delete, and other functions. A sidebar on the left lists categories: All, Untagged, Brownian, Diffusion Theory (selected), HBA, Projection operator, Simulations, and TTR(105-115). The main area is a table view of documents:

Key	Title	Author	Year
polymer-chp3	Einstein Diffusion Equation	Marku...	2000
jcp33_1338	Ensemble Method in the Theory of Irreversibility	Rebert...	2008
jcp128_244109	Formulation of improved basis sets for the study of polymer dynamics thro...	Rober...	2008
gromacs4manual	Gromacs User Manual version 4.0, www.gromacs.org	D. van...	2005
macmol30_5958	Maximum-Correlation Mode-Coupling Approach to the Smoluchowski Dy...	Angel...	1997
jcp106_771	Mode coupling theory for calculating the memory functions of flexible chai...	Konst...	1997
PNAS-2002-Jaro	Molecular conformation of a peptide fragment of transthyretin in an amyloid	Christ...	2002
jmb340_555	Molecular Dynamics Studies of thyroid Aggregation of Peptide Fragments...		2004
molsim-polymer	Molecular Simulation of Polymer Rheology	Matth...	2001
tcf	On the Calculation of Time Correlation Functions	B. J....	1970
jcp98_564	Positional time correlation function for one-dimensional systems with barr...	Angel...	1993
polymer-chp8	Rates of Diffusion-Controlled Reactions	Marku...	2000
screenlengths	Screening Lengths of Polymers in Solution	Amy ...	2003
polymer-chp4	Smoluchowski Diffusion Equation	Marku...	2000

Below the table is a note: "Select a document to view and edit notes". At the bottom left are buttons for Create Tag... and Delete Tag. The status bar at the bottom says "26 documents".

1. 可輸出 .bib(bibtex)。
2. 可於簡報或文檔中快速生成文獻整理。
3. 易於引用與查詢。
4. 可將任何文件編列於資料庫中。

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On-line Resource for Education
Open Source for Education
Physics and Its Applications
Physics in Computation and Research
Publishing

View Your Mind
Latex Equations and Graphic Layout
Tomboy Associated with ekee
Lyx Associated with ekee
Drag the Equation anywhere
Referencer
Presentation, Paper and Website

輸出網頁，文章，簡報



Figure 3. The Al_{13} cluster with a central atom (Al) and 12 hosting atoms (Al) is presented. Other without label are carbon atoms.

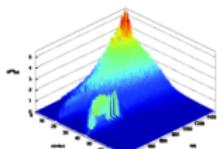


Figure 4. 3-dimensional TDPSD for the central atom of Al_{13} clusters.

A. Temperature-dependent Power Spectral Density (TDPSD)

Based on our previous attempts, we calculate PSD every 100K for metallic clusters. However, the nature of the temperature-dependent power spectrum and its distribution function within the 100K interval, we calculate PSD every 10K and construct a three dimensional TDPSD diagram using 150 PSD data from 10K to 1500K [1]. We also want to know the frequency and amplitude when the temperature goes up with respect to the temperature for all atoms.

In the TDPSD diagram, the color bar is used to represent the amplitude of the frequencies. The hot zone (red color) shows the highest amplitude and the cold zone (dark blue) shows the lowest amplitude. As we can clearly see, the surface atoms of the TDPSD, we project the diagram from $\omega = 0$ to $\omega = 15$.

It is noticeable that there is a sharp island located at $\omega = 30$ and it disappears at about 450K. To explain this phenomena, we can further draw a cross-section of the TDPSD for all atoms from $\omega = 0$ to $\omega = 20$.

In fig. 6, the oscillation domain shows the precession between atoms. For instance, we found that at $T = 400K$, the central atom (stomped curve) starts to precess with the surface atoms (green curve), and the surface atoms precess one after another about 900K, which is the melting point of C_60 . The whole dynamical picture will be discussed in the coming presentation using more TDPSD diagrams.

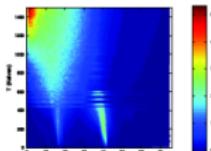


Figure 5. The 2D projection of the TDPSD for the central atom of Al_{13} clusters is presented. The color bar shows the amplitude of the frequency from the lowest (dark blue) to the highest (dark red).

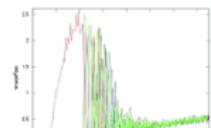


Figure 6. The cross-section of the TDPSD for all atoms at $\omega = 0$ to $\omega = 20$ is presented. The red line, blue line, and green curves represent profiles of the central atom, the surface atoms, and the carbon atoms respectively.

B. Temperature-dependent Ultra-fast Shape Recognition (TUDSR)

The ultra-fast shape recognition (USR) is first proposed to measure protein and polymer structures [15]. Furthermore, it has been applied for drug discovery and protein database [14, 17]. By using the statistical moments to describe the distribution of the bond lengths or distances, we can easily compute the moments between two structures. In our approach, with a given distribution $\{x_1, x_2, x_3, \dots\}$, the moments are described as follows:

The 1'm moment can be regarded as the mean value of the distribution,

$$\mu_1 = \frac{1}{n} \sum_{k=1}^n x_k \quad (1)$$

The 2'nd moment can be regarded as the variance of the distribution,

2009年6月29日 星期一

Least square fitting與曲線近似法

通常在解線性聯立方程式時,如下式:

$$[A]_{n \times n} [X]_n = [B]_n$$

會遇到無法求得解的情況,least square fitting即是計算利用上式誤差平方和為最小值,因為等號或許不成立,應寫為上式:

$$[R] = [A]_{n \times n} [X]_n - [B]_n$$

則

$$[S] = [R]^T [R] = ([A]_{n \times n} [X]_n - [B]_n)^T ([A]_{n \times n} [X]_n - [B]_n)$$

$$= [X]^T [A]^T [A] [X] - [X]^T [A]^T [B] - [B]^T [A] [X] + [B]^T [B]$$

若 $[A], [X], [B]$ 均為real,則可以寫成

$$S = [X]^T [A]^T [A] [X] - 2[X]^T [A]^T [B] + [B]^T [B]$$

使 S 為最小,即求其極值

$$(dS/dx_i) = 2[A]^T [A][X] - 2[A]^T [B] = 0$$

即

$$[A]^T [A][X] = [A]^T [B]$$

The 1'm moment can be regarded as the mean value of the distribution.

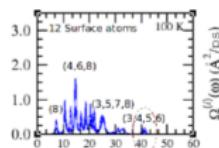
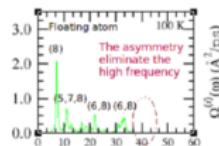
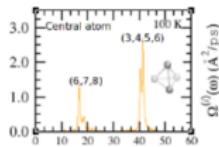
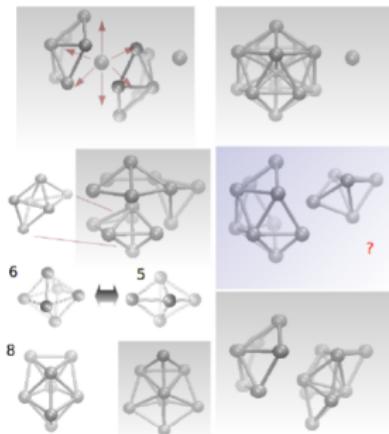
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Beamer+keynote

Outline
Abstract
Introduction
Motivation and Review
Methodology and Results of Ag14
Results of Ag13Cu1
Conclusions and Future Prospect

Conclusions of the Current Works
PhD Thesis Proposal
Acknowledgements
Fragmentary Analysis of PSD in Progress

The high frequency mode and the cage effect



知識不是力量，懂得運用知識才是力量。

感謝大家。